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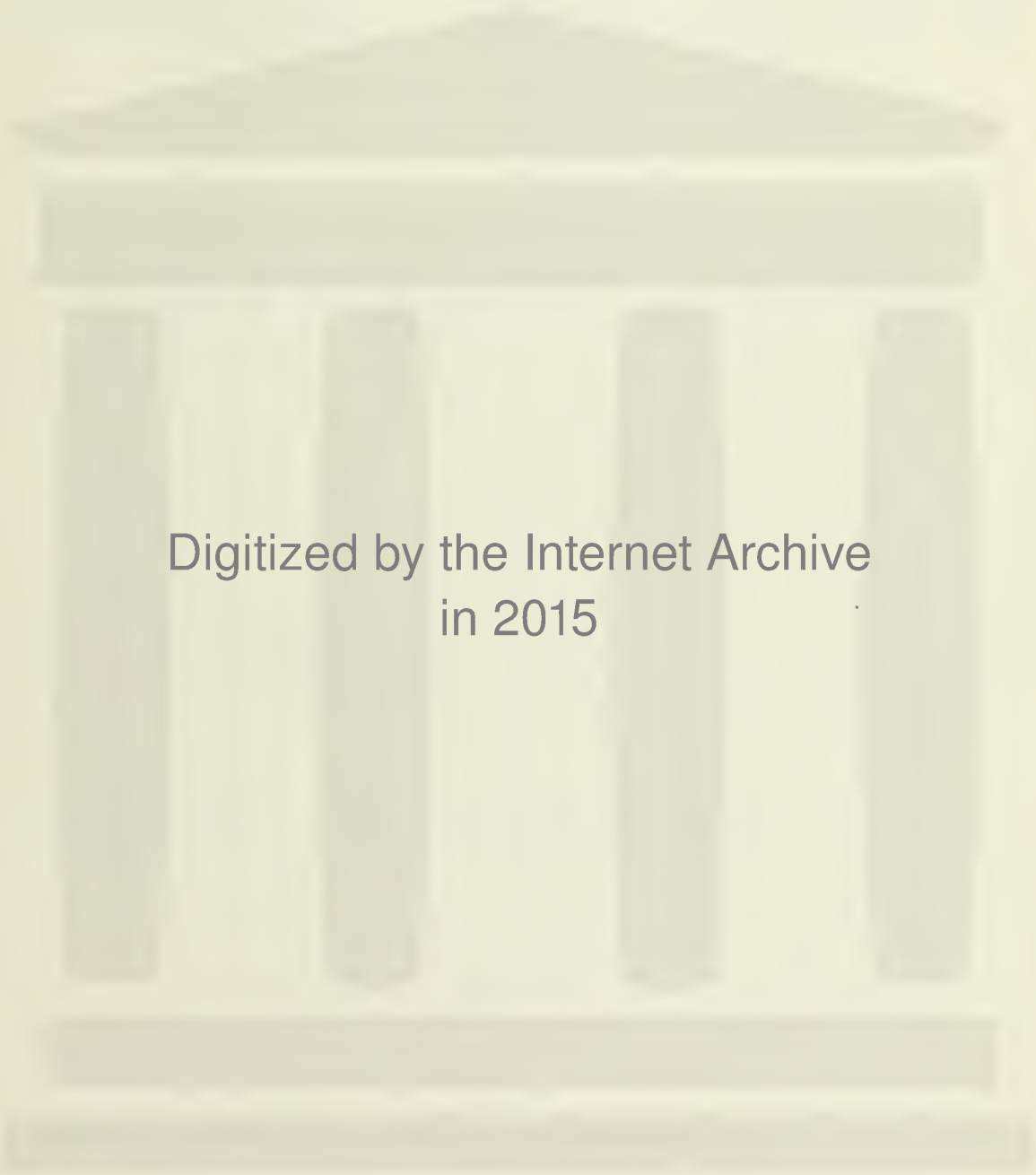
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THE STREET RAILWAY JOURNAL.

INDEX TO VOLUME VIII.

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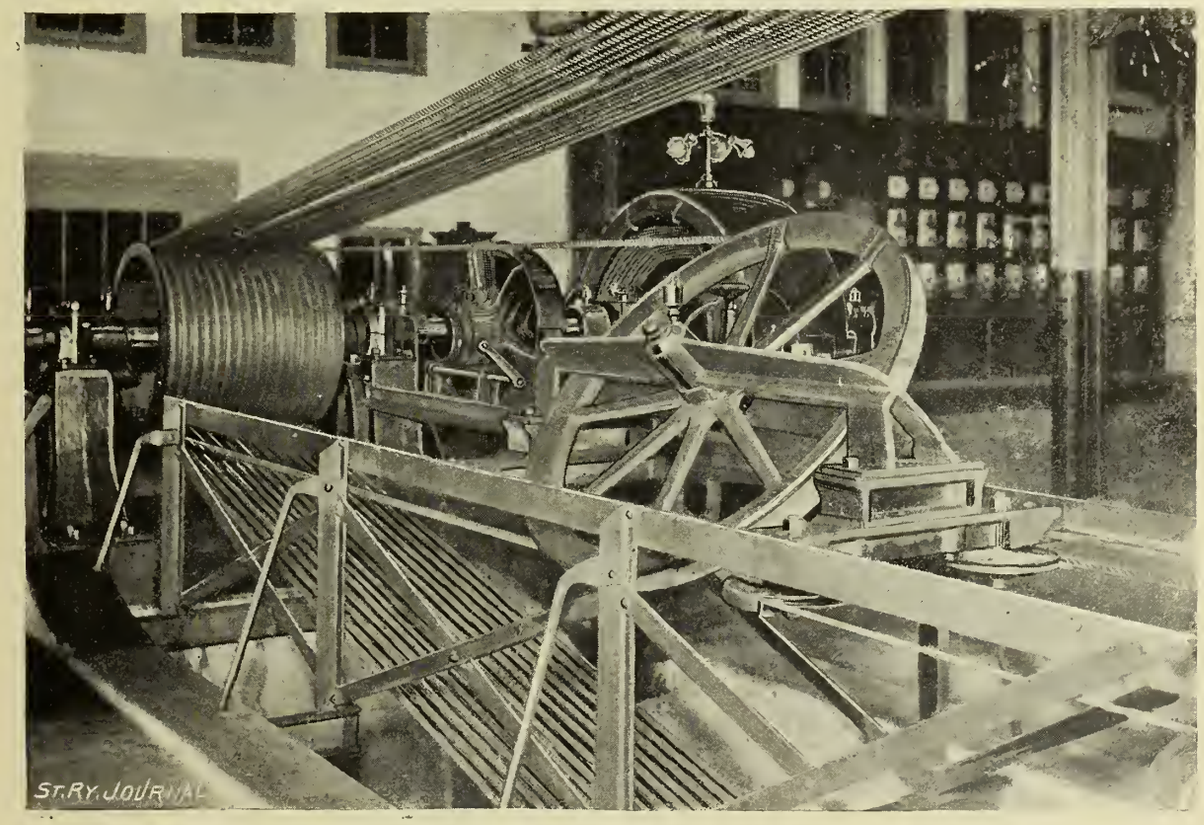
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THE STREET RAILWAY JOURNAL

Vol. VIII. *NEW YORK & CHICAGO, JANUARY.* *No. 1.*

Tension Apparatus for Cotton Rope Drives.

The accompanying illustration is an enlarged view of the tension apparatus employed in the power plant of the Los Angeles Consolidated Railway Co., and which was briefly mentioned in the description of the plant given in the December issue of the STREET RAILWAY JOURNAL. The illustration shows a direct belting of a 500 H. P. Westinghouse multipolar generator, and it will be noted that the power is transmitted by an endless cotton rope, one loop of which is led around a tension carriage mounted in position as shown. The ropes for surporting the tail weight of the carriage are attached to horizontal sheaves shown under the base of the frame. While this is not a novel scheme in rope drives, it is the only one, so far as we know, employed in an electric railway plant, and its success in this field will be watched with interest.



ROPE DRIVE TENSION SHEAVE.—LOS ANGELES CONSOLIDATED ELECTRIC RAILWAY.

THE use of electric cars on trunk lines may soon become an assured fact. The Edison General Electric Co. have submitted estimates to the Illinois Central Railroad Co. for the necessary apparatus for such a service, and the installation, if made, will probably be first for a suburban traffic at Chicago. A number of the Chicago directors of the Illinois Central Co. are said to be enthusiastic over the proposition.

McMahon Ammonia Motor at the World's Fair Grounds.

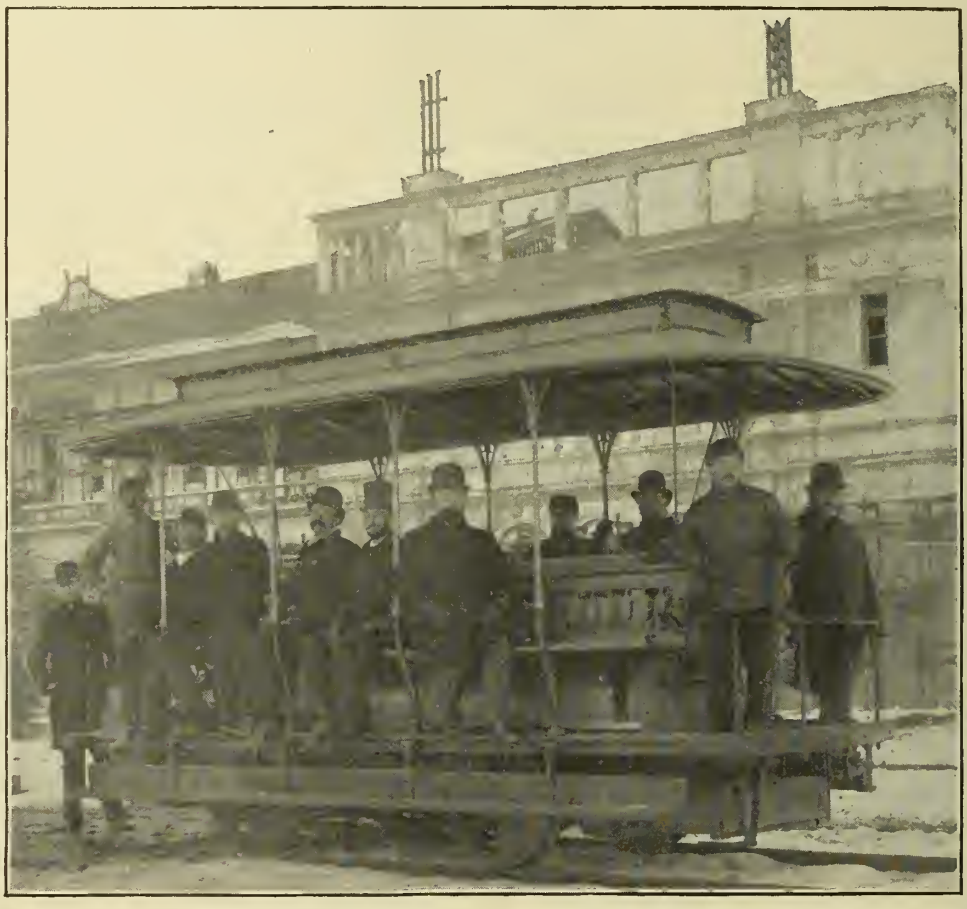
At Jackson Park, Chicago, a railway system of fourteen miles has already been constructed. The system affords excellent facilities for testing severely new motors which inventors desire to operate on the grounds when the Exposition is opened. As the authorities of the Fair are constantly at the grounds they have abundant opportunities to inspect the apparatus. The illustration on next page shows the new ammonia street car motor which is now being tested at the grounds. The photograph was taken when the car was in front of the Woman's Building, the construction of which has advanced more rapidly than any structure in the enclosure. The inventor of the system is P. J. McMahon, and it is exploited by the Standard Fireless Engine Co., of Chicago.

The motor is operated by anhydrous ammonia, and it consists of a double engine of the same form and appearance as those used in small locomotives. The anhydrous ammonia as a liquid is carried in a drum contained in an iron tank under a pressure ranging from 150 to 185 lbs. This drum connects with a similar drum which serves the same purpose as the dry pipe of a steam engine; that is, to give dry gas. In a part of the iron tank separated from the ammonia is a certain amount of water into which the exhaust is discharged and absorbed. As the

39862

affinity between water and ammonia is great, the absorption is produced with great rapidity, and no back pressure, or practically none, takes place. The cylinders of the engine are enclosed in a tank so that the gas escaping from leaks is at once absorbed. This arrangement also prevents freezing of the cylinders. From the escape or expansion of the gas, the absorption of heat is so great as to produce an extreme lowering of temperature, but as the water absorbs the ammonia, heat is produced in the solution which serves to equalize the temperature and prevent freezing. In fact, the heat produced is greater than could be utilized, and for this reason the exhaust gas and the solution pass through a number of small tubes which serve to return the surplus heat to the anhydrous solution.

When the gas has been used to such an extent that the pressure is insufficient to operate the motor the car is run into the generating station, the spent liquor is withdrawn, and the gas tank is filled again. The spent liquor is then pumped from the receiving tank to the generator where the application of heat serves to separate the gas from the water, the gas passing into a separator where it is freed from the small amount of water carried over as steam and then passes on to the condenser which consists of a number of pipes where a constant stream of water flowing over the pipes cools and condenses the gas to a liquid which then passes into the supply tank. The heat in the generator serves to expel the greater portion of the gas so that nearly pure water is left and this is withdrawn from the generator and stored in a tank until used to supply the absorption tank on the motor. The charging and discharging is accomplished in about two minutes.



McMAHON'S AMMONIA MOTOR CAR.

It is asserted that the cost of operating the motor is quite small and improvements are being made which will make the machine still more economical.

Meeting of the National Electric Light Association.

The fifteenth convention of the National Electric Light Association will be held at the Iroquois Hotel Buffalo, N. Y., February 23, 24 and 25, 1892. Mr. C. O. Baker, Jr., has been appointed general master of transportation, with headquarters at 136 Liberty Street, New York.

The proceedings of the Association, owing to the intimate relations growing between the electric light and street railway interests, are of more importance to street railway managers each year. At the last convention of the Association, which was held in Montreal during the past summer, a large number of gentlemen prominent in street railway lines were present, and undoubtedly many will take the occasion to go to Buffalo next month to attend the sessions of the Association there.

Chicago Street Railway Commission.

The commission appointed by Mayor Washburne of Chicago to consider the matter of improving the street railway facilities of the city, has already held several meetings. Alderman Sexton, the chairman, in calling the committee to order for the first time, stated the problem in these terms:

"Chicago is growing at the rate of 1,000 a week. The World's Fair will soon be here. If we can't handle the people now, what are we going to do in a few years or when the Exposition opens? Our deliberations require haste. Whatever we do, let us do it at once. Let us have continued and earnest work. I believe our action will be accepted by the Council and sanctioned by the people."

It was voted to divide the work into four sections and to appoint committees as follows:

Cause — Biegler, Ream, Stauber.

Immediate Relief —Stone, Kerr, Yerkes.

Permanent Relief —Hesing, Cullerton, Purington, Wheeler.

Steam and Elevated Roads—Martin, Gorton, Corbin.

At the second meeting of the commission Alderman Goldzier presented a suggestion for relieving the North Side road. His idea is to make the downtown loop underground. Mr. Goldzier's remarks explain his plans:

"The main cause of the trouble is the congestion in the centre of the city. Suppose the La Salle Street tunnel be continued for a loop with no other opening afforded on the side except one on La Salle Street just north of Randolph Street. Have an open space at this point 200 ft. long and almost the width of the street for unloading and loading passengers. The open space would afford an opportunity for preventing the overcrowding of cars, and all persons wanting to go to the North Side could take the cars at this point. I think the loop should be much shorter than the present one. There would be no delay, and it would not be necessary to have so large a loop. This would greatly relieve the congested condition of the street and would take away the cumbersome cable trains. Horse cars could be operated to connect with the cable at La Salle and Randolph Streets. Under the present conditions suppose Mr. Yerkes would put on twice as many cars, the streets would be more blocked and the transportation would be worse than it is now. If my scheme is feasible there is no limit to the number of cars except the strength of the cable."

This suggestion of Mr. Goldzier, while novel and interesting, has been seriously criticised and been declared entirely impracticable. It would be unsafe, on account of the great crowds, to attempt to load all passengers at one point. The city engineer, however, has stated that there are no unsurmountable engineering difficulties.

At this session J. M. Hannahs described his well known elevated system.

At the third meeting of the commission it was decided to send the following list of questions to the cable companies with the request that they answer the queries as soon as possible:

To the South Side company:

1. How much time it consumed in making the circuit of the loop

2. How many cars can be accommodated on the loop?
3. What is the average number of passengers carried by each car during "rush" hours?
4. What is the maximum number of cars on Wabash Avenue during rush hours?
5. Ditto on State Street?
6. What is the running time from the southern terminus of the cable on State Street to the corner of State and Madison Streets?
7. Ditto on Cottage Grove Avenue?

To the North Side company:

First three questions same as for South Side.
4. Maximum number of cars on Clark Street during the rush hours?
5. Ditto Lincoln Avenue?
6. Ditto Clybourne Avenue?
7. Ditto Sedgwick Street?
8. Ditto Larrabee Street?
9. Running time from northern terminus on Clark Street to Illinois Street and La Salle Avenue?
10. Ditto on Wrightwood and Lincoln Avenues?

To the West Side company:

First three questions same as above.
4. Maximum number of cars on Madison Street during rush hours?
5. Same on Milwaukee Avenue?
6. Running time fromwestern ter minus on Madison Street to corner Washington Street and Fifth Avenue?
7. Ditto on Armitage Avenue?

Alexander Clark presented to the commission the claims of the Chicago & Evanston Electric Railway, a brief description of whose system is given elsewhere in this issue. Coming to the question of motive power he said:

"The motive power will be electricity. Motors weighing 30,000 lbs. will be used, having a capacity to haul 200 tons on the level. These motors will be capable of hauling the heaviest trams up or down a five per cent. grade, and will run through on the surface road after leaving the elevated portion. The speed on the elevated portion of the road will be thirty miles an hour, and on the surface in the thicker settled portions of the city the same as the cable, twelve miles an hour, and in the outlying districts fifteen to twenty miles an hour, thus putting people down in the heart of the city from Evanston and the surrounding territory in from thirty to thirty-five minutes."

A communication was read from R. H. Keithley, in which a comprehensive plan for providing rapid transit, was outlined. Chicago, he said, would have to adopt some such plan as had been recommended by the rapid transit commission in New York. The city needed a system, in his opinion. He suggested first that the South Side Rapid Transit Co. be compelled to build at once its line from Van Buren Street to Jackson Park. This road he thought, should connect with an underground electric road at Fourteenth Street, which would extend north under State Street, below sewers and under the river to the Southwest corner of Lincoln Park. He thought the tunnel should be built a double iron tubular construction. He proposed an elevated track from the point extending over the sidewalk along the west line of the park to North Park Avenue to near Fullerton Avenue, and then in a direct line to Diversey Street and Clark Street to connect with the horse cars. Stations were provided at intervals for the underground portion.

An elevated road operated by electricity on Wabash Avenue was suggested.

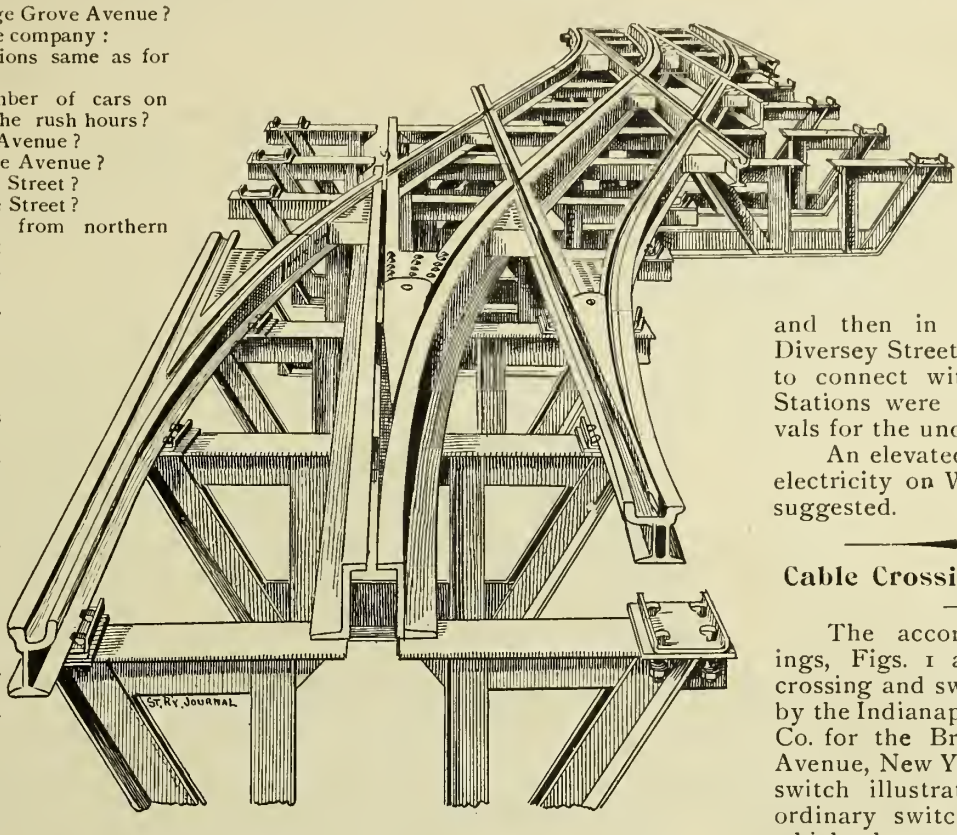


FIG. 1.—SWITCH CONSTRUCTION—BROADWAY (N. Y.) CABLE LINE.

Cable Crossing and Switch.

The accompanying engravings, Figs. 1 and 2, illustrate a crossing and switch recently made by the Indianapolis Frog & Switch Co. for the Broadway & Seventh Avenue, New York, cable line. The switch illustrated in Fig. 1 is the ordinary switch construction, of which there are quite a number placed at suitable intervals in the Broadway line to facilitate the transfer of cars from one track to the other, in case the line should be blockaded from any cause, Fig. 2, being the crossing at the intersection of Twenty-third Street. The very substantial manner in which the crossing and switch are constructed is fully shown in the illustration and reflects credit upon the manufacturers.

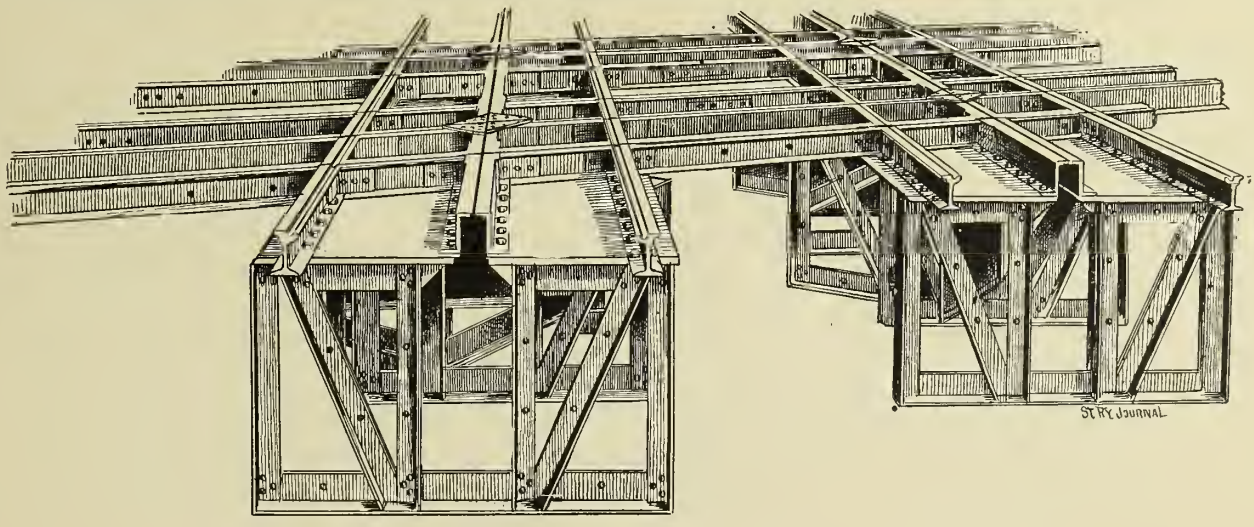


FIG. 2.—CROSSING AT TWENTY-THIRD STREET—BROADWAY (N. Y.) CABLE LINE.

THE United States produces 9,202,000 tons of pig iron per year, or over 1,100,000 tons more than Great Britain her greatest competitor.

A BLOCK of buildings containing the car houses and offices of the Springfield Street Railway Co., Springfield, Mass., was recently destroyed by fire. The loss to the company will probably be in the neighborhood of $10,000.

Stomach Stones.

In "Notes from the Field" printed in our last issue, we mentioned the fact that a horse belonging to the Frankford & Southwark, Philadelphia City, Passenger Railway Co. fell dead after coming in from a trip, and on opening the stomach to determine the cause of death five stones were found which had been formed by a deposit in layers of calcareous matter, the weight of which had produced a rupture of the diaphragm. Three of these stones are illustrated in the accompanying engraving, the largest one of which weighed fifty-seven ounces and measured sixteen inches in circumference. It is represented as cut in half, showing the rings or layers quite distinctly indicated by the various tints of the stone. The animal is said to have looked like a perfect railroad horse, was medium sized, had a smooth coat, good action and had given no symptoms of the disease which caused his death.

The disease known as stone in the stomach is not a very common one with street car horses, but is most frequently found in horses employed by millers and which



STONES FOUND IN THE STOMACH OF A CAR HORSE.

are fed from the sweepings of grist mills, and is supposed to originate from small pieces of millstone or other foreign body which the animals may have swallowed with their food, and which form the nucleus around which the deposit is made. The usual symptoms of such formation are a depraved and capricious appetite and a disposition to eat the woodwork of the stable, earth or, in fact, almost any substance within their reach. Occasional colics may also result from stomach stones, and when these lodge at the outlet of the stomach they usually prove fatal. The position that seems to afford the most relief to an animal afflicted in this way is sitting upon the haunches. During the fatal attack the symptoms are those of obstruction followed by inflammation and gangrene. There is no treatment ordinarily that will prove effective.

Privileges Accorded to Police and Fire Departments.

The following is a consensus of the regulations adopted by street railway companies in a number of cities in regard to free transportation of policemen and firemen :

Boston—Policemen in full uniform, ride free when standing on the platform, but not more than two are allowed to ride free on any one car.

Chicago—Policemen, in uniform, ride free, and some in citizen's clothes ride on complimentary tickets.

Pittsburgh—Police and firemen ride free all over the lines.

Detroit—Books of 100 tickets are issued to policemen for twenty-five cents.

New York—With one or two exceptions the surface railroads permit two uniformed policemen to ride free on the front platforms of cars.

Brooklyn—All officers in uniform are allowed to ride free on any street car in the city, but the number on any one car must not exceed five. Captains, detectives and sergeants are given books of tickets and yearly tickets.

Philadelphia—Policemen, in uniform, ride free ; no other privileges are allowed.

Central & North River Railroad, New York—Charges for packages ; no concessions to firemen ; two policemen allowed to ride free.

Twenty-third Street Railroad, New York—Policemen in uniform, up to two, free.

Cleveland City Cable Railroad—No concessions to firemen ; policemen, in full uniform, ride free.

The Pullman Double Decker in Boston.

When the Pullman double decked, centre vestibule car, described in our November issue, was put in operation on the West End Street Railway, Boston, its trial was in the nature of an experiment. Nothing of the kind had ever been practically used there, and it was regarded as doubtful whether the public and management would approve of the decided innovation. It was also thought by some that in the narrow and crooked streets for which Boston is noted, and through some of which the car had to pass, it would not give such good service as a shorter car might.

The performance of the car, however, during the month of December, when it has been in operation on the West End road, has proved the falsity of these fears and the wisdom of the management in making the test. Mr. Whitney says in regard to the car : "It gives excellent satisfaction to the public and carries more passengers than the other cars, and to that extent helps to solve the transit question for large cities." From reports taken of the actual work done by the car, the interesting fact is brought out, among other points, that more passengers are carried on the upper than on the lower deck, and this too in winter weather. The following is a statement of the actual number of passengers carried during four round trips between Harvard Square and Bowdoin Square on December 13, the mileage made being fifty-four :

TRIPS.	TIME.	Lower Deck Passengers.	Upper Deck Passengers.	Total.
First trip.....	12.05 P. M.	88	85	173
Second trip.....	1.20 "	58	109	167
Third "	2.35 "	136	154	290
Fourth "	3.50 "	133	127	260
Fifth "	5.05 "	73	108	181
Sixth "	6,50 "	92	88	180
Seventh "	8.05 "	57	102	159
Eighth "	9.10 "	73	135	208
		710	908	1,618

The Munsie-Coles Electric Conduit System.

In order to provide for an efficient system of electric traction in locations where the use of the overhead wire is prohibited, and at the same time overcome the difficulties inherent in the ordinary conduit system, the method herewith presented has been devised, and although somewhat more costly in the first construction than the overhead system it can be built for very much less money than any of the cable systems.

As will be seen from the accompanying illustrations, the main conductors are placed in a blind conduit between the tracks, as shown at *g*, in Figs. 1 and 2, and each track is provided with a shallow conduit, *c*, located between the rails and constructed with slot rails in the ordinary manner. The track conduits are intersected at suitable intervals with handholes, *d*, which are placed directly opposite the manhole, *e*, over the main conductor. In the handholes are placed two contact posts, one directly under and one at the side of each conduit. To the inner one of these posts, which is hollow, loops from the main conductor are led through insulating ducts, and connected with the contact point or spring on the top of the post, Fig 3. The post directly under the slot supports a friction roller or circuit closing device which is operated by means of a traveling closing bar or long flexible trolley, suspended within the conduit from the car, in such a manner that in passing the friction roller is pressed down, making a spring connection with the positive wire contact point and conducting the current to the motors, the return being through the rails. The traveling closing bar which may be attached to one or more cars is of sufficient length to reach from one friction roller to the next as it is necessary to make contact with the one in advance before the other is left, so that the distance between the handholes is regulated to suit the length of the trolley, Fig. 6.

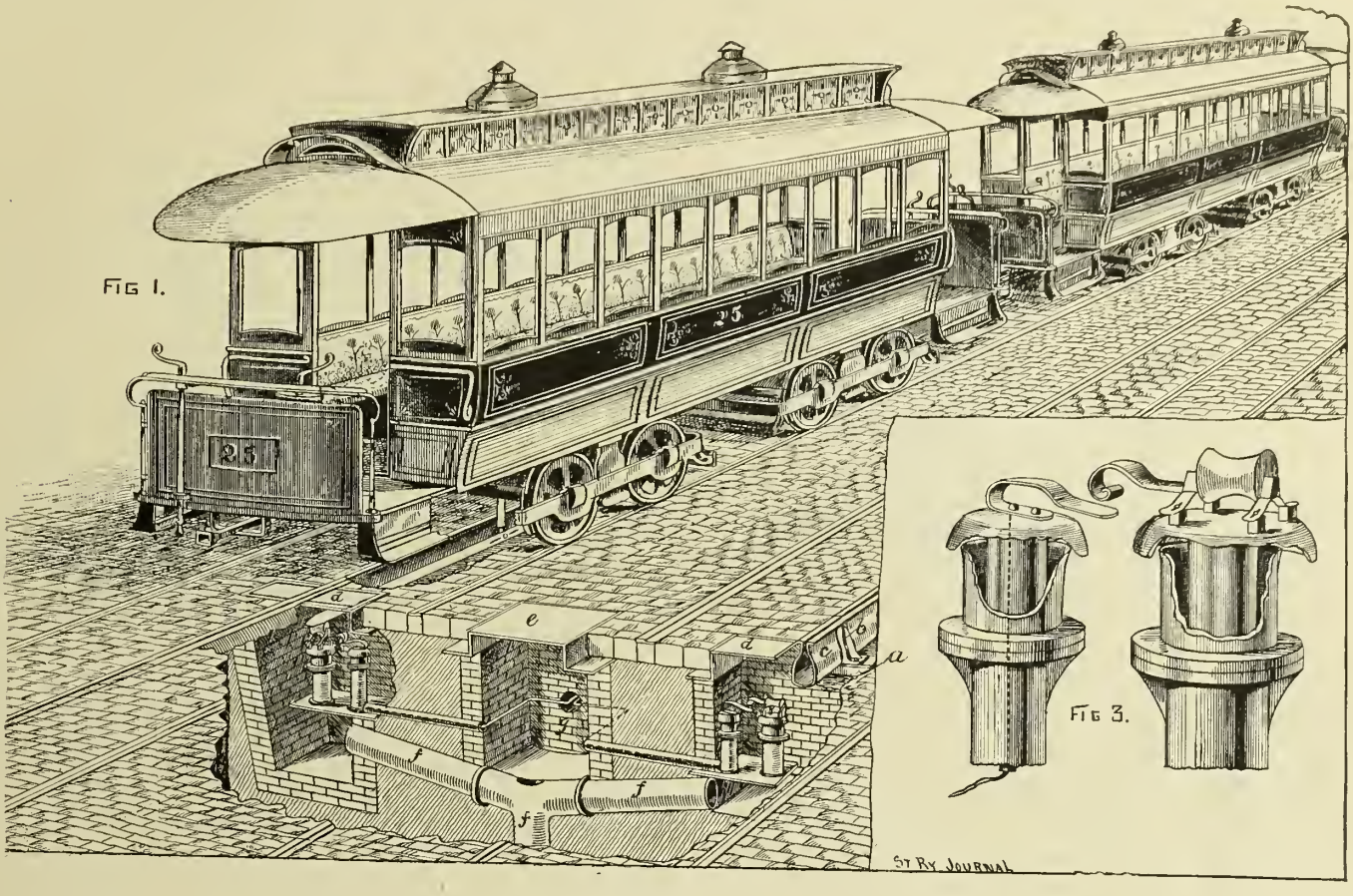


FIG. 1. FIG. 3.

FIGS. 1 AND 3—MUNSIE COLES ELECTRIC RAILWAY CONDUIT SYSTEM.

The closing bar or trolley is flexible and jointed as shown at *G*, and is rigidly attached to the first support at *f*, but is provided with slots in which the other supports make an adjustable connection which admits of the cars being operated on curves without the bar coming in contact with the walls of the conduit. The joints are also so arranged that vertical flexure is provided when running on uneven surfaces. Switches and crossings offer no obstacles to the operation of this system, as contact posts can be placed in any situation and the trolley will adapt itself to all conditions.

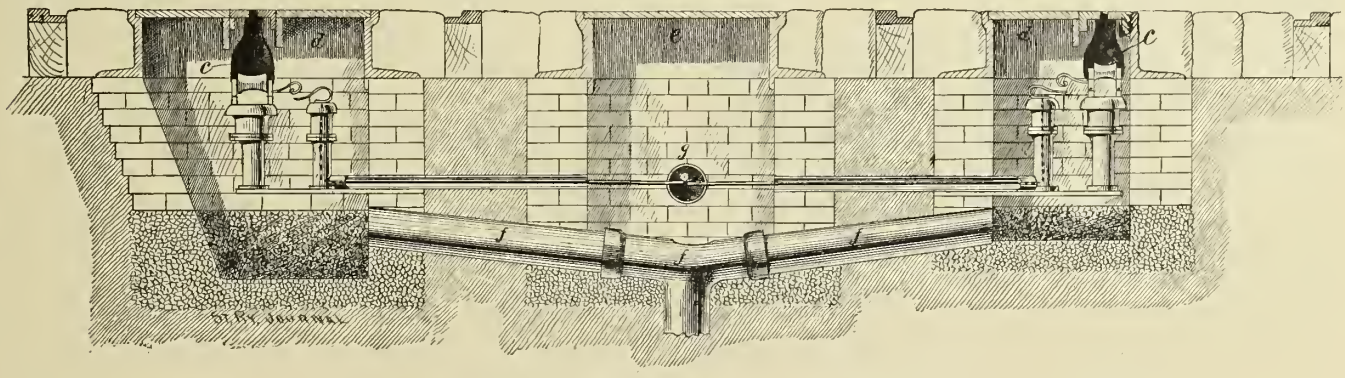
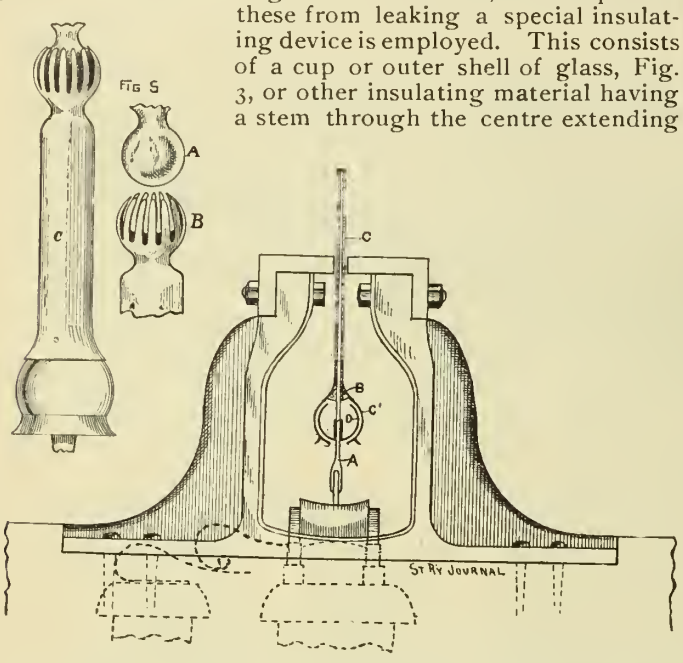


FIG. 2.—MUNSIE-COLES ELECTRIC RAILWAY CONDUIT SYSTEM.

The handholes and manholes are provided with suitable drainpipe which are connected at intervals with the

sewer, and the handholes are made a little lower than the drain pipe to provide for the accumulation of solid matter which can be removed by the linemen.

From the description it will be seen that the contact points on top of the inner posts are the only exposed bare points in the whole length of the circuit, and to protect these from leaking a special insulating device is employed. This consists of a cup or outer shell of glass, Fig. 3, or other insulating material having a stem through the centre extending



FIGS. 4 AND 5.—MUNSIE-COLES ELECTRIC CONDUIT SYSTEM.

higher than the cup which supports an overhanging cover which is designed to prevent dirt of moisture from falling into the cup, while at the same time it gives the necessary break between the cover and cup. The space between the outer shell and stem is filled by an absorbent which is designed to keep the stem and under side of the cover dry in all conditions of atmosphere. The friction rollers, it will be noted, are not charged except when the trolley is passing, and hence, will not form a ground should a piece of wire or any other conductor fall on to it through the slot.

A cross section of the hanger or supporting arm of the traveling contact bar is shown in Fig. 4, and is so constructed as to prevent the conductor from coming into contact with the slot rails. As will be seen, the shank is composed of a conductor, *a*, forming the centre and covered by an insulating material, *b*, which is enclosed in a metalic shield, *c*, which protects the insulation from wear on the slot rails. A glass cup, *d*, is fitted to the conductor having a triple perforated cover designed to enclose an absorbent to protect the conductor from moisture; *c'* is a detachable metalic shield which fits over the glass cup, *d*, and prevents rain or mud falling on the latter, and at the same time prevents any rapid change of atmosphere about the absorbent, so that there would seem to be little chance for the current to escape while being conducted to the motor.

The method of attaching the trolley hanger to the truck is shown in Fig. 5, and consists of a hollow ball, *a*, firmly attached to the truck to which the hanger proper, *c*, is attached by means of metalic fingers, *b*, which grip the ball with sufficient hold to support the weight of the contact bar, but so arranged that in case the car should become derailed they will spring loose from the rigid ball and prevent injury to contact bar and connections.

It will be observed that the yokes and conduit are so constructed that the paving blocks may be laid firmly against them, and the conduit being shallow the cost of construction will be much less than the conduits heretofore constructed. The device is controlled by the Munsie-Coles Electric Railway Equipment Co., of New York City, from whom further particulars may be obtained.

Electric Postal and Express Cars in St. Louis.

St. Louis is the first city in the United States, and thus in the world, to put into operation special cars devoted to an electric postal and express service. Negotiations have been progressing for some time past between the street railway companies of St. Louis and Major Harlow, postmaster of the city, for adopting an extensive postal system on the existing lines which are most in need of such an innovation. Major Harlow has had several interviews with Postmaster General Wanamaker in regard to the scheme, and the latter gentleman has been heartily in favor of it since the subject was first broached to him. The Major is also enthusiastically in favor of it, which is evidenced not only by what he has to say on the subject, but by his untiring efforts to make some arrangement with the street railway companies.

The reasons for wanting postal street cars to do service are apparent to all, and to St. Louisans especially. The city of St. Louis occupies a territory of sixty-two square miles, or more than the area of the District of Columbia. Within these limits are the central post-office and five sub-stations, or, there is one post office to every ten square miles. It is very evident that the number is not sufficient to accommodate the public. In consequence, there are many complaints about the time required by a letter to get from one part of the city to the other, and to do away with all trouble the adoption of postal railway cars on the street railway lines of the city has been suggested.

Major Harlow's plan in running these cars is as follows: Along the proposed route there are to be established at least forty sub-stations. A whole car, or an apartment in a car is to be fitted up in the same man-

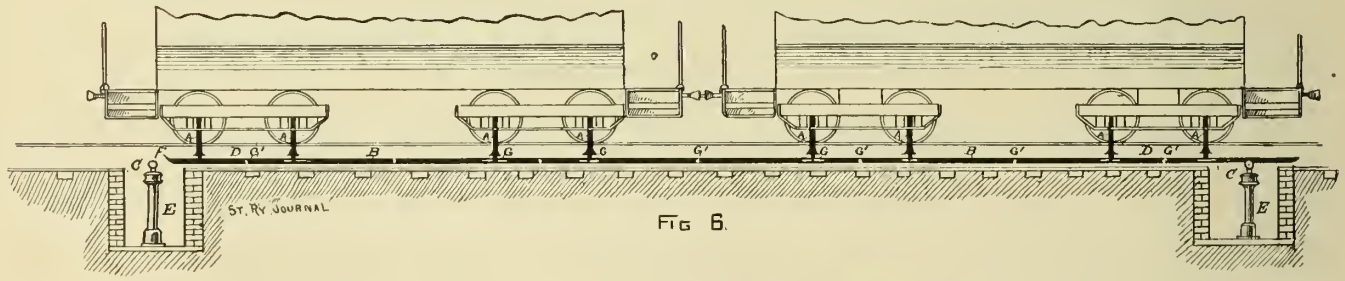


FIG 6.

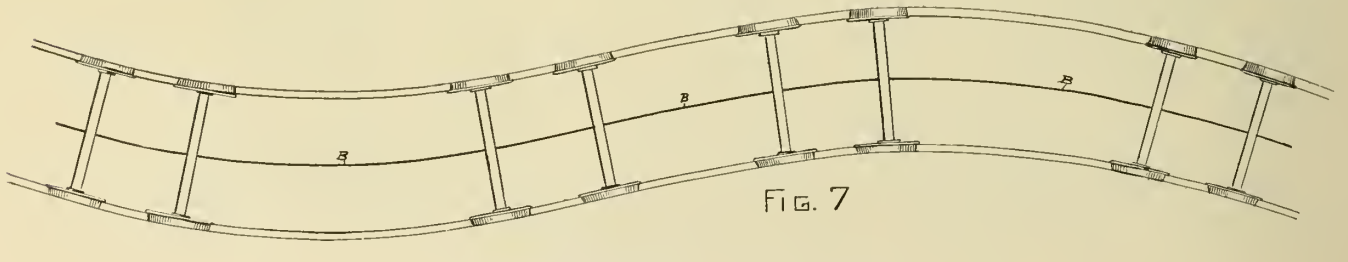
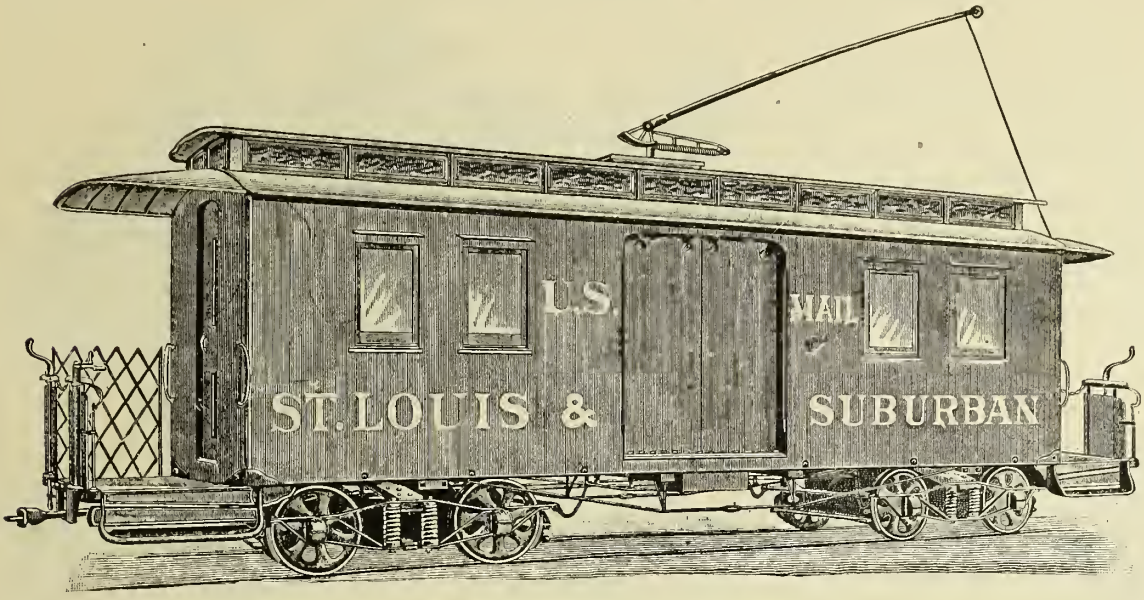


FIG. 7

MUNSIE-COLES ELECTRIC CONDUIT SYSTEM.

ner as in a postal car for steam roads, with all the necessary pigeon holes for letters, etc., and be run upon a regular schedule. When the city mails are to leave the central post office each bag is to be designated for a certain sub-station, and the number of bags to be put on each car is to be attended to by a clerk familiar with that part of the city through which the car runs, and whose duties also include delivering to each sub-station



U. S. ELECTRIC MAIL CAR—ST. LOUIS & SUBURBAN RAILWAY CO.

the bag or bags belonging to it, and while the car is in progress receiving whatever mail matter is given him through the mail box provided on the car. This arrangement will insure an exchange of mail matter between all the sub-stations. After the bags are left at each sub-station the carriers receive the letters belonging to their routes, and after delivering them return to the sub-station with all mail matter they have collected from mail boxes and individuals, which will be in readiness for the car on its return trip to the central post office. This would do away with all necessity of the postmen making several trips to the central office each day, and would mean a saving of from eighty to 100 hours per day, the equivalent of an additional force of ten or twelve postmen.

This arrangement, it is almost needless to say, outside of all the convenience it would afford the public, would certainly prove of pecuniary benefit to our government. The increase of the mails, from minor improvements in the mail service of the past goes to show that the above arrangement would increase our mails to a very considerable amount.

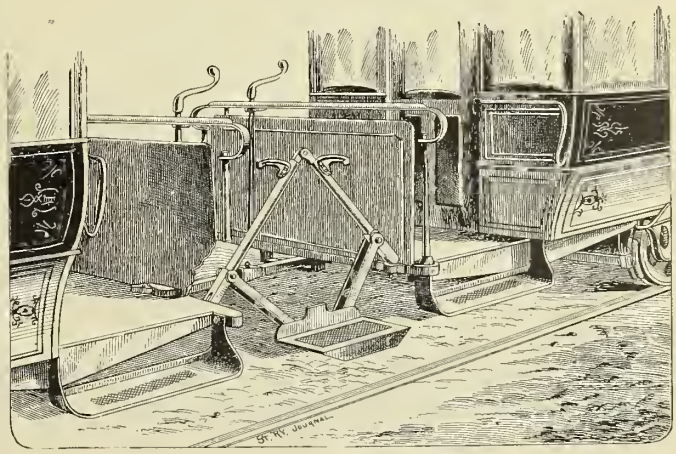
The street railway managers and the postal authorities, however, have come to no definite agreement as yet. Postmaster Harlow claims that the remuneration demanded by the street railway companies puts out of the question the adoption of the system, and this, too, although the street railway managers say that they will derive no pecuniary benefit from their part of the contract.

The postal car in use on the St. Louis & Suburban road does both a city and a country business in handling mail matter. The route of this company extends from Sixth and Locust Streets, St. Louis, to Florissant, St. Louis County, sixteen miles from the city, and the mail car supplies it as well as all the intermediate post offices, as on a steam railroad. In fact, as the road was a steam one before electricity was adopted, it devolved upon the electric cars to do the work of the steam cars. The car shown in the illustration was made by the St. Louis Car Co. The body is thirty-four feet long, width eight feet four inches, height when mounted on trucks, eleven feet four inches. The trucks are St. Louis Car Co.'s No. 5, and on each is mounted a fifteen H. P. Thomson-Houston S. R. G. motor. The total weight of the car is about 16,000 lbs. It not only carries the mails, but baggage, express packages, and dairy products. It makes two trips per day one in the morning and one in the evening.

The car on the southern railway running to Carondelet does an express business only. It is a temporary affair, but has been running for some time past. It will be replaced very soon by a fine car, somewhat similar to the one on the St. Louis & Suburban. It is different from the latter car in one detail, that is, the narrow door at each end is done away with, and in its place are substituted two swinging doors placed a little to one side, for accommodating long pipes or lumber in case long material of this nature should be expressed to anyone. There is no dasher, but the ordinary iron grab handles and posts are used as on a railroad car. The car makes two trips a day, at eleven A. M. and five P. M. The St. Louis & Suburban car is divided up, one part being provided with the ordinary facilities for handling mail matter, such as pouches, pigeon holes, etc., and the other for the express and baggage. Express matter to be sent to Carondelet or intermediate points is delivered at the 'South St. Louis Electric Express Office," corner 6th and Market Streets, the downtown terminus of the line, and is put on the car, which delivers to all the sub-stations between the termini of the line. At these sub-stations packages are delivered to their owners by the express agent. G.

An Adjustable Step for Trail Cars.

In the accompanying illustration is presented a device to provide for easy communication between motor and trail cars. As will be seen from the illustration, the device consists of a platform of cast iron or



COBB'S ADJUSTABLE STEP.

other material so hung from two hinged arms that it is maintained on nearly the same level as the steps of the adjacent cars. The supports are made of gas pipe and provided with brass handles near the top on the same level with the hand rails which serve as a firm and convenient support for the hand of the passenger or conductor while crossing. The step is prevented from swinging by means of two small links, not shown in the engraving, which are connected with a bolt designed to move in a vertical slot back of the step.

The bridge is supported in such a manner as not to

be affected by the side sway of the car and readily adjusts itself to the varying distance between the cars. It is claimed that the position of the bridge between the platform steps is safer and more convenient than if it were on a line with the centre of the car, as in this case it would require an opening in the dashboard, which might become a source of danger in case the gate should be left open. The use of the bridge does away with one of the chief objections to operating trail cars, for it is often the case that one car will be overloaded when there are plenty of vacant seats in the other car, but cannot be utilized on account of the difficulty and danger in passing from one car to the other, an exasperating condition that often faces the tired man of business. This step seems to obviate many of the difficulties, and will materially assist the conductor in collecting fares, while it relieves him of the great risk incurred in attempting to pass between cars as ordinarily operated. Further particulars regarding the device may be had by addressing the inventor, Arthur Cobb, Louisville, Ky.

Electric Car Snow Plow.

A snow plow for electric cars, designed to be readily attached to and detached from the motor car, has recently been placed upon the market by the Wales Manufacturing Co. of Syracuse, N. Y., and is shown in the accompanying engravings. A number were in use on different electric railways last winter, and proved eminently satisfactory.

There are no wheels on the plow to jump the track, but, instead, the fore part of the plow rests upon the rail by means of a heavy half round shoe of boiler plate which slides along the rails and allows the plow to pass over frogs, crossings, etc., without difficulty, as shown in Fig. 2. The plow is provided with an iron nose which can be raised or lowered and can be used as a scraper where the track is sufficiently high above the paving. The plow weighs 350 lbs., and can be easily handled and moved from end to end of car by two men. The method of attaching to car is shown clearly in both of the engravings.

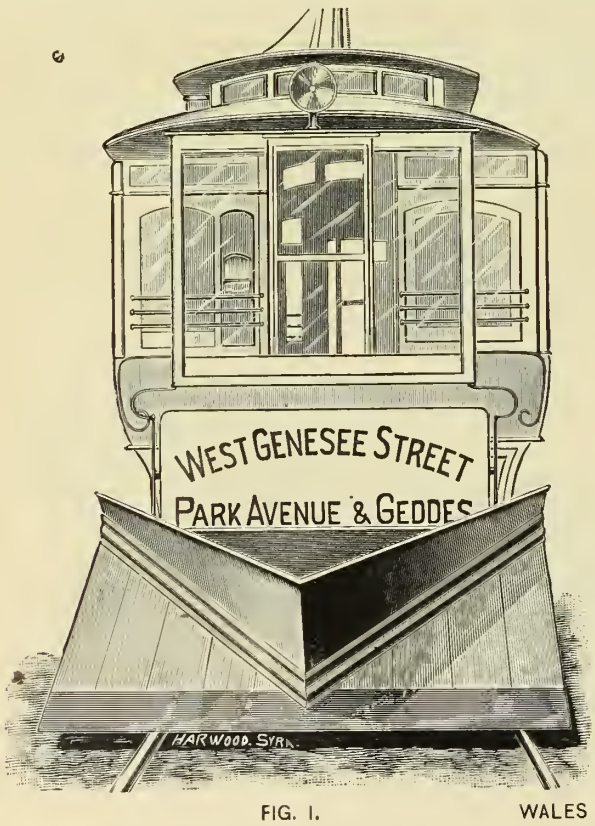


FIG. 1.

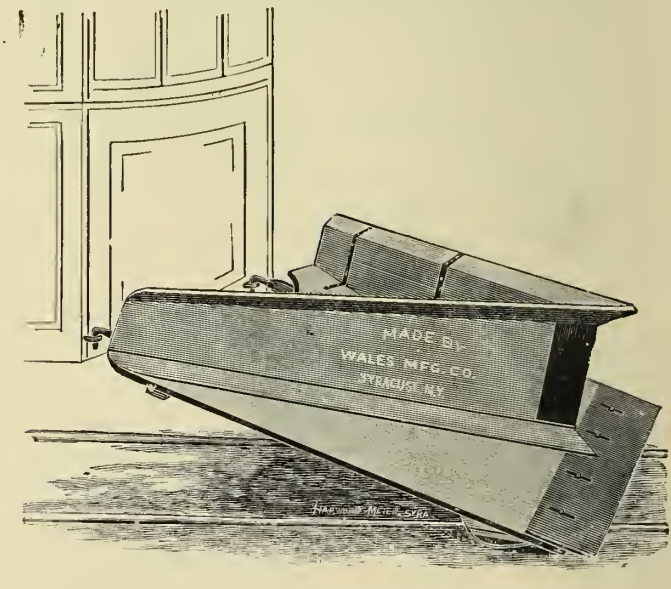


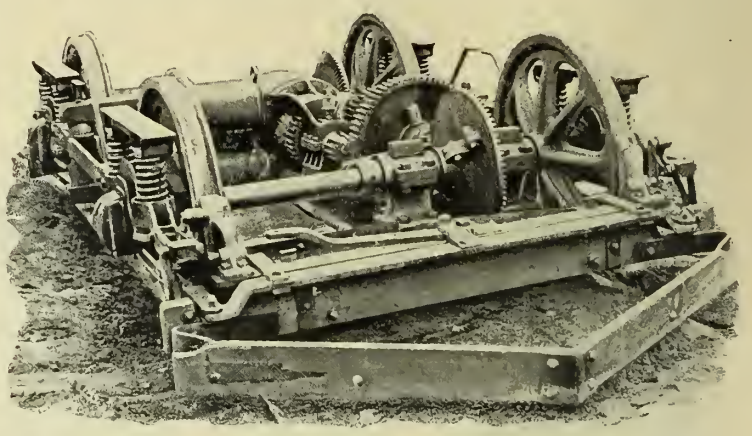
FIG. 2.

WALES ELECTRIC SNOW PLOW.

THE Pelton Water Wheel Co. have installed at Laxa, Isle of Man, an overshot wheel 110 ft. in diameter.

Device for Economizing Power on Grades.

It is a well known electrical principle that in order to obtain the greatest efficiency from an electric motor the armature must be run to its maximum speed, and hence, since motors in climbing steep grades slow down about fifty per cent. an enormous amount of current is consumed without an equivalent in motive power. It cannot be expected that an electric car will climb a steep grade at the same speed at which it will run on a comparatively level track, but while the speed of the car is necessarily reduced it is desirable to run the armature to its maximum speed.



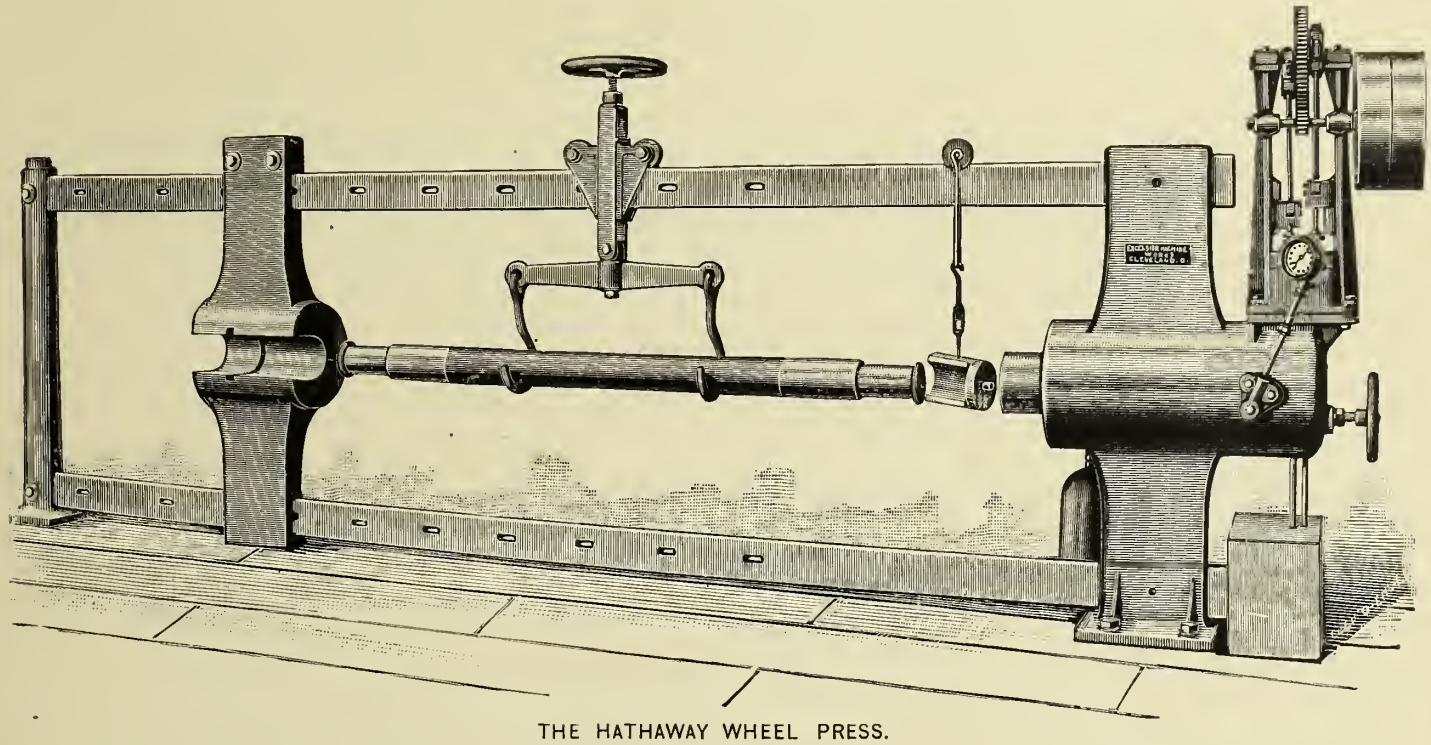
THE GOSS DEVICE FOR ECONOMIZING POWER ON GRADES.

The accompanying illustration shows a method of connecting armature with wheels in such a manner that the speed of the armature can be made uniform on level tracks or grades. A single motor is shown, mounted on a Bemis truck, and, as will be noticed, the armature shaft is provided with two pinions of different diameters which mesh into gears of correspondingly different diameters on the countershaft which in turn communicates power to the axle by means of beveled gears. The gears of the countershaft are provided with clutches to be operated by a lever from either platform, by means of which the driver can use either the large or small gear, or throw them both out of mesh so that the motor can run without moving the car. By employing the small pinion on heavy grades great power is obtained, while only a comparatively small quantity of current is required. When running on a level track where high speed is required the large pinion is employed. With this device it is claimed that no more current is required to run four miles an hour on grades than to run at sixteen miles on a level track. This device has been operated experimentally for about a year, and its claims are said to be sustained. In

a comparative test on an eleven per cent. grade with two other cars, one equipped with two fifteen H. P. motors and the other with two twenty H. P. motors of the double reduction type, the truck above described, with tow cars, consumed only fifty-nine amperes, while the other cars took seventy-eight and eighty-four amperes respectively. On a five mile road where the above tests were made it requires an eighty H. P. generator to operate two cars. With the new equipment it is thought three or four cars could be operated with the same amount of current. Further particulars may be obtained by addressing the inventor, E. W. Goss, Amesbury, Mass.

The Hathaway Belt Power, Hydraulic Wheel Press.

A wheel press is always a desirable and very often a necessary part of the equipment of every street railway. One of the most convenient machines of this kind which has been brought to our attention is one which is illustrated in the accompanying engraving, and is manufactured



THE HATHAWAY WHEEL PRESS.

by Alfred G. Hathaway of Cleveland, whose transfer and turntables and other articles of car house equipment are well known among street railway managers. As will be seen, the pump is attached to the framework of the press and can be set longitudinally, as shown, or transversely with the ram so as to suit the condition of the shop shafting, enabling the user to locate his press at any desired place.

The pump is of the duplex pattern with single acting plungers, the gearing being five to one. The plungers are packed with compressive fibrous packing with bolted gland which is tight and works with no undue friction. The pump barrel is made in one piece from hammered steel. The suction and delivery pipes are large, perpendicular and easy of access by separate bonnets situated on top of the pump barrel. The movable beam runs on rollers upon the top bar, and is recessed so that blocks may be placed in each of sufficient thickness as to act as a template in forcing on car wheels. A swing chuck placed against the ram acts as a template for the other end of the axle. The block can also be used when forcing shafts into wheels. Return weight, water tank, safety valve and pressure gauge are also furnished.

These hydraulic presses are manufactured of sufficient size to take wheels of thirty-six inches in diameter, and they have a distance between bars of forty-one inches. The tight and loose pulleys are fifteen inches in diameter and turn at 150 revolutions per minute, and have each a three and one-half inch face. The press can exert a pressure of fifty tons.

Rapid Transit Plans in Boston.

The subject of underground rapid transit in Boston has been the topic of several interesting addresses recently by Henry M. Whitney, president of the West End Street Railway Co. in that city.

In an address made before the Rapid Transit Commission December 7, in connection with this subject, Mr. Whitney showed by a series of figures the rapid increase during the last ten years of the number of passengers brought in and carried away from the city by the steam railways, as well as those transported by the surface lines within the city. In 1880 the aggregate number of passengers carried per day by the street railway lines on the north side from Cambridge, East Middessex and East Boston was 51,000, and the number carried by the steam roads was 30,000. On the south side the numbers were respectively 114,000 people by the street railways and 30,000 by the steam roads, making for 1880 a total of 225,000 people brought into and carried from the city each day. Mr. Whitney showed that in 1890 the traffic had absolutely doubled over every line then running, including the steam roads.

The growth of the street railway business is shown by the fact that in 1880 the roads now under the West End system carried 59,000,000 passengers. The following year they carried 63,000,000, the next year they carried 69,000,000 the next year 71,000,000, the next year 76,000,000, the next year 80,000,000, the next year 86,000,000, the next year 91,000,000, the next year 97,000,000, the next 104,000,000, the next year 114,000,000

Mr. Whitney then, after referring to the advantages to the city of having a transit system which could efficiently and cheaply care for this immense and growing traffic, detailed his plan for facilitating the work of transportation. This plan provides, in addition to the present surface lines, for a tunnel under the Common, commencing on the south at the junction of Tremont and Warrenton Streets and emerging at Adams Square. This preserves the line of travel as it at present exists, and when public necessity and convenience may require the development of an elevated railroad, provides a system which can be readily adapted to the new conditions. While confident of the desirability to the city of the execution of the plan as outlined, Mr. Whitney stated that he desired it thoroughly understood by the Commission that the West

HARRISON STREET RAILWAY COMPANY.

Cr. CASH. Dr. CASH.

Unclassified. Each Item to be Posted Separately	DATE.	REPAIRS. Buildings and Fixtures.	REPAIRS. Cars.	REPAIRS. Track and Road Bed.	REPAIRS. Harness & Stable Equipments.	HORSES. Purchase of Horses.	FEED. Including Expense of Grinding.	Horse Shoeing. Labor and Materials.	Salaries. Officers and Clerks.	WAGES. Conductors and Drivers.	WAGES. Detectives, Car Cleaners, Wechmen, Switchmen Starters, &c.	Light and Fuel	Office Ex. Advertising, Stationery, Telephone, Incidentals.	Snow and Ice.	Conductors Coat and Cap.	RENTALS. Tracks.	RENTALS. Real Estate.	Damages to Person and Property.	Legal Expenses.	Taxes.	Interest.	Miscellaneous. General Expenses.
	Amounts brought forward,																					
	Amounts carried forward,																					

Balances and Grand Totals.	Ledg. Folio.	TOTALS.	Unclassified. Each Item to be posted Separately.	Passenger Receipts.	Rentals Tracks.	Rentals Real Estate	DATE,	Balances and Grand Totals.	Ledg. Folio.	TOTALS.
							Amounts brought forward,			
							Amounts carried forward,			

End Street Railway Co. could not undertake to work unless the State were willing to strengthen its hands by the removal of the danger of hostile legislation. The knowledge of the reasonable security of their investments would be the only condition, Mr. Whitney thought, upon which money could be enlisted from capitalists for the enterprise, and he urged upon the commission the desirability of some measures by the legislature by which the result would be obtained.

Forms for Keeping Street Railway Accounts.

We are frequently asked to give simple and convenient forms for keeping street railway accounts, and in the accompanying blanks we present the first and second pages of a cash book as copied direct from one in use by a prominent street railway company operating in the State of New York. From these pages the posting may be done directly to the ledger without journalizing, and the forms will be found to give a very satisfactory classification of accounts for horse railways, and can be easily modified to be used on lines employing mechanical traction. The pay roll account is shown as follows :

HARRISON STREET RAILWAY CO.

.....189.....

PAY ROLL NO.....

WAGES—Conductors and Drivers	
" Clerks	
" Starters, Inspectors	
" Watchmen, Switchmen, &c.	
" Repairs, Cars	
" " Harness	
" Shoeing	
" Feed	
" Light and Fuel	
REPAIRS—Building and Fixtures	
" Track and Roadbed	

In this connection we present on the following page the blank prescribed by the railway commissioners for the State of New York, on which the quarterly reports of all street railway companies in the State are required to be made. This blank will also help in the classification of accounts. The subject of the standard method of keeping accounts received special attention in a paper read at the last meeting of the American Street Railway Association, and a committee was appointed to recommend to the Association, at its next meeting, forms that may be adopted as standards by railroad companies in all parts of the country.

SPANISH cedar is becoming a very popular finishing wood on the Pacific coast, largely taking the place of redwood, to which it is superior because of its hardness and susceptibility to a high polish. The wood is expensive, however. It comes from Mexico and Central America, the finest from the last named country. The cedar grows on mountain sides and along streams and creeks. The primitive methods employed in logging makes the cost of the cedar from $75 to $80 per thousand landed in San Francisco in the log. Spanish cedar, it is believed, will take the place of mahogany.—*The Mississippi Valley Lumberman.*

A SERIOUS accident occurred December 7 on the cable road at Belleville, a suburb of Paris. The grip slipped, and as the brakes would not work properly the car descended the hill, upon which it was, at a high rate of speed and collided with a car which was ascending at that time. All the passengers in both cars were more or less hurt, and twelve of them received injuries which were very serious.

ail Company.

STATEMENT of the Earnings, Operating Expenses, Deductions from Income and Net Income for the Quarters ending 18..... and 18

	18	18
Gross Earnings from Operation,		
Operating Expenses (excluding all Taxes)		
Net Earnings from Operation		
Income from other sources than Operation		
GROSS INCOME FROM ALL SOURCES		
Deductions from Income as follows:		
*Interest on Funded Debt		
*TAXES, On property used in Operation of Road		
*TAXES, On Earnings and Capital Stock		
*TAXES, Other than above		
*Rentals		
NET INCOME FROM ALL SOURCES		

Operating Cost....per cent of Earnings (excluding all Taxes).

Operating Cost....per cent of Earnings {including Taxes on all property actually used in Operation of Road and on Earnings and Capital Stock.}

Operating Cost....per cent of Earnings (excluding all Taxes).

Operating Cost....per cent of Earnings {including Taxes on all Property actually used in Operation of Road and on Earnings and Capital Stock.}

GENERAL BALANCE SHEET.

..... 18

ASSETS.		*LIABILITIES.*	
Cost of Road and Equipment		Capital Stock, Common	
Stocks and Bonds of other Companies		Capital Stock, Preferred	
Other Permanent Investments		Funded Debt	
Supplies on hand		Loans and Bills Payable	
Accrued Interest		Interest on Funded Debt Due and Accrued	
Due by Agents of this Co. on account of Traffic		Dividends Unpaid	
Due by others (not Agents of this Company), on account of Traffic		Due for Wages and Supplies	
Due by Companies & Individuals (on open Accounts other than Traffic)		Due Companies and Individuals (on open accounts)	
Cash on hand			
Profit and Loss (Deficiency)		Profit and Loss (Surplus)	

.....being duly sworn, deposes and says that he is.....

of the.....Company; that the foregoing Quarterly Statement and General Balance Sheet are true and correct to the best of his knowledge and belief.

Sworn to before me, this.....
day of.....18.....

Address.....

.....

.....

*Enter proportion for this quarter, of the annual amount, whether paid or not.

NOTES:
- Fill in all dates and cost of operating as called for above, and where there is nothing to enter under any item, so designate by a cipher.
- On the above Quarterly Statement enter figures for the current Quarter on the right side, and for corresponding Quarter of previous year on the left side of this sheet.
- Where no separation is made in Assessments between "Property used in Operation" and property not so used, all Taxes as Assessed may be returned as upon "Property used in Operation."
- The General Balance Sheet is to be a condensed transcript of the General Ledger as it stands on March 31, June 30, September 30 and December 31 of each year, and must show the exact financial condition of the Company on those dates.
- Interest on Funded Debt which has accrued, but may not be due, as well as that which is due and unpaid at the close of the Quarter, must appear on the Balance Sheet as a Liability.

The Street Railway Situation in Chicago.

If a Chicogoan were asked what question is exciting the greatest interest in his city at the present time, he doubtless would reply, "the street car problem." The topic certainly seems to take precedence over all local matters. It is the subject of a vast number of editorials usually vehement in character; it occupies the most prominent position in the news columns; it comes before the City Council in a variety of forms, and it has formed the subject matter for innumerable interviews with Mayor Washburne, who has dealt with it in at least one special message addressed to the aldermen.

Chicago unquestionably needs additional transportation facilities. The public realizing this fact must of necessity find an object for attack, and the surface roads naturally come in for practically all the abuse and criticism distributed lavishly by the public representatives. The general charge laid at the doors of the local companies is inadequacy of facilities. The other accusations, urged with bitterness, need but a brief reference. They are of the general character always brought against corporations which deal with the public.

An extract from Mayor Washburne's message will throw some light on the situation. He says:

"It having come to your knowledge and to the knowledge of the administration that the present facilities rendered the public for passenger transportation within the city are wholly inadequate, and in view of the fact that the World's Columbian Exposition will soon add very greatly to the demands of travel in all parts of the city, it is desirable that radical and immediate steps be taken to remedy the evil."

The question naturally arises, in what way was the present state of things brought about? The liberal policy of Chicago roads in extending their lines and in increasing their facilities, has been recognized throughout the country. Millions have been expended in cable construction, and in the purchase of rolling stock; yet at the present time they cannot handle comfortably the enormous traffic which demands accommodation.

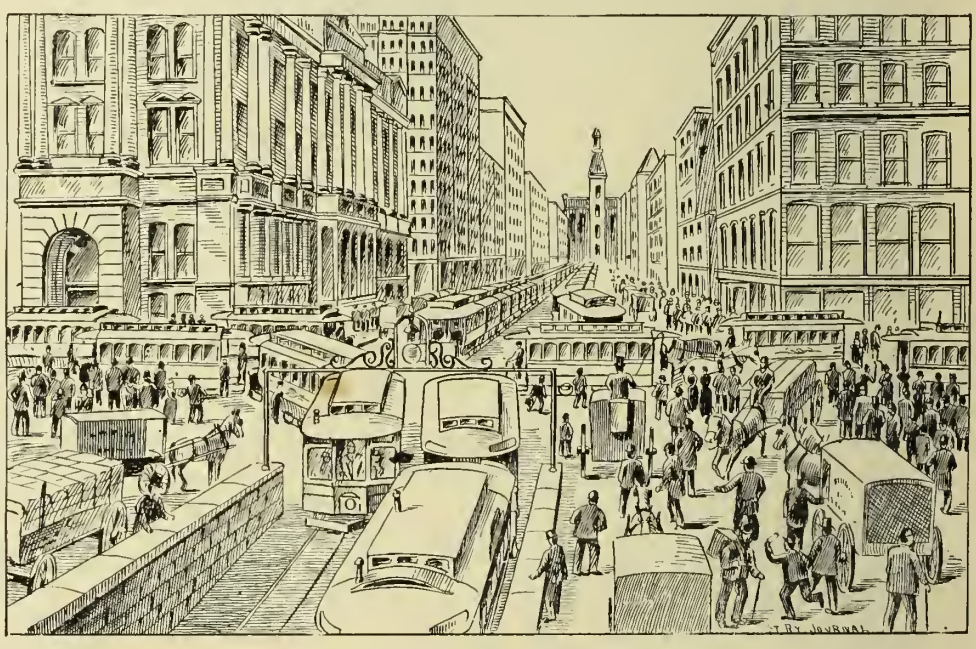
It is not necessary to search long for the chief cause. The street car interest, like many another interest, has been overtaken by an increase of population entirely beyond expectation. But are the companies doing all that can be expected of them? The press of the city answers by an emphatic negative, but its opinions are expressed in such bitter, uncompromising terms that one cannot be impressed by the impartiality of its decisions. The STREET RAILWAY JOURNAL has taken considerable trouble to investigate the question, and the results are given herewith.

Any one who will visit the downtown loops of the several companies will find that during the "rush" hours at night and in the morning they are crowded by cable trains almost touching each other all around the circuit. The Chicago City Railway Co. which operates the roads on the south side of the city is so crowded on its downtown loop that its cars form almost a blockade each evening. Cars from its two main lines use the same loop. The demand for transportation has been increasing so enormously that at the present time the single loop is wholly inadequate. As a result, a solid line of cars, each waiting for its turn to enter the loop, may be seen each evening extending on both State Street and Wabash Avenue for four or five blocks.

No one realizes better than the company itself, its need for additional loop facilities, but the City Council refuses to accede to its request for a new loop. The aldermen wish either to force the company to use an inconvenient loop or to impose impossible conditions. Should the permission for a new loop be granted, the South Side company states that it can afford the public all the surface facilities needed. This statement was made by General Manager Wheeler to a representative of the STREET RAILWAY JOURNAL. "Grant us the loop," he said, "and we can comply with all the demands made upon us in the next few years. At present we can do no more. We are now sending around the loop all the cars that can run on it. We are now sending out so many cars at night that they fairly blockade Wabash Avenue and State Street. Under such circumstances no good is accomplished by adding cars. They would simply wait their turn to pass around the loop. If we are granted the permission we will begin work at once."

"When do you expect the petition will be granted?" was asked.

"I can't tell that. It will be granted some time, I think. Meanwhile we must do the best we can. Of course I do not mean to assert that with a new loop we could give every one a seat at six o'clock at night, but we could meet all reasonable demands."



STREET SCENE AT ENTRANCE TO TUNNEL, CHICAGO

What has been stated explains the situation very completely so far as the South Side is concerned. Perhaps the bitterest complaint has been made of this company of late; yet it is prevented by the City Council from taking any steps to improve its service.

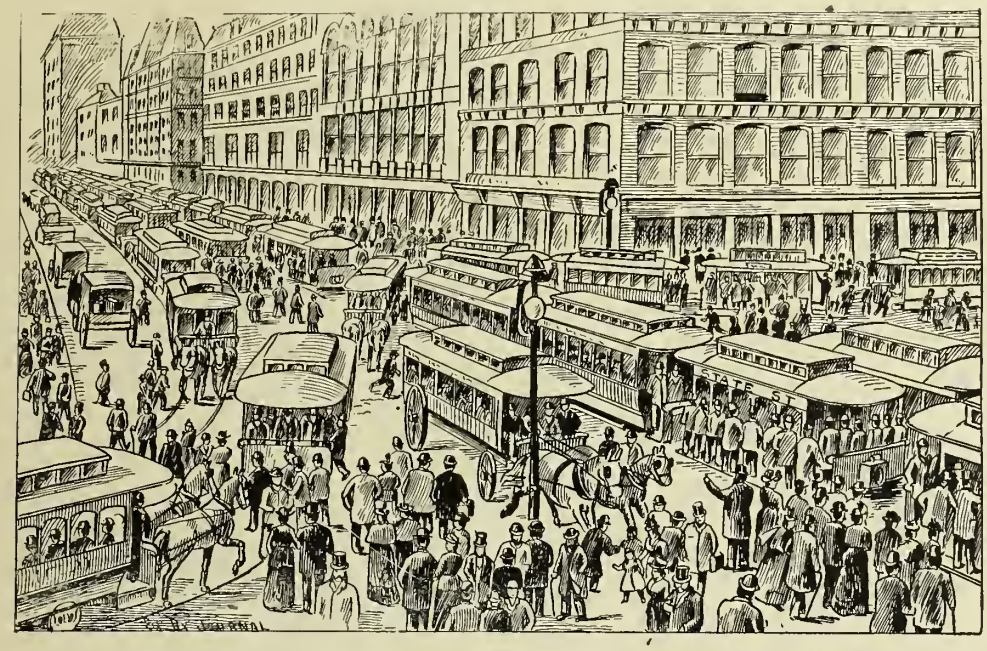
The West Side road has come in for its full share of abuse, yet officers of the company say it can handle all the traffic which comes to it. During the last four years it has increased its facilities so it can handle twice or three times the number of passengers which could be carried at the beginning of that period. For example, the cars on the Milwaukee Avenue line were making 45,000 miles a month when the present company assumed control four years ago. At the present time the mileage is 90,000 each month. The mileage run on the Madison Street line, the most largely patronized route, has been more than doubled during the last four years and increases are constantly making.

To provide for the demands of the people of the West Side, the company has built twenty miles of road during the last four years. It wished to build considerably more but the hostility of the last city administration prevented the company from beginning work. There are now pending in the City Council ordinances providing for the construction of forty miles of line. This includes extensions of existing lines and the construction of crosstown lines of which the West Side has none worth mentioning. Whether these ordinances will be passed or loaded down with such conditions that they cannot be accepted remains to be seen. What the attitude of the present city government is has not yet been ascertained. Citizens

whose property will be benefited or whose convenience will be enhanced are making strenuous efforts to secure the passage of these measures.

It has been stated that the West Side company has been charged with furnishing inadequate accommodations. It has also been charged that the cable system was defective. These matters were called to the attention of General Manager Parsons of the West Side company, and he consented to make a statement for the STREET RAILWAY JOURNAL.

"We have had," said he, "a series of misfortunes from broken grips and from employes running into switches. It has been unfortunate that these accidents occurred at the time of the 'rush' trips morning and evening. They have not been the result of any defects in the cable system. The facts have been grossly exaggerated, although, of course, delays have in some cases occurred. The newspapers seem to find it necessary to take a 'shy' at us every so often. Now, to illustrate: In last Thursday's *Tribune* mention was made of an accident causing a delay of forty-five minutes. As a matter of fact the delay was not over three minutes. It happened right out there," he continued, pointing out of his window, "and the wagon with the men who look after that sort of thing was on the spot at once."



SCENE AT CORNER OF MADISON AND STATE STREETS, CHICAGO.

"How about the statement of the newspapers that inadequate accommodations are provided?" was asked.

"This is another instance of gross exaggeration. I have in my hand a sworn statement showing the cars in which persons were standing. It shows that of the total number of cars operated not over one-seventh of them contained passengers who were standing. One count, for example, showed that of 2,200 cars passing around the loop in a day only 315 had standing passengers."

"Can you accommodate all the traffic with the natural increase for the next five years?"

"Why certainly, although we can't provide seats for everyone when there are gathered at a street corner more people than a train will hold."

Now, as to the North Side road. During the last five years the North Side company has increased its system from thirty-five miles to eighty. During that time it has built twenty miles of cable road, and there is a great demand for more. The demands on the lines are enormous, and Mr. Yerkes speaks of the cause in this way:

"Here we have a great city growing faster than we can realize. In the heart of the city there are buildings in which 3,000 persons do business. I do not criticize this, but it shows the number of people that congregate in the business centre every day. It is a big business centre which everything pours into and out of in an exceedingly short space of time."

The delays and breakdowns on the North Side can be explained, as Mr. Parsons explains them, in the case of the West Side. They have been exaggerated by the local papers as much in one case as in the other. One of the officers of the road, in speaking of the charges made by the press, said to the writer recently, "You realize the falsity of the charges as well as I do. They are all included in the word 'buncombe.'"

Mr Yerkes's attention was called to the question of inadequacy by a representative of the STREET RAILWAY JOURNAL. He said: "We are abundantly able to handle the traffic. We have power enough to meet all demands for the next five years, but we shall have to increase the rolling stock."

The situation, as it exists to-day in Chicago, can be judged from what has been written. It may be summed up in a sentence: The street railway companies are doing everything in their power to serve the public, but a sufficient number of cars cannot be run on the tracks to accommodate the vast number of people who wish to ride at certain hours of the day.

It is not the purpose of this article to show where the remedy lies. A public commission has that matter under consideration. It may be well to quote again from Mayor Washburn's message, to show that his opinion is not entirely different from that which has been expressed here. He says:

> "It is plain that the facilities of the present surface roads, even if they were improved to the point of perfection, are insufficient to care for the rapidly growing population, and their inadequacy will become more marked each year. Your honorable body has granted ordinances to two elevated railroad corporations in this city, both of whom have partially constructed their roads. For many months both these companies have remained apparently idle, and appear to be taking no steps to perfect their roads and grant to the public a service which they are in duty bound to provide as soon as practicable."

In view of all these facts Mayor Washburne determined to appoint a commission "with the view of having a comprehensive report upon this, to-day, all important problem, and which will lay before the administration and the public the difficulties to be met and the obstacles to be overcome and the best means to overcome them."

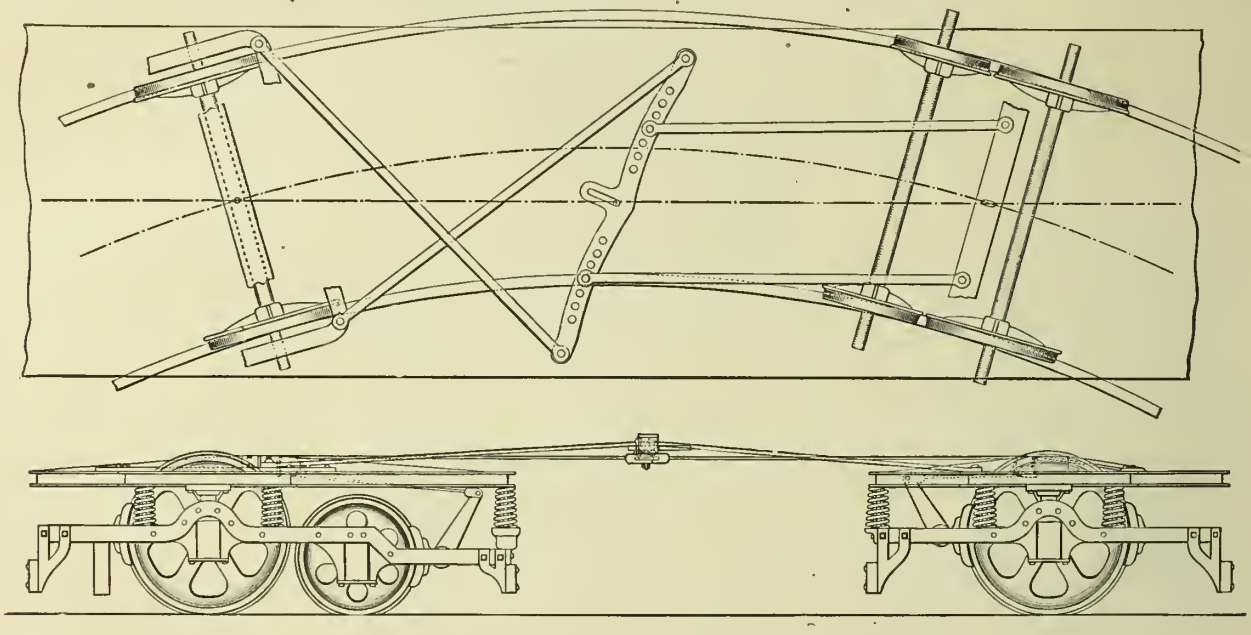
The commission, which includes aldermen and citizens of the several divisions of the city, and representatives of the street car companies, is as follows: On the part of the City Council from the South Division, William R. Kerr and Anson Gordon; for the West Division of the city, Robert L. Martin and Edward F. Cullerton; for the North Division of the city, Austin O. Sexton and Peter J. Biegler. The citizens appointed upon this committee for the South Division are D. V. Purington and N. B. Ream; for the North Division, C. K. Corbin and Washington Hesing; and for the West Division, A. J. Stone and Frank Stauber. The North and West Division street railway represented by Charles T. Yerkes and the South Side Cable lines by G. H. Wheeler. The chairman is Austin O. Sexton.

WHAT is said to be the largest girder in the world was placed in position, December 20, over the Mattabesset River at East Berlin, Conn. It is 102 ft. six inches long, six feet deep, and weighs over fifty tons. It was manufactured by the Berlin Iron Bridge Co.

THE record of steam railroad accidents in the United States during September, upon which information could be obtained, includes 139 collisions, 92 derailments, and six other accidents, a total of 237 accidents, in which 65 persons were killed and 198 injured.

The Shaw Radial Car Truck.

A number of interesting trials have recently been made on the line of the Merrimac Valley Street Railway Co. and other roads in that neighborhood, with a new car truck, the invention of Henry S. Shaw of Boston, Mass. The construction of the truck is simple, as will be seen from the accompanying engravings, which give its plan and elevation. It has two pairs of driving wheels, with one small pair of wheels, which act as guides and which are attached to one set of the driving wheels. The wheels at the forward end of the car follow automatically the line of track whether it be straight or curved, and the



THE SHAW RADIAL CAR TRUCK.

radial bars by which both sets of wheels are connected give the second pair of wheels the same direction, by means of the movement of the body of the car. The radial bars also hold the wheels in place and aid them in passing over obstruction on the track.

The truck is so arranged that ninety per cent. of the load of the car comes upon the driving wheels, to which, of course, the motors are connected, only ten per cent. of the weight being supported by the small wheels. Further information in regard to the working of this truck can be obtained from Samuel A. Randall, 143 Federal Street, Boston.

Two Underground Electric Railway Projects in Chicago.

Although there are electric railways in Chicago they are located at a considerable distance from the centre of the city. The fact that no electric road has been built nearer the business section is due to the fact that Prof. J. P. Barrett, the city electrician, is an uncompromising opponent of overhead wires. No company contemplating the use of conductors above ground can expect any encouragement from him. The development of a conduit electrical system is therefore of particular interest to Chicago.

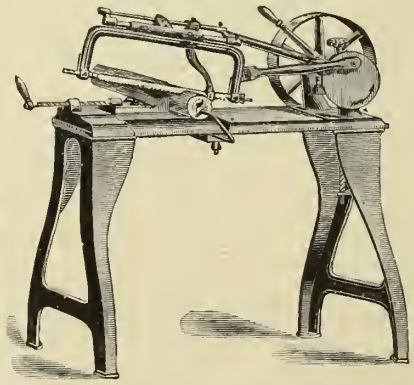
At the present time there is a prospect that a thorough test will be made of two of these systems. It has already been stated that the Fullerton Avenue loop on the North Side will be equipped with the Love system. This section is about a mile and a half in length.

To equip this line with the Love system will involve a heavy expense, but the company which is exploiting it believes that the test will demonstrate the practicability of the plan. The car which will be used will be a small one, only ten feet in length; it will be equipped with an Eickemeyer motor. It will be built, in all probability, by the Pullman company. It is true beyond question that the electrical features of the Love system have been well worked out, and the construction is such that many of the difficulties attending the operation of conduit schemes will be avoided. The company hopes to have the road in operation within ninety days.

The electric railway at Buda-Pesth has attracted an extraordinary amount of attention during the last year, and it has been described as the only successful conduit electric railway in the world. It is not improbable that the success of the road has been somewhat exaggerated, for little has, apparently, been written of the natural difficulties to be expected in the operation of a road of this kind. The owners of the system, Siemens & Halske, have great faith in it and believe it will solve the problem. Mr. Mysenburg, of Chicago, became interested in the road when in Buda-Pesth last summer, and called Mr. Yerkes' attention to it. The latter thought it advisable to make a trial of it in Chicago. The test will be made on one of the West Side roads. General Manager Parsons, of the West Side company, is authority for this statement. It has erroneously been stated that a contract has been awarded to O. W. Mysenburg & Co. for the installation. No contract has been made, but it is not unlikely that the firm will build the road. Mr. Wright, of the firm, left for Buda-Pesth on December 8, to make a thorough study of the system. The matter will probably be definitely settled within two months.

The Star Power Saw.

In street railway power houses and repair shops a power saw for cutting iron and steel bars and pipe often proves a great convenience, if not, in many cases, a positive necessity. To furnish a convenient and inexpensive machine of this character has been the aim of the Millers Falls Co., of Millers Falls, Mass., the saw being shown herewith.



By this machine metal can be cut much more rapidly than by a lathe, planer, or black smith's hack. By its use also a good percentage of metal is saved, as the pieces cut are left smooth and no labor or metal is lost in squaring up, as in the case after cutting with the hack.

No attention is required by the machine while in operation until the piece is cut off. The expense of the blades is small, since one blade will cut a steel shaft four and a half inches in diameter several times.

Electric Plant of the Missouri R. R. Co. of St. Louis.

The Missouri Railroad Co. has under its control a cable division, commonly called the Olive Street line, and an electrical division, the Market Street line. The former is one of the best cable roads in the country. For economical working it has very few equals. There are about 200 cars operated by cable power, of which forty-five are grip cars, and of the 155 trailers half are summer and half winter cars. There are in operation at the present time by cable about eleven miles of road extending from Fourth Street on the east to Forest Park on the west.

The electrical division, with which we are more intimately concerned in this article, runs from Fourth Street to Tower Grove Park, a distance of five and a half miles, double track. The cars of the Forest Park, Laclede Avenue & Fourth Street railway use the tracks of the Market Street line from Fourth Street to Twenty-seventh street, then branch off to Laclede Avenue, and run along this street to Forest Park, a distance of about one and three-fourths miles. Our reason for mentioning this road is that it is operated by the Missouri company, deriving its power from the latter's power station, housing its cars in the latter's car house, etc. Both lines have been in operation for eleven months, and their performances in handling the traffic have been most satisfactory. They parallel the cable road belonging to the same company, and in consequence have relieved it of some of its passengers, but the receipts of both lines belong to the same stockholders.

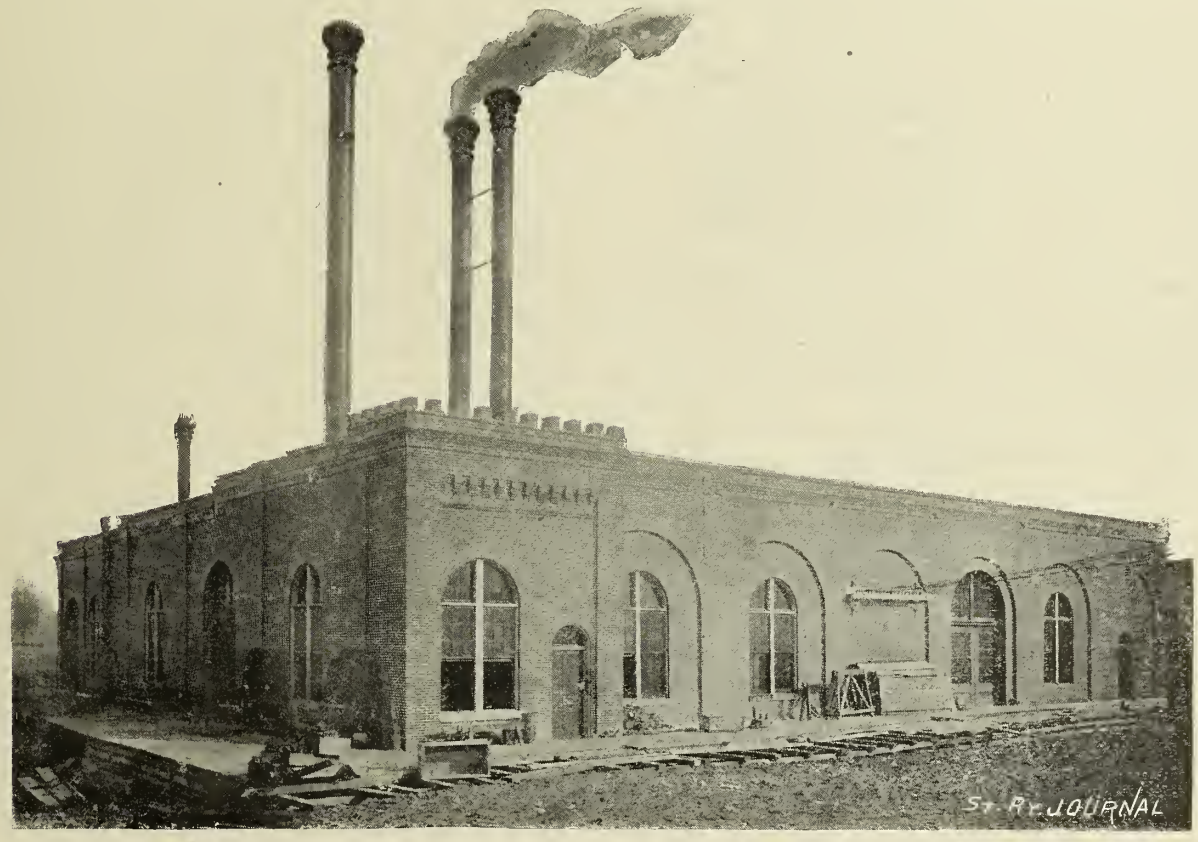


FIG. 1.—EXTERIOR OF POWER STATION, MISSOURI R. R. CO., ST. LOUIS.

The power station (see Fig. 1) is situated on Clayton Road and the Wabash Railroad tracks, and thus its coal facilities are of the very best. No attempt has been made at architectural beauty in putting up this structure, but it was designed to be a substantial building for practical uses, such as all buildings of like nature should be. It is of stock brick laid on a heavy limestone foundation, and is one story in height. The high windows on the south and east sides provide ample light, and are large enough to do away with the necessity of any extensive skylight arrangements. Sufficient ground lies between Clayton Road and the structure itself for a large addition, should any such ever be needed. A switch from the main line of the Wabash Road runs along the north side of the building, and here the coal cars deliver bituminous coal through the large doors opening into the boiler room. The entire building is square in form, and measures 142×135 ft.

The engine room (see Fig. 2) which occupies the south and east sides of the building, and is in the form of an L, measures 135×106 ft. The present engine equipment consists of one 1,000 H. P. engine of the Hamilton-Corliss type, and built in Dayton, O.; two of 600 H. P. of the Harris-Corliss type, built in-Providence, R. I.; one of 100 H. P. built by Porter & Allen, and one of sixty H. P. built by the Fulton Iron Works Co. of St. Louis, an aggregate of 2,360 H. P. This is the ultimate capacity of the plant, as there is no more space left for additional equipment. The cylinder dimensions of the 1,000 H. P. engine are 36×60 ins.; of the two of 600 H. P. each, 30×60 ins.; of the 100 H. P. engine, 12×20 ins.; of the sixty H. P. engine, 10×20 ins. The diameter of the 1,000 H. P. engine's flywheel is twenty-eight feet, face six feet three inches, weight sixty-eight tons; of 600 H. P. engine's, twenty feet, fifty-four inches, twenty tons, respectively, diameter of 100 H. P. engine's flywheel five feet six inches, face fifteen inches; same of sixty H. P. engine, seven feet eight inches. All engine bearings are equipped with self oilers; and all engines are so arranged that they are in communication with the shafting and pulleys. The latter are arranged in one long line, 120 ft. in length. The shafting is divided into two sections, one of which has a diameter of eight inches and the other of nine inches. The latter half has recently been put in, and it is to be operated in connection with the 1,000 H. P. Hamilton-Corliss engine. All the pulleys are provided with the Hill clutch device, made by the Hill Clutch Works of Cleveland, O., and thus the direct coupling of the engines and dynamos is not permanent, but they may be interchanged at will. All shafting bearings are supplied with self oilers, and a speed of 182 revolutions per minute is maintained.

The required tension on the belts is regulated by means of the dog and screw arrangement made by the Hill Clutch Works. This not only tightens or loosens the belt, but gives to it a certain side or lateral play, which greatly increases its efficiency. The belts are all solid and were made by the Charles Munson Belting Co. of

Chicago. The width of the belt used with the 1,000 H. P. engine is seventy-two inches; with the 600 H. P. engines, fifty-three inches; with that of 100 H. P., thirty-five inches; with the sixty H. P. engine, sixteen inches.

The boiler room is 100×36 ft., and is at present equipped with six boilers, in batteries of three each. The boilers are of the ordinary tubular type, and were made by Rohan Bros., of St. Louis. They have a six inch shell, are twenty-two feet in length, and have a diameter of sixty inches. Each boiler has eighteen flues of six inches diameter each. One battery is used at a time, but as soon as the 1,000 H. P. engine is put into operation an additional battery will no doubt be required. The boilers are supplied with water from the city mains. There are two Hooker No. 10 pumps in use, manufactured by the Hooker Co. of St. Louis, and a vertical pump of the type that steamboat men call a "doctor." A Rohan heater, they can be self or separately exciting, a small exciter being operated by the sixty H. P. engine. Each generator is equipped with the latest type of Thomson-Houston lightning arrester, and the automatic circuit breaker of the same company.

The switchboard is very neatly fitted up in cherry. There are fourteen feed wires centering at the board, and each one is marked with the name of the street at which it connects with the trolley wire. The switches are insulated from the switchboard by means of square slate slabs, while in the case of the resistance coils, rheostats etc., the insulating material employed is porcelain. Very much to the credit of the Thomson-Houston company and the scrupulous care of the railway company's electrical engineer, but one generator has been taken apart since the road started operations eleven months ago, and this machine, which is one of those first installed, is apart at

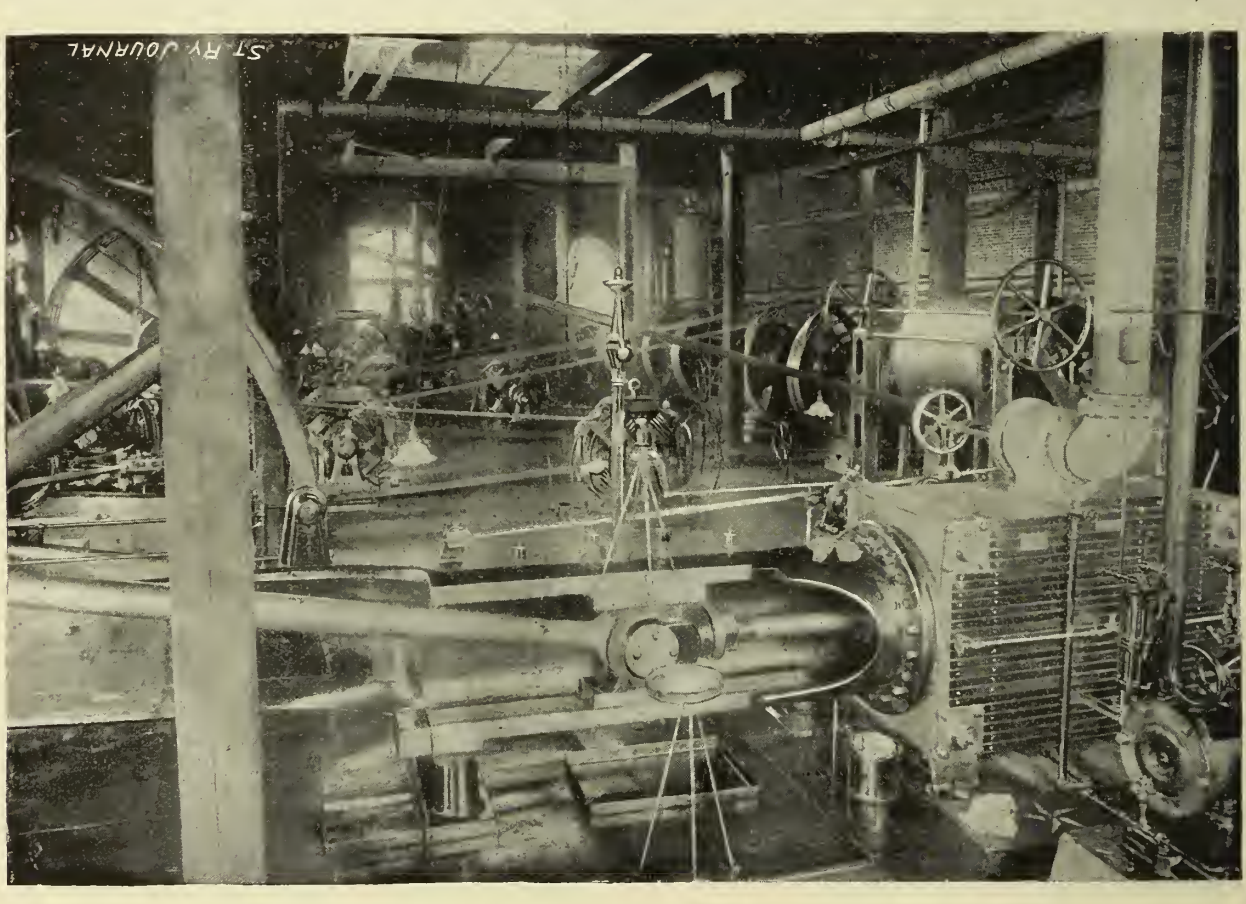


FIG. 2.—INTERIOR OF POWER STATION, MISSOURI R. R. CO., ST. LOUIS.

is used to heat the water to the required temperature, 212 degs., before its entrance into the boilers. Combined with the heater is a patent settler for clearing the water of all mud and impurities.

The steam piping outfit is about as complete as it could be. The main steam pipe runs from the boiler room to the north side of the engine room. It is here divided, one part branching off towards the 1,000 H. P. engine, and the other towards the four other engines. All pipes are covered with a good thickness of asbestos bound to them by means of brass strips.

There are at present in use three steel smokestacks. (See Fig. 1.) They are ninety-five feet in height, and have a diameter of forty-four inches. They are given a good appearance by a capping of ornamental flutings. The steam engineering was done by Rohan Bros., and the Kupperle Co., both of St. Louis, and a great deal of credit is due them for the admirable manner in which they have equipped the plant.

The generator equipment consists of seven Thomson-Houston machines. Two of these are of the "M. P. 250" four pole type, of 275 H. P. each, and make 400 revolutions per minute. The five smaller dynamos are also of the multipolar type, of 100 H. P. each, and make 750 revolutions per minute. All the machines are so arranged that the present time, simply for renewing the binding strips on the armature.

There are in operation at the present time thirty motor cars and fifteen trailers, one half on the Market Street line and one half on the Laclede Avenue line. All the rolling stock was built by the J. G. Brill Co., of Philadelphia, and is representative of the fine work turned out by that company. The car bodies are sixteen feet long, while the length over all is twenty-four feet. The trailers are of the same dimensions as the motor cars, are equipped with Brill's patent equalizing gear and two of Smith's patent double centre lamps. The motor cars are lighted by electricity, and are equipped with Brill's patent No. 7, independent, rigid motor truck. On each truck are mounted two fifteen H. P. Thomson Houston double reduction motors. Comment on the workings of the motors is almost unnecessary, as motors of this class have already established an enviable reputation for themselves. A thirty inch wheel is used with the motors, while the trailers are equipped with wheels of twenty-two inches diameter, and thus afford greater convenience for passengers boarding the cars. The cars are run at an average speed of ten miles an hour. This means about eight miles an hour downtown, and twelve miles an hour in the outlying districts.

The track construction is the very best that could be desired. From Fourth Street to Twelfth Street the stringer construction, laid while the road was operated by horses, is still in use and is quite as smooth as the girder construction. The wooden stringers seem to act very much like a cushion. This is most noticeable when the transition from the stringer to the girder construction takes place, the latter having a smooth but hard sensation. The remainder of the road, from Twelfth Street to Forest Park, the terminus of the Laclede Avenue line, and to Tower Grove Park, the terminus of the Market Street line, is laid with seventy-eight pound Johnson girder rail. This portion of the road, especially where the street is paved, is most substantial. The ties are planed squares and placed quite as near together as in steam railroad construction. Concrete, well tamped, serves to make the road as rigid as possible, and all joints are well guarded by an additional tie. There are no suspended joints, but each joint is supported by a chair and the latter by a tie. All curves, where the street is not paved, are laid with orange wood blocks, and where the Market Street line crosses the Missouri Pacific and St. Louis & San Francisco tracks smooth but heavy crossings are provided for both steam and electric cars.

The company's car house is situated at Compton Avenue and Dexter Street. It consists of one large building a block in length. One end is but one story in height, and here are accommodations for the Laclede Avenue cars, and at the other end, of the same height and dimensions, are accommodations for the Market Street cars. The centre of the building is of two stories, and here are situated the general offices as well as the car repair shops of the company.

At the Forest Park terminus of the Laclede Avenue line the management intends erecting an extensive pavilion to accommodate next summer's crowds.

In conclusion, we wish to thank Mr. P. C. Maffit, President of the Missouri Railroad Co., Mr. Hill and Mr. Thompson, respectively, steam and electrical engineers of the power plant, for their courtesy in giving us the above information. G.

The Practical Side of the Electric Railway.

Chapter II.—Overhead Construction.

By J. H. Bickford.

There are two methods of line construction, known as the direct and indirect. The term "direct" is applied to that method of construction in which the trolley wire or working conductor is of large area and of high conductivity and carries the current its entire length, being connected only at one or two points with the feed wires which lead out direct from the station.

The second or "indirect" method is that in which the trolley wire or working conductor is of smaller area and of low conductivity, and is divided into sections of 500 or 600 ft., each of which is connected to a parallel wire of high conductivity, called a main, which is run on the poles at the side of the street, and which is fed at intervals, so that the current is maintained at a nearly uniform potential throughout the entire line.

The first method has some advantages over the second on short lines two miles or less in length and on which only a few cars are operated. In this case the No. 0 copper wire which is usually used is of sufficient capacity to carry the current, but on long roads where it becomes necessary to reinforce the working conductor by feed wires the large wire has no advantage, and being heavy entails an additional expense for maintaining it above the street. On long roads where the direct method is employed the potential at the points most distant from the station is usually very low; not more than 300 volts on a certain five mile road with which I am acquainted, this condition being due to the absence of feed wires.

Some of the disadvantages attending the use of a heavy 0 wire where it is possible to reinforce it, are that it requires very large poles to support it in order to keep it in proper position; it is unwieldly and difficult to splice, and if made of copper has a low tensile strength compared with wires of other material; being soft it wears more readily and offers a large surface for the accumulation of snow and sleet; from its tendency to stretch it is difficult to maintain it in position on curves or hold it to a proper adjustment on the tangents.

From the above it will be seen that hard drawn copper wire has few advantages to recommend its use on either long or short roads. On the other hand, the indirect method has many advantages and possesses few of the disadvantages of the direct method either on short or long roads. The working conductor employed with the indirect method is usually a No. 4 silicon bronze wire which is extremely light in comparison with copper wire of the same size and has a greater tensile strength; it is easily handled, will not stretch perceptibly, and has far better wearing qualities; its greater tensile strength ensures it from accidental breaking, and its small area offers little surface for the accumulation of sleet and snow; it is easily held in position on curves and can be readily spliced. Another great advantage attending the use of small wire is the fact that being light the trolley wheel in passing tends to lift it, causing it to bend at every point, which, in case it is covered with snow or sleet, tends to crack the incrustation so that it falls off in showers as the wheels roll along, while the large wire being virtually a rod is not raised perceptibly by the trolley, and in case it is covered with sleet the wheel is liable to pass over it without making a contact. It is not claimed that with the smaller wire the trolley will clear it of snow and ice in all cases, for it sometimes becomes so thick that it is necessary to clear it off with poles and scrapers. But in any event it can be removed from the smaller wire more readily than from the larger one.

I am confident, from personal observation, that most of the electric roads that have been built within three years will necessarily be reconstructed within five years from the date of building, many having already been reconstructed. Of course, the fact must be recognized that the business being new, many blunders were made from inexperience; all had gradually to feel their way up to a proper standard, and it is not surprising that cheap work and cheap material played an important part in early constructions. The question has been heretofore not how good but how cheaply can a mile of electric road be built. Will it cost over $1,200 or $1,500 per mile? Had the answer been "Yes, it will cost twice that amount for a good line," many roads would have more dollars in their treasury to-day than they now have. In order to make the construction inexpensive, small poles were employed, and in many cases were not set more than four feet in the ground. In fact, some recently constructed lines have made the blunder of setting their poles with too short a section underground. Poles that are small and insecurely set will bend and cut their way through the soil and will soon appear to have a decided attraction for the other across the street, while the trolley wire shows a like attraction for the rails. Although thousands of wooden poles have been employed that are not more than eight inches in diameter at the ground line and four or five inches at the top, we do not hesitate to say that it is a waste of money to follow such a practice, as such poles will not hold the wire in position more than three years. With their use span wire cannot be kept taut, and if the trolley wire is particularly heavy the sag will be correspondingly great, and when the attempt is made to take up the sag such poles will either break or bend, depending on the wood, whether chestnut or cedar.

Where cedar poles are employed they should not be less than thirty feet in length nor less than eleven inches in diameter at the ground line and not less than eight inches at the top. Chestnut poles should be of the same length and not less than ten inches at the ground line and seven inches at the top. Where round steel poles are employed the sections of tubing should not be less than six inches, five inches and four inches. The six inch section should be about eighteen feet long, the five inch

section about eight feet and the four inch section four feet; this will make a total length of thirty feet. We are aware that most steel poles are made from twenty-six feet to twenty-eight feet in length, but this not enough. If guard wires are to be employed thirty feet is the least length that ought to be employed, and where feed wires are employed the poles should even be higher than thirty feet. It is not a good practice to attach a number of feeds to a short slim pole, and a thirty foot pole should not be required to carry more than a two pin arm. Wooden poles of the dimensions above named, except as to length, are large enough for streets of ordinary width, but steel poles of the above dimensions should be confined to streets not exceeding fifty feet in width. On the curves where heavy strains occur larger poles, whether of wood or metal, should be employed in order to maintain the trolley wire at the required height.

In case wooden poles are to be employed I would rec ommend a hard pine pole not less than ten inches square at the base and tapered to not less than eight inches at the top. The first twelve feet at the base should be left square and the remaining length sawed octagonal. The poles should be set not less than six feet in the ground, and after setting, the corners, from twelve inches above the ground up, may be chamfered leaving the surface one inch wide. This will make a strong, neat pole that will cost about six dollars. The top should be coned, and painted to prevent decay from the effect of moisture. The pole being in position, a piece of timber or plank should be placed next the curb about fifteen inches below the surface of the ground and stones should be tamped in at the back of the pole near its foot. Steel poles should in all cases be set in a concrete foundation, and it is also better to set wooden poles in the same material. Wooden poles should be set to rake away from the street at least twenty-four inches as they will pull up straight in time and will look much better looking outward than inward. Poles with brackets, however, may be set straight or nearly so. Both wooden, and steel poles should be painted with some neutral color except at the base which may be in some dark colors.

(*To be continued.*)

Foreign Street Railway Notes.

By Our Special Correspondent.

STREET RAILWAYS IN HOLLAND.

During the last few years the system of street railways in Holland has developed upon a remarkable scale. This may be caused by the Dutch laws which contain very favorable stipulations for the construction and working of street railways. The gauges employed are various, 2 ft. 5½ ins., 3 ft. 3½ ins., 3 ft. 6 ins., 4 ft. 8½ ins. being the most common. The track construction is of many different patterns, but after ten years' experience the Vignol rail on timber or steel ties, has been adopted generally, except at cross streets where grooved rails on stringers are still used. The lines are almost always of single track and have no special stopping stations.

In the towns the street railways are operated mostly by horses, but in the country, nearly without exception, by locomotives. If the locomotives are used inside the towns all the moving parts of the machinery are covered by an iron case and they are also furnished with a smoke consumer. In several towns and villages a law is in force that in narrow streets a man with a bell must go before the train; this is made necessary because the train passes sometimes very close to the houses of the street; there are, in fact, places where the space between the train and the house is only four inches. On several lines only one man is employed on the locomotive; but in most of the provinces of the kingdom the authorities have ordered that two men, viz., an engineer and a fireman, must be on each locomotive.

Since the first of January, 1890, the highest allowable speed has been fixed at twelve and a half miles per hour; but while passing through towns and villages and while crossing bridges and important roads in many provinces only 4.6 miles per hour are allowed by provincial law.

In many cities in Holland a special tax is levied per car for the use of the streets. As a short car pays the same tax as a long car, the street railway companies prefer to use the latter. In consequence, a train is composed very often of the locomotive, baggage car and one passen ger car containing first and second class compartments with thirty-six seats inside and room for sixteen passengers on the platforms.

In the year 1890 there were forty-seven companies operating 556 miles of street railways in Holland. Of these 522 miles were of double track and thirty-four miles of single track. Thirteen companies used only horse power and twenty-nine companies only steam power, while five companies used both steam and horse power. Of the above mileage one-half was of the standard 4 ft. 8½ ins. gauge. There were owned by these companies 213 locomotive engines, 1,023 horses, 802 passenger cars and 467 baggage cars.

UNDERGROUND RAILWAYS IN GLASGOW.

The construction of an underground railway in the important city of Glasgow was approved by Parliament in the year 1888, but the contracts for the different portions of the work have only recently been let.

This railway will cross the city of Glasgow from the east to the west and will have a total length of about six and a half miles. It starts from a branch line of the Caledonian Railway in the south-east part of the city close to the north bank of the river Clyde, then crosses the oldest city park of Glasgow, going along a nearly straight series of streets to the Queen's Dock, with which railway lines it will be joined by sidings. From the Queen's Dock it turns to the north and goes through a hill on which the West End park is situated, crosses the Kelvin River and the Botanical garden and comes out on the open ground where an extension may ultimately be made.

The greater part of the line will be entirely underground, but at several points the road will be carried in open cuttings whose sides will be secured by retaining walls. The track will lie, on an average, twenty feet below the surface of the streets.

At each of the thirteen stations proposed the ticket offices will be placed on the street level and staircases will lead to the railway platforms. The steepest gradient on the line will be one in eighty.

The total cost of this railway is estimated at £4,700,000 out of which £220,000 must be paid for real estate.

ELEVATED RAILROADS IN BERLIN.

The well-known electrical firm of Siemens & Halske in Berlin has prepared plans for the construction of a network of elevated railroads in the city of Berlin which will use electricity as a motive power. All cars will be equipped with motors and will be run separately under a headway of from two to three minutes. In cases, however, of great traffic, trains are to be formed of two to four of these motor cars. A service of eighteen hours a day is proposed. It has been estimated that each car on each run between the terminal points of the line will carry forty passengers, and that 15,000,000 to 75,000,000 passengers will be carried in each year.

The cost for constructing these elevated railroads of double track has been calculated to be $605,000 per mile. Taking this figure as a basis the total cost of the proposed elevated railways will be $22,000,000. The present plan is to construct only the south line of only five and a half miles in length, provided, of course, that governmental sanction can be obtained, which is considered doubtful.

ELECTRICAL STREET RAILWAYS IN RUSSIA.

The first electrical street railway in Russia will be constructed in Kiew, a city of about 130,000 inhabitants and situated on the river Dnieper. This street railway will use the overhead system and will be ready for operation in the summer of 1892.

Conditions of Maximum Motor Efficiency.

An interesting paper entitled "A Motor Operating Automatically at any Desired Speed or Torque, and with Maximum Efficiency Under all Conditions," was recently published by H. Ward Leonard. An abstract of the article together with a reply by C. O. Mailloux, published in the *Electrical Engineer* is given below :

MR. LEONARD'S PAPER.

In the operation of electric motors there are three principal factors to be considered, the speed, the torque and the efficiency. Under any variations in power the efficiency should remain as nearly constant as possible. For one class of work it is desirable to keep the speed constant when the torque varies. For a second class of work it is desirable to keep the torque constant at one particular amount when the speed varies. For a third class it is desirable to operate at many different speeds, and yet automatically at any particular speed desired regardless of the torque. For a fourth class it is desirable to operate at many different torques, and yet automatically at any desired torque regardless of the speed ; and for a fifth kind it is desirable to keep the amount of power supplied constant, regardless of a change in torque, that is, so that if the torque changes by the requirements of practice, the speed would automatically change so that the power consumed would remain constant.

Of the above five principal classes of work there is only one, namely, constant speed and variable torque, which we can take care of with reasonable efficiency and from our existing supply circuits.

It is well known that when a street car is first started and is scarcely in motion the actual power represented by such motion is almost nothing, for, although the pounds pull is large, the feet per minute is extremely small; consequently the power required must be exceedingly small. What do we find in practice ? We find that in order to develop a power of but a fraction of a horsepower we must, on account of the slow speed demanded, develop about 30 H. P., and then waste about ninety-eight per cent. of this horse power in order to utilize the remaining two per cent. in the way it is desired. The efficiency of the modern electric street car is not probably more than two per cent. when just starting from dead rest and moving at the rate of one-half foot per second.

When we come to investigate this, we find that the explanation is that in order to get the necessary large torque with freedom from excessive sparking we must have a very large current in a nearly constant field; and since our E. M. F. is constant we must use an amount of power which will vary almost directly with the torque, and will be regardless of the speed. Or, in other words, the efficiency of the motor will vary directly as the speed,with an efficiency of perhaps eighty per cent. at full speed.

As a result of my investigation of this subject I have concluded that the operation of electric motors should conform to what apparently, is a new law and which may be stated as follows :

Vary the voltage as the speed desired.

Vary the amperes as the torque required.

In other words, make the speed dependent upon the voltage only and independent of the current, and make the torque dependent upon the current only, and independent of the voltage. Since the product of the speed and torque represents the work being done, and the product of the volts and amperes represents the power supplied, it is evident that if we can operate in conformity to this law, we shall have a constant efficiency under all conditions, disregarding, of course, the small fixed losses in the field and armature.

One way in which this law can be followed is to supply the field of the motor from one source of electric energy and supply the armature from another source, the E. M. F. of which can be varied. It will be noticed that when the speed is fixed a fixed voltage will be necessary in order to conform to the law, and the shunt motor is found to conform perfectly to the law; but it is the only motor I know of which does conform to the law which seems to be generally applicable.

For operating an electric railway we will place a shunt wound motor on the car, and directly driven by this motor will be a special generator, which will be connected to the electric motor below the car. It is evident that the generator and working motor armatures may be wound for any voltage desired, say 20 volts, which will make the problem of insulating the street car motor an extremely simple one. If desirable, we can supply several cars of a common train from one special generator on the forward car. With this outfit we will be able to take any car up any practicable grade or around any curve with no more power than is required to move the car on a level, and always consume the same power, regardless of weight, grades or curves. That is, the automatic increase of current, to take care of any increased torque, will be compensated for by a corresponding decrease in the volts and speed.

I wish to call attention to a very important development leading out from this, namely, that we will be able to use alternating currents for operating our street cars, for it is well known that the ordinary alternating current generators will operate perfectly as motors, if the speed and torque be kept constant. Since by this system we can, from a constant torque and speed, get any other torque and, automatically, a corresponding speed, we shall be able to run street cars perfectly by alternating currents. This again will enable us to dispense with trolleys, conduits, storage batteries, etc. We will place between our tracks, in manholes, converters whose primary pressure can be anything required for proper economy and whose secondary will be, say, fifteen volts. This secondary circuit will connect directly with the rails. The road will be divided in sections, each a few hundred feet long, and each section will be supplied by its own converter,

On first consideration, the additional apparatus necessary would seem to make the system prohibitory in practice; but the capacity of the present single motor is greater than the combined capacity of the apparatus this system would require, and the capacity of the prime motor is very much reduced.

In order to reduce the first cost to a minimum and yet secure the advantages of different automatic speeds and high efficiency, I have devised two modifications of the arrangement described above. The first is adapted to power in which a smooth, efficient acceleration of a load from rest is required, as in the case of passenger locomotives and elevators. The second case is where various automatic speeds are desired, but no especial importance attaches to the starting of the load from rest, as is the case in machinery in general.

For the first case we have the trolley system of electric street cars as the most important. Let us suppose we have two motors of 15 H. P. each for the car. We find that for full speed upon a level we require about fifteen amperes at 500 volts. Upon heavy grades we find that about fifty amperes are required, and, as before, we have 500 volts. With this consumption of energy we find that we get a speed upon the heavy grade which is about one-quarter of the speed upon a level. In order to operate upon my system let us place upon the car a motor generator, the motor part of which is wound for 500 volts and twelve and a half amperes, and the generator part of which is wound for 125 volts and fifty amperes. The fields of the motor and generator part are distinct and are wound for 500 volts, as are the fields of the two propelling motors under the car. All these fields are supplied from the 500 volt trolley circuit. In the field of the auxiliary generator is placed a rheostat.

Now, suppose the car rests upon a grade. The motor generator is running, but the generator has a very weak field. Its armature is connected by a controlling switch to the propelling motors. We now gradually cut resistance from the generator field circuit and finally get about twenty volts at the brushes of the generator. With this E. M. F. we get sufficient current to produce fifty amperes through the armatures of the propelling motors in a saturated field. This gives us the full torque and the car starts at a speed of perhaps half a foot a second. This speed can be maintained constantly and indefinitely, and the consumption of energy will be less than two H. P. This is less than three amperes from the trolley line. In practice, however, the speed will be rapidly but gradually accelerated until we have 125 volts upon the terminals of of the propelling motors. We will now be running at one-quarter speed and will be consuming 125 volts and fifty amperes, that is, 6¼ K. W. instead of 25 K. W. to get the same result with existing motors. To put it another way, we will not be using as much energy as is represented by the 500 volts and 15 amperes necessary for full speed on a level.

The next step on the controlling switch will disconnect the armatures of the propelling motors from the auxiliary generator and put the two armatures in series across the trolley line direct. We will now go at a speed represented by 250 volts, that is, one-half full speed. The next step of our switch will place the two armatures in multiple across the 500 volts, and the next and last step will place the 120 volt auxiliary generator in series with the main central station generators and give us 625 volts on our armatures and a correspondingly increased speed. We will be able to go up a grade of six to eight per cent. at full speed, with fifty amperes and 500 volts, which, with the present motors, gives us only about one-quarter of that speed.

Under this arrangement it will be noticed that the only apparatus which could be called additional is the small motor of 500 volts for the generator part of our motor generator, which is useful not only for starting, but for full speed also. In stopping the car we have an electric brake action delivering back energy to the line at full efficiency and not through a rheostat, as at present.

If we have a train of, say, three cars, so that we have six motors, we can start from rest with sufficient smoothness by placing all six armatures in series, which will give us something less than one-sixth speed as the first step. Then we can place three in serieds with two multiples, which gives us one-third speed. Next, two in series with three multiples, which gives us one-half speed; and finally, all in multiple, which gives us full speed. Under such conditions, we can dispense with the small converting plant altogether.

THE LAW OF MAXIMUM EFFICIENCY OF ELECTRIC MOTORS.

BY C. O. MAILLOUX.

In the very interesting article on his new method of operating motors, Mr. H. Ward Leonard enunciates a so-called new law of efficiency which is, unfortunately, not free from objections.

Mr. Leonard states his "law" as follows :

"Vary the voltage as the speed desired,"
"Vary the amperes as the torque required."

The now classical researches and historic experiments of Marcel Deprez have long since consecrated these two statements, which are to be found, more or less amplified and elaborated, in the writings of Du Moncel, Froelich, Ayrton and Perry, Silvanus Thompson and others. The claim to novelty rests upon the "combination," or rather, the opposition of the two statements to make a law. It so happens, however, that the combination does not formulate *a* law, but merely states, somewhat awkwardly, some of the conditions favorably to *the* law—Siemens' law of efficiency. The awkwardness and vagueness of diction is made readily apparent by the fact that a good illustration of the "law," as worded, obtains in the now common practice of regulating street car motors by means of a variable resistance in the circuit. The manipulation of this resistance at the time of starting, or afterwards, *causes the amperes to vary as the torque* required. It also causes the *voltage* (available at motor terminals) *to be varied as the speed desired.*

This example conforms to the *letter* of Mr. Leonard's law of efficiency. That it does not conform to its *spirit* as well is shown by the deprecatory manner in which Mr. Leonard himself refers to the efficiency obtained and obtainable in such cases.

While the law is evidently more general and far reaching, in certain directions, than its author intended, in other directions it does not reach as far as might be desired or expected. Mr. Leonard furnishes a good illustration of this deficiency, though apparently without noticing that he has, in so doing, wandered from the territory "covered" by his rule. He says:

"If we have a train of, say, three cars, so that we have six motors, we can start from rest with sufficient smoothness by placing all six armatures in series, which will give us something less than one-sixth speed as the first step. Then we can place three in series with two multiples, which gives us one-third speed. Next, two in series with three multiples, which gives us full speed. Under such conditions we can dispense with the small converting plant altogether."

It is scarcely necessary to point out that in this case the torque and speed are both varied or regulated, not by following Mr. Leonard's "law," but by varying the *counter-electromotive force*. The circuit-potential available to the motors may remain constant. The current, on the contrary, will not remain quite constant for all groupings. It is apparent, therefore, that Mr. Leonard's law would be most useful when supplemented by a key to, or list of, its exceptions.

The present writer sees no necessity for discovering new laws to replace the one law of efficiency (Siemens') which we already have, so long as this law is found sufficiently comprehensive and general to include and cover, satisfactorily, all cases yet referred to it. According to this well known law, the efficiency (K) of an electric motor is the ratio of this counter E. M. F. (e) to the direct E. M. F. (E) of the current supplied to it, or, algebraically,

$$K = \frac{e}{E}.$$

A mere glance at this equation suffices to show three ways in which the efficiency (K) can be enhanced in any given case. 1. By lowering E. 2. By raising e. 3. By doing both simultaneously. These might be called the three *conditions* which influence efficiency, and might be embodied in the following rule which is a corollary from Siemens' law;

"Vary either the direct or counter-electromotive forces, or both, so as to keep them at all times as close to each other in value as possible."

Mr. Leonard's apparatus and his "law" conform to this rule by taking advantage of the *first* condition. The case quoted of the six motors variously grouped corresponds to the *second* condition. He gives no instance of methods corresponding to the *third* condition.

The present writer first realized the bearing and importance of the above "conditions" in 1886. In 1887 he operated a storage battery car in New York City in which the speed regulation was effected partly by grouping the batteries, partly by grouping the two motors, thus taking advantage of *all three* conditions. The car operated by the writer in Washington in 1890 was also regulated in a way to profit by all three conditions.

Without pretending to discuss here the merits of Mr. Leonard's ingenious method and arrangement, which doubtless will not be without its sphere of applicability and usefulness, it is perhaps interesting to point out that in the case of an electric car, a continuous current converter such as described by Mr. Leonard, would add some 1,500 lbs. and *two commutators* to the car. The objections to the two extra commutators would "weigh" if anything, *more* than the double machine. The writer has himself devised methods of regulation employing continuous current converters in connection with ordinary *series motors*. He has always been too diffident and timid, however, to broach the question of the two extra commutators either to the street railway manager or the motor man, both of whom would more willingly entertain a proposition to reduce, instead of increase, the number of commutators.

One of the interesting and important conclusions to which the study of the equation of efficiency leads is that there can be no efficiency unless there is a counter E. M. F. (*i. e.* when $e=0$, then $K=0$). Now, since we have no commercial way of causing counter E. M. F. in motors except by motion of the armature, it follows that when the motor is not in motion, we have usually $e=0$, and the efficiency K, consequently $=0$. This consequence is one from which no system of continuous-current motor operation is exempt. One can, it is true, reduce E to the lowest value needed to produce in the motor the current necessary for the torque desired. The energy thus spent ($E\,C$) is what Marcel Deprez designated some years ago as the "cost of the torque." This "cost of the torque" always corresponds, as shown by Deprez, to the C^2R loss in a series motor. It practically does also in other motors.

THE street car furnishes the only platform upon which men of every shade of political belief will stand. —*Exchange.*

A RATHER humorous question asked by an old lady passenger on the Los Angeles cable line one day, illustrates in a general way the idea entertained about cable roads by unthinking people. The cable had stopped for a few moments when she turned to the conductor and asked if the machinery and rope didn't stop every time a car stopped.

Report of the Trustees of the New York and Brooklyn Bridge for the Year Ending December. 1, 1891.

In the past twelve months the receipts from tolls have been $1,176,447.95, divided as follows: Promenade, $8,221.02; carriageways, $79,255.59; railroad, $1,088,971.24. This is $49.353.45 in excess of the twelve months ending December 1, 1890, notwithstanding the fact of the abolishment of tolls on the promenade since May 31. Passengers carried by railroad numbered 39,766,043 and the income derived from this department shows an increase of $56,957.11 over that of the previous year.

The whole number of foot and railway passengers was 41,268,370, showing an excess of 309,886 over the number reported last year.

The comparison of receipts is as follows:

	PROMENADE.	CARRIAGE-WAYS.	RAILROAD.	TOTAL.
For 12 months ending Dec. 1, 1890	$18,614.68	$76.465.59	$1,032,014.23	$1,127,094 50
For 12 months ending Dec. 1, 1891	*$8,221.02	$79,255.59	$1,088,971.34	$1,176,447.95

* Six months only on the Promenade.

The comparison of traffic is as follows:

	PROMENADE.	RAILROAD.	TOTAL.
Passengers for 12 months ending Dec. 1, 1890	3,222,073	37,676,411	40,898,484
Passengers for 12 months ending Dec. 1, 1891	*1,502,327	39,766,043	41,268, 70

* Six months only on Promenade.

The receipts from all sources for the year ending December 1, 1891, are as follows:

City of Brooklyn construction account	$360,000.00	
City of New York " "	180,000.00	
Receipts from tolls	1,176,447.95	
Material sold, labor, etc.	957.09	
Interest	7,095.53	
Rent, real estate and telegraph wires	105,284.86	
		$1,829,785.43
Balance on hand as per last report	255,676 32	
Receipts from all sources for 12 months to November 30, 1891	1,829,785.43	
		$2,085 461.75

EXPENDITURES.

Construction account	$517,053.34	
Pay rolls for 12 months	570,516.15	
Salaries for 12 months	37,870.50	
Real estate, rolling stock, supplies, etc.	456,840.89	
City of Brooklyn	100,000.00	
City of New York	50,000.00	
		$1,732,280.88
Balance on hand December 1, 1891		$353,180.87

Total amount received from rentals for twelve months, $105,284,-86, of which $85,230.12 was received from real estate, and $20,053.74 from telegraph and telephone wires.

The Bridge police force comprises one captain, two sergeants, three roundsmen and ninety-six policemen.

Eighty-nine persons were accidentally injured on the Bridge by falling on the stairs and from other causes. Forty-four persons were taken ill upon the Bridge, one person died suddenly; there were three fatal accidents; one person committed suicide; there were eight lost children; two vessels were deprived of their top-masts while passing under the Bridge; there were forty-two runaways, eight causing slight damage, ten serious and twenty-four no damage.

The history of the increase of the demands of the public upon the facilities afforded by the Bridge is one of steady growth, whose succeeding chapters are found in the annual reports submitted each year by the Board of Trustees to the Mayors of New York and Brooklyn.

At page 13 of the report for the year ending December 15, 1890, that history was brought down to the point of the appointment of the Board of Experts, which board was at that time engaged in deliberation upon the problem of how best to increase the terminal facilities of this work. Since that report was submitted, that board reached a conclusion and made its report to the Special Committee of Trustees having the matter in charge.

Upon due consideration the Special Committee decided to accept the report and plan of the Board of Experts, and reported the same to the full Board of Trustees, with a recommendation for its adoption, which recommendation was favorably received and the plan adopted. The full report of the Board of Experts embodying their plans, was printed and widely circulated.

The enabling Act provides that for the purpose of making the terminal improvements embraced in the Washington Street section, the City of Brooklyn shall pay two-thirds of the cost and the City of New York one-third.

The trustees have received for this purpose up to this time,

From the City of Brooklyn	$360,000.00
From the City of New York	180,000.00
	$540,000.00

The Act of 1891 provides that the funds to meet the cost of the improvement shall be secured by the comptrollers of the two cities, borrowing upon the respective credit of each city the proportion therein required to be paid. It further provides that the bonds to be issued for such loans shall be thirty year bonds, and shall bear interest at three per cent. and shall not be sold at less than par. This Act was passed at a time when, in the light of previous experience, it was assumed that such bonds could be readily disposed of. Upon attempting to market the bonds as directed by the Act, the comptroller of Brooklyn found the condition of the money market to be such that only 360 of the bonds could be sold. The trustees are advised that the financial condition of the community is such that money-seeking investment can find in it more profitable channels than municipal bonds paying three per cent. interest, and that so long as this condition of the business community continues, it will be practically impossible not only to complete the work on the Washington Street improvement, but to make progress upon any other portion of the improvements authorized by the legislature.

These facts necessitate the early application for legislative amendment of Chapter 128 of the Laws of 1891, either by the removal of the restriction requiring the bonds to be sold at par or by providing that the moneys necessary for the carrying on and completion of the work, shall be raised by the sale of bonds bearing a larger rate of interest than that prescribed in the Act under consideration.

In anticipation of the acquiring of the land the trustees directed detailed plans for the necessary structures provided for in the adopted plans to be prepared, and when prepared, ordered the necessary steel and other material for the building of such structures. All of which had to be made especially for this work.

This rendered it necessary for the contractors to commence its production as soon as the order was placed, with the result that the entire material is now in the hands of the contractors ready for delivery, but the trustees are unable to accept it for lack of funds. This presents the complication that for such material the trustees may have to pay not only the contract price, but at least interest upon the deferred payment by way of damages for their inability to perform their part of the contract, by accepting and paying for the material ordered by them, and which was ready at the time provided in their contract.

Travel during the year, over the Bridge railway, has continued to increase, but at a diminished ratio as compared with that of previous years. Up to January 18 the ratio increased; from then to September 27 it diminished; since it has rapidly increased. In the aggregate, however, for the whole year, the increase has been marked. In October last 3,623,016 passengers were carried, an average per day of 120,767, a number greater than that carried during any other month since the railway was first operated; the nearest being in October, 1890, when 3,431,503 passengers were carried, an average per day of 110,694. On November 21 151,554 passengers were carried, the greatest number on any day during the year. On that day 522 trains were run and 1,913 single car round trips were made.

From the opening of the Bridge railway, September 24, 1883, to November 30, 1891, inclusive, 220,487,283 passengers were carried. During the year the trains have run with great regularity and few interruptions. The total time lost by delays from all causes was seven hours and thirty-six and a half minutes, an average of one minute and sixteen seconds per day of twenty-four hours, or of one minute for each 87,111 passengers carried. Of these delays during the year, fifty-four per cent. was occasioned by a failure of or a defect in some of the several parts of the cable hauling machinery, and the remainder, forty-six per cent., by causes common to ordinary railroad transportation.

Contrary to what appears to be a general impression, but little time is lost on the railway in consequence of the grip mechanism failing to act; thus during the past year from this cause there were in all thirty delays, amounting altogether to two hours and fifty-seven and a half minutes, of the 7,300 hours the cable was run.

The previous excellent record of the railway, as being pre-eminently a safe one for passengers, remains unimpaired. Of the large number carried since its opening to public use no one has been killed, and during the past year none have been seriously injured. The principal accidents to trains have been in the form of rear collisions at the stations, caused by an incoming train bringing up against a preceding one, not hauled out from the platform. As the passenger cars are now constructed, when such an accident occurs there is little or no damage done to the cars themselves; *and the passengers are entirely safe from shock, as well as from injury, if they are within the cars and seated.*

To effectually provide against the possibility of a train, from any remote cause, becoming uncontrollable when going down or up the steep slopes of the Bridge, each car is equipped with two independent brake systems, one operated by air and the other by hand; and in no instance have both of these systems failed to act in an emergency.

For the better accommodation of the increasing number of passengers transported on the railway during the evening and early morning hours, trains are now run from 7 o'clock P. M. to 12.40 o'clock A. M. on three minutes' headway, and from 12.40 o'clock A. M. to 2.40 o'clock A. M. on seven and a half minutes' headway instead of on four minutes' and fifteen minutes' headway respectively, as was formerly.

In the eight years and more the railway has been operated, six hauling cables have been used. Of these, four have been worn so greatly as to necessitate their removal, and two are now in service, one being employed to haul the trains, and the other being held in reserve, change being made from one to the other, as may be required by the conditions of use. The record of cable service up to November 1, 1891, is given in the following table which exhibits a term and amount of work done by each cable, unparalleled on ordinary cable railways.

CABLE SERVICE ON THE NEW YORK AND BROOKLYN BRIDGE RAILWAY FROM SEPTEMBER 24, 1883, TO NOVEMBER, 1, 1891.

CABLE.	CONDITION.	TERM OF SERVICE. DAYS.	TERM OF SERVICE. YEARS.	MILES HAULED.	TON MILES HAULED.	AVERAGE NO. OF TONS HAULED.
No. 1.....	Worn out.	1140	3.123	228,329	22,142,706	97.
" 2.....	" "	607	1.636	120,232	25,492,892	212.03
" 3.....	" "	393	1.077	82,099	20,395,073	248.42
" 4.....	" "	356½	0 977	74,111	18,923,467	255.3
" 5.....	In use.	276½	0.758	58,881	16,746,912	284.1
" 6.....	" "	187	0.512	39,980	12,506,413	312.8

It will be noticed that though the term of service has decreased from the first to the last cable used, the average load hauled has similarly greatly increased.

It has not been possible during the past year to greatly increase the facilities of the Bridge railway, or to materially lessen the discomforts of travel during the hours when the largest number of passengers are transported. The station platforms and the trains in service are still unduly crowded when the travel is greatest, and relief can only be had by enlarging and improving the termini, and by adding to the capacity of the railway. As elsewhere stated in this report, adequate measures to effect these improvements and to substantially double the capacity of the railway have been taken and are being prosecuted with energy as far as existing circumstances permit.

Toward these ends contracts have been made for the material and erection of the extension of the roadways in New York, and of the railway platform in Brooklyn, for duplicate boilers and cable hauling machinery, and for the roofs and other metal parts required for the extensions of the power and boiler houses. A part of this work in New York is in place; the walls for these houses and the foundations for the machinery are now being erected and will be completed in a brief time. Also to permit the erection of the new station in Brooklyn, on the site along Washington Street, between Sands and High Streets, determined by the Board of Experts, the repair shops have been removed to the new buildings recently erected therefor on the block between High and Nassau Streets.

The proposed addition to the cable driving plant will allow four cables to be placed on the railway, of which two at all times will be ready for use—and the machinery in all its parts will be in duplicate—whereby in case of the failure of any of these parts when in operation, other similar parts held in reserve may instead be immediately put into service. To complete the plans for doubling the capacity of the railway, duplicate tracks are to be laid the entire length of the line and quadruple tracks in the new stations, so that during the busy hours and at other times when the traffic demands it, two cables, one for each track, may be operated.

Respectfully submitted,

ALFRED WAGSTAFF,
President.

Comparative Operating Expenses.

Through the kindness of S. W. Divine, general manager of the Chattanooga Electric Railway, we are permitted to give the following report made by the superintendent regarding the operation of the line for the month of September, and follow it with the report of the West End company of Boston for the month of August. The difference in the operating expenses per car mile will be noted. It must be borne in mind, however, that the latter line employs long eight and six wheel cars.

OPERATIONS OF THE WEST END STREET RAILWAY CO. OF BOSTON FOR THE MONTH OF AUGUST, 1891

Gross receipts	$136,246.06
Motive power	25,630.00
Motive power per mile	.0704
Total expenses per mile	.2069
Earnings per mile run	.3745
Net earned per mile	.1676

OPERATIONS OF THE CHATTANOOGA ELECTRIC RAILWAY FOR THE MONTH OF SEPTEMBER, 1891.

Gross receipts	$10,375.00
Total operating expenses	4,200.00
Miles run	79,000
Motive power per mile	.0120
Total expense " "	.0625
Total earnings " "	.1365
Net earnings, " "	.0740
Number of cars	18.
Number of miles per car per day	140
Average income per day per car	$19.06
Total expenses	8.00

Report of the Massachusetts Street Railway Company.

The following figures are taken from the annual returns of several of the largest street railway companies in Massachusetts to the railroad commissioners of the State. The period covered is the year ended September 30, 1891 :

West End Street Railway.

	1891.	1890.
Capital stock authorized by charter	$16,400,000	$11,900,000
Capital stock authorized by vote	16,400,000	11,900,000
Capital stock paid in	13,549,350	9,891,150
Funded debt	4,272,000	4,034,442
Unfunded debt	1,945,971	3,246,95
Total debt	6,217,971	7,281,101
Cash assets	2,704,052	1,837,103
Net debt	3,513,919	5,443,998
Cost of construction	5,516,994	5,309,173
Cost of horses	910,664	928,218
Cost of cars	2,655,748	2,503,026
Other articles of equipment	1,543,869	5,584,986
Total cost of equipment	5,110,281	1,153,742
Real estate	6,650,654	5,796,548
Total property and assets	19,981,982	17,527,810
Cost of extension of tracks	225,004	53,473
Reconstruction of tracks electrical construction, etc	.....	556,668
Cost of new horses	.....	.....
Cost of new cars	432,788	953,654
Cost of new equipment	390,127	479,550
Cost of new real estate	860,201	976,905
Total addition to property	1,908,121	3,020,250
Property sold or reduced in valuation	320,898	240,149
Net addition to property	1,587,223	2,780,101
Passenger earnings	5,889,180	5,678,390
Rents from other roads	13,401	12,986
Received from sale of manure	15,864	17,242
Income from other sources	50,539	71,464
Total income from all sources	5,968,984	5,780,083
Repairs of roadbed and track	202,599	285,054
Repairs of cars, horse shoeing, etc	316,190	323,082
Repairs of buildings	38,396	72,165
Renewal of horses	137,565	143,904
Salaries of officers and clerks	103,564	77,568
Wages of other employes	2,184,695	2,188,440
Provender	609,752	490,883
Taxes	245,735	222,378
Rents paid other roads	12,359	12,465
Insurance	16,158	35,517
Damage to persons and property	148,592	158,736
Office and other expenses	637,532	458,175
Total expense of of operating	4,703,136	4,468,369
Net income above operating expenses	1,265,848	1,311,714
Interest accrued	287,539	244,503
Dividends declared	888,318	737,000
Surplus for the year	89,991	330,210
Total surplus for September 30	214,661	355,558
Box cars	820	838
Box cars, electric motors	297	164
Open cars	842	856
Open cars, electric motors	172	173
Horses	6,796	6,927
Overhead electric equipment, miles	81.23	65.46
Underground wiring, miles	29.83	8.26
Poles only, miles	1,891	1,110
Feeder wire for miles of track	9,335	7,419
Electric snow plows and sweepers	43	9
Miles of railway (single track) operated	23,524	23,470
Total miles run during year	17,462,572	17,665,360
Passengers carried	119,264,401	114,854,081
Round trips made	2,328,274	2,333,570
Persons regularly employed	3,885	4,148
Passengers killed		3
Passengers injured		144
Employes killed		2
Employes injured		25
Other persons killed		10
Other persons injured		70

Lynn & Boston Street Railway.

	1891	1890.
Capital stock authorized by charter	$1,000,000	$500,000
Capital stock authorized by vote	700,000	500,000
Capital stock paid in	600,000	500,000
Funded debt	425,000	425,000
Unfunded debt	93,773	103,164
Total debt	518,773	528,164
Cash assets	49,102	37,577
Net debt	469,671	490,587
Cost of construction	603,543	568,268
Cost of horses	89,500	95,200
Cost of cars	121,400	116,600
Other articles of equipment	147,370	117,142
Total cost of equipment	358,270	328,942
Real estate	197,086	176,474
Total property and assets	1,208,001	1,111,262
Cost of extensions of tracks	35,275	17,031
Cost of new horses	....	5,600
Cost of new cars	4,800	6,400
Cost of other new equipments	30,483	54,549
Cost of new real estate	20,612	234
Total addition to property	91,170	83,815
Property sold or reduced in valuation	5,955	8
No addition to property	85,215	83,807
Passenger earnings	586,071	575,669
Rents from other roads	1,918	1,873
Received from sale of manure	3,333	3,513
Income from other sources	2,500	2,427
Total income from all sources	593,822	583,482
Repairs of roadbed and track	27,395	46,323
Repairs of cars, horse-shoeing, etc	44,521	46,906
Repairs of buildings	1,900	1,757
Renewal of horses	15,264	19,545
Salaries of officers and clerks	15,696	15,070
Wages of other employes	231,866	228,471
Provender	84,056	67,262
Taxes	11,064	9,597
Rent paid other roads	25,800	25,029
Insurance	4,442	4,234
Damages to person and property	5,292	5,250
Office and other expenses	54,516	36,553
Total expenses of operating	521,812	505,996
Net income above operating expenses	72,010	77,486
Interest accrued	25,879	26,835
Dividends declared	40,000	32,000
Surplus for the year	6,131	18,651
Total surplus September 30	89,228	83,098
Box cars	118	112
Open cars	133	130
Horses	895	952
Box cars, electric motors	8	8
Open cars, electric motors	10	6
Electric snow plows	4	1
Miles of railway (single track) operated	62.24	60.31
Total miles run during the year	1,929,523	1,841,285
Passengers carried	11,575,368	11,292,333
Round trips made	237,193	227,607
Persons regularly employed	437	430
Passengers killed	0	0
Passengers injured	15	10
Employes killed	0	0
Employes injured	0	0
Other persons killed	2	0
Other persons injured	2	6

Newton Street Railway.

Capital stock authorized by charter	$50,000
Capital stock authorized by vote	100,000
Capital stock paid in	100,000
Funded debt	100,000
Unfunded debt	30,176
Total debt	130,176
Cash assets	1,633
Net debt	128,543
Cost of construction	152,174
Cost of horses	....
Cost of cars	48,765
Other articles of equipment	14,317
Total cost of equipment	63,082
Real estate	20,845
Total property and assets	237,734
Cost of extensions of tracks	29,603
Cost of new horses	....
Cost of new cars	27,952
Total addition to property	56,952
Property sold or reduced in valuation	9,707
Net addition to property	47,245
Passenger earnings	49,376
Income from other sources	563
Total income from all sources	49,939
Repairs of roadbed and track	1,858
Repairs of cars and electrical equipment	5,190
Repairs of buildings	96
Salaries of officers and clerks	2,469
Wages of other employes	14,807
Provender	608
Taxes	387
Rents overhead line	595
Rent electric motive power	7,642
Insurance	545
Damages to persons and property	262
Office and other expenses	3,446
Total expense of operating	37,905
Net income above operating expenses	12,034
Interest accrued	6,955
Dividends declared	....
Surplus or deficit for the year	5,079
Total surplus or deficit September 30	7,559
Box cars	9
Open cars	12

Horses	2
Miles of railway (single track) operated	5.48
Total miles run during year	186,543
Passengers carried	1,008,803
Round trips made	17,051
Persons regularly employed	27
Passengers killed	0
Passengers injured	0
Employes killed	0
Employes injured	0
Other persons killed	1
Other persons injured	3

Holyoke Street Railway.

Capital stock authorized by charter	$150,000
Total debt	33,445
Cash assets	25,229
Net debt	8,216
Cost of construction	88,203
Total cost of equipment	56,466
Real estate	27,877
Total property and assets	197,775
Net addition to property	90,431
Passenger earnings	40,765
Total income from all sources	41,037
Total expense of operating	34,072
Net income above operating expenses	6,965
Interest accrued	549
Dividends declared	3,000
Surplus for the year	3,415
Total surplus September 30	14,330
Miles of railway (single track) operated	5.70
Total miles run during year	132,690
Passengers carried	833,244
Round trips made	29,230
Persons regularly employed	30

Fitchburg Street Railway.

Capital stock authorized by charter	$60,000
Funded debt	30,000
Unfunded debt	1,888
Cash assets	2,506
Net debt	29,382
Cost of construction	69,519
Total cost of equipment	19,934
Real estate	5,495
Total property and assets	97,954
Net addition to property	1,249
Passenger earnings	31,563
Total income from all sources	31,760
Total expense of operating	27,387
Net income above operating expenses	5,449
Interest accrued	800
Dividends declared	3,000
Surplus for the year	1,649
Total surplus September 30	6,066
Miles of railway (single track) operated	6.30
Total miles run during year	130,454
Passengers carried	522,531
Round trips made	26,654
Persons regularly employed	24

Worcester Consolidated Street Railway.

Capital stock authorized by charter	$350,000
Funded debt	150,000
Unfunded debt	253,002
Total debt	403,002
Cash assets	31,828
Net debt	371,174
Cost of construction	418,195
Total cost of equipment	146,295
Real estate	179,993
Total property and assets	776,312
Net addition to property	106,410
Passenger earnings	271,061
Received from sale of manure	1,473
Income from other sources	1,402
Total income from all sources	273,936
Total expense of operating	223,139
Net income above operating expenses	56,797
Interest accrued	17,197
Dividends declared	28,000
Surplus for the year	5,600
Total surplus September 30	18,809
Miles of railway (single track) operated	21.11
Total miles run during year	908,639
Passengers carried	6,071,948
Round trips made	170,237
Persons regularly employed	187

Boston & Revere Electric Street Railway.

Capital stock authorized by charter	$50,000
Funded debt	25,000
Unfunded debt	14,282
Cash assets	5,172
Net debt	34,110
Cost of construction	70,534
Total cost of equipment	9,920
Real estate	4,902
Total property and assets	90,528
Net addition to property	350
Passenger earnings	6,697
Total expense of operating	4,788
Net income above operating expenses	1,909
Interest accrued	1,582
Surplus or deficit for the year	326
Total surplus or deficit September 30	1,246
Miles of railway (single track) operated	3.80
Total miles run during year	16,950
Passengers carried	133,940
Round trips made	4,557
Persons regularly employed	10

Natick & Cochituate Street Railway.

Capital stock authorized by charter	$25,000
Total debt	584
Cash assets	9,717
Cost of construction	21 550
Total cost of equipment	7,418
Real estate	4,000
Total property and assets	42,685
Passenger earnings	12,263
Total income from all sources	12,990
Total expense of operating	10,170
Net income above operating expenses	2,820
Dividends declared	1,500
Surplus for the year	15,781
Total surplus September 30	17,101
Miles of railway (single track) operated	3
Total miles run during year	43,302
Passengers carried	268,219
Round trips made	7,217
Persons regularly employed	8

North Woburn Street Railway.

Capital stock authorized by charter	$200,000
Capital stock paid in	100,000
Unfunded debt	32,550
Cash assets	4,648
Net debt	27,902
Cost of construction	88,493
Total cost of equipment	21,062
Real estate	15,226
Total property and assets	129,429
Net addition to property	288
Passenger earnings	20,536
Total income from all sources	20,837
Total expense of operating	21,157
Net income below operating expenses	270
Interest accrued	1,826
Deficit for the year	2,096
Deficit September 30	3,121
Miles of railway (single track) operated	78c
Total miles run during year	106,534
Passengers carried	405,663
Round trips made	9,351
Persons regularly employed	18

Quincy & Boston Street Railway.

Capital stock authorized by charter	$50,000
Unfunded debt	31,412
Cash assets	8,050
Net debt	23,362
Cost of construction	38,973
Total cost of equipment	32,852
Real estate	7,745
Total property and assets	37,621
Net addition to property	3,755
Passenger earnings	31,333
Total income from all sources	31,868
Total expense of operating	31,048
Net income above operating expenses	82c
Interest accrued	1,015
Deficit for the year	195
Total surplus September 30	6,209
Miles of railway (single track) operated	7.56
Total miles run during year	115,806
Passengers carried	647,202
Round trips made	25,392
Persons regularly employed	16

East Middlesex Street Railway.

Capital stock authorized by charter	$300,000
Funded debt	125,000
Unfunded debt	68,063
Cash assets	8,760
Net debt	184,304
Cost of construction	241,331
Total cost of equipment	89,802
Real estate	58,662
Total property and assets	398,554
Net addition to property	17,981
Passenger earnings	89,421
Total income from all sources	90,831
Total expenses of operating	79,553

Net income above operating expenses	11,278
Interest accrued	10,980
Surplus for the year	298
Total surplus September 30	5,491
Miles of railway single track, operated	20.65
Total miles run during the year	298,944
Passengers carried	1,587,913
Round trips made	30,346
Persons regularly employed	67

Abstract of Report in the Eleventh Census on Street Railways.*

The development of street railways during the decade lying between the tenth and eleventh censuses—a development both as to facilities and amount of business done—may certainly be counted as one of the most remarkable features of the whole comprehensive business of transportation. Looking first to the question of length, it is found that in 1880 there were 2,050 miles of street railways in operation, while in 1890, this number had risen to 5,783 miles, an increase in the ten years of 3,733 miles. This increase, remarkable as it is for the whole ten years, is still more remarkable when the decade is divided into two periods of five years each, for then it is seen that the most astonishing development has been during the last half of the ten years and at a rate before unparalleled. The figures show that during the first five years the increase of mileage was 888 miles, while during the last half it was 2,845 miles. Looking for the cause of this extraordinary increase, it can readily be found in the introduction of electric roads. Of these roads, which on June 30, 1890 constituted nearly one-fifth of the number of street railways, none were in operation previous to the year 1886. In that year two electric railways commenced operations; in 1887 the number had increased to six; in 1888 to thirty; and in 1890 to fifty-seven, while during the first six months of 1890 no fewer than forty-nine new electric roads were reported. The development of cable roads has also largely assisted in this increased mileage, but not nearly to such an extent as the electric railway, while, as has been shown, the year 1886 was the year of inception of the electric road, the first cable road began to run in 1887. The increase by years is shown in the following table:

YEARS.	Total Length (Miles.)	Increase.	
		Miles.	Per cent.
Ten years		3,733 31	182.10
1880	2,050.16		
1881	2.150.09	99.93	4.87
1882	2,342 20	192.11	8.93
1883	2,506.14	163.94	7.00
1884	2,680.31	174.17	6.95
1885	2,938.29	257.98	9.93
1886	3,268.58	330.29	11.24
1887	3,890.22	621.64	19.02
1888	4.499.49	609.27	15.66
1889	5,285.11	785 62	17.46
1890 (6 months)	5,783.47	498.36	9.43

Looking to the urban locality of increase it is found that the most remarkable is in the smaller cities, a fact that is plainly illustrated in the subjoined table:

Items.	Length of Street Railways		Factor of Increase.
	1890.	1880.	
All cities	5,783.47	2,050.16	2.82
Cities of more than 50,000 inhabitants	3,205.59	1,584.16	2.02
Cities of less than 50,000 inhabitants	2.577.88	466 00	5.53

When the final computations were made it was found that on July 1, 1890, the street railway companies of the United States in independent operation numbered 789, and that these, repeating the previous figures, carried on their operations over 5,783 miles of street line, or over a total track length of 8,123 miles. On this length of line 32,505 passenger cars were in use; the roads and equipment cost, all told, 389,357,289, they gave employment to 70,764 men, and carried the astonishing total of 2,023,010,202 passengers. A good idea of the extent of this traffic may be realized when it is stated that the street railways of the

Geographical Divisions.	Length of Line.		Increase.	
	1890.	1880.	Miles.	Per Cent.
The United States	5.783.47	2,050.16	3,733.31	182.10
North Atlantic	2,063.94	1,035.60	1,028 34	99.30
South Atlantic	465.93	135.96	329.97	242.70
North Central	1,867.93	508.46	1,359.47	267.37
South Atlantic	773.05	242.63	530.42	218.61
Western	612 62	127.51	485.11	380.45

United States carried last year a number of passengers considerably greater then the population of the globe, and when it is also stated that the steam railways of the United States with all their 157,759 miles of line and 25,665 passenger cars only carried during the same year 472,171,343 passengers, or 1,550,838,859 passengers less than were carried by the street railways.

The increase by geographical divisions will be seen by the last table in the foregoing column.

It will be noticed that the Western Division shows the greatest per cent of increase and the Nothern Central the next, although the two Southern Divisions display a rapidity of construction which is in keeping with the other forms of development marking this section of the country.

Dealing somewhat more with particulars, the twenty-seven principal cities of the United States are next taken up and their increase shown:

Cities.	Length of Line.		Increase.	
	1890.	1880.	Miles.	Per Cent.
Baltimore	100.57	46.54	54.03	116.09
Boston, Lynn & Cambridge	237.83	95.56	142.27	148.88
Brooklyn	173.24	111.65	61.59	55.15
Buffalo	44.30	25.44	18 86	74.14
Chicago	193.11	80.47	112,64	139.98
Cincinnati	67.90	48.18	19.72	40.93
Cleveland	88.38	26.41	61.97	234.95
Denver	79.12	8.00	71.12	889.00
Detroit	59.25	26.56	32.69	123.08
Indianapolis	45.00	15.00	30.00	200.00
Jersey City & Hoboken	46.65	15.40	31.25	202.92
Kansas City	69.42	9.50	59.92	630.74
Louisville	84.42	39.25	45.17	115.08
Milwaukee	52.75	11.41	41.34	362.31
Minneapolis	58.00	9.00	49.00	544.44
Newark & Elizabeth	62.59	37.54	25.05	66.73
New Orleans	112.59	81.89	30.70	37.49
New York	180.56	130.55	50.01	38.31
Omaha	51.50	4.50	47.00	1,044.44
Philadelphia	276.94	258.17	18.77	7.27
Pittsburgh & Allegheny	65.95	38.63	27.32	70.72
Providence	44.95	35.30	9.65	27.34
Rochester	35.83	13.02	22.81	175.19
St. Louis	115.25	63.29	51.96	82.10
St. Paul	25.27	6.00	19 27	321.17
San Francisco	89.11	57.08	32.03	56 11
Washington, D. C.	45.22	29.47	15.75	53.44

The Western cities again show the largest percentage of increase, but Boston and its neighborhood show the greatest absolute increase and Chicago is second. The reason for Philadelphia's remarkable length of line lies in the fact that this is street length, it being a perculiarity of that city, and, in some degree, of the Boston roads, that the tracks usually occupy different streets in going to and from a terminus instead of being laid upon the same street. The result is that roads in these two cities traverse a greater length of street in proportion to track length than in New York, Brooklyn and Chicago. The difference between the two calculations can be seen in the following table showing *street* length of line and *track* length of these five cities:

Cities.	Street Length of Line.	Track Length.
Philadelphia	276.94	390.33
Boston, Lynn & Cambridge	237.83	377.42
Chicago	193.11	365.76
New York	180.56	351.53
Brooklyn	173.24	351.12

Still keeping to the same twenty-seven principal cities, the preceding statistics of cars, employes, passengers and cost are to be distributed as follows:

Cities.	No. of Cars.	No. of Employes.	No. of Passengers Carried in One Year.	Total Cost.
Baltimore	490	1,547	40,659 982	$6.709,450.39
Boston, Lynn & Cam.	2,396	4.188	129,038,563	17,604,671.76
Brooklyn	2,862	6,359	147,500,399	17,711,765 51
Buffalo	219	730	16,685,983	2.012,541.46
Chicago	3,657	5,796	180,326,470	26,943,443.78
Cincinnati	561	1,213	37,905,370	8,056,031.64
Cleveland	730	1,650	39,164,773	7,156,027.89
Denver	461	866	21,535,735	7,518,400.14
Detroit	296	772	22 791,566	2,370,197.61
Indianapolis	205	482	9,863,000	1,683,765.13
Jersey City & Hoboken	317	880	24,115,322	2,629,759.62
Kansas City	652	1,3.6	38,000,978	12,344,487.44
Louisville	429	746	21,281,584	3,713,078.88
Milwaukee	248	622	14,512,156	4,208,956.24
Minneapolis	324	616	14,648,529	3,836,233.60
Newark & Elizabeth	244	525	20,968,884	3,282,381.75
New Orleans	527	876	30,510,662	5 978,464.89
New York	3,503	12,778	449,647,853	99,294,071.24
Omaha	200	469	11,900,000	6,500,000.00
Philadelphia	1,368	4,136	165.117,627	15,746,376.08
Pittsburgh & Allegheny	378	1,529	46,099,227	10,076,053.83
Providence	349	787	18,473.722	2,080,068.76
Rochester	192	510	11,372.596	6,615,586.46
St. Louis	1,469	2,501	67,800,252	10.716.195.77
St. Paul	227	433	11,245,805	2,653,585.54
San Francisco	988	2 398	80,619,005	17,239,933.24
Washington, D. C.	451	1,112	31,032,187	3,5 2,659.95

*From advance sheets.

Turning next to motive power the following division of statistics is decidedly interesting.

Items.	All Motive Powers.	Distribution.			
		Animal.	Electric.	Cable.	Steam.
Length of line	5,783.47	4.061.94	914,25	283 22	524,96
Length of all tracks.....	8,123,02	5,661.44	1,261.97	468.31	711,30
No. of cars ...	32,505	22,408	2,895	5,089	2,113
No. of employes.....	70,764	44,314	6,619	11,673	8,158
No. of passengers.....	2.023,010,202	1,227,756,815	134,905 994	373,492.708	286.854,685
Total cost.....	$389,357,288 87	$195,121,682.50	$35.830,949.63	$76,346,618 23	$82,058.038.51

Perhaps the most notable feature of the above table is the fact that in 1890 the railways operated by animal power were still far ahead of all others as regards their gross operating statistics. Rapid as was the advance of electric and cable roads during the last five years of the decade, only a beginning was made in the supplanting of the older form of motive power. It is interesting also to see that although both in number and length of lines the electric railways have far outstripped the cable railways, the latter, nevertheless, represent twice as great an investment, operate nearly twice the number of cars and do a business more than twice as great. These relative figures point clearly to the far greater density of traffic upon the cable lines and to their large first cost. The cable lines, almost without exception, operate in the denser portions of the large cities, while the greater part of the electric roads are either suburban or serve the people of comparatively small cities.

The following table which gives a summary of the capital stock, funded debt, dividends and interest, while it cannot be implicitly relied on as showing the condition of every road, may be accepted as being sufficiently correct and indicative for all practical purposes. The year for which the report is made is that ending July 1, 1890

Items.	Capital Stock Issued and Outstanding.	Dividends Declared	Rate of Dividends Declared. Per cent.	Funded Debt Issued and Outstanding	Interest Accrued.	Rate of Int'st Paid. Per cent.
All motive powers....	$163,506,544.50	$11,600,334.54	7.09	$103,494,259.99	$5.870,710.72	5.67
Animal.....	62,415,651.50	4,390,519.54	7.03	31,361,904.99	1,997,664.92	5.81
Electric... ..	4,034,90 .00	225,697.00	5.59	3,230,300.00	187,505.00	5.80
Cable.....	6,437,900.00	653,587.00	10.15	4,076,000.00	218,160.00	5.35
Steam.....	25,917,180.00	1,561,512.00	6.03	19,326.200.00	1,181,512.00	6.11
Mixed and Inseparable.	64.700,950.00	4.739.019.00	7.37	42,499,855.00	2,285,368.80	5 38

The "eighty-one per cent." of the street railroads referred to above is all that gave any satisfactory statement in the form of a balance sheet, but it includes most of the important companies, and calculations to fill out the 100 per cent. can readily be made.

Legal Intelligence.

STREET RAILWAY CO.—MUNICIPAL POWER—ORDINANCE—HEATING OF STREET CARS—POLICE REGULATION. This action sought the prosecution of the defendant street railway Co. for the violation of the following sections in the general ordinance, and subdivisions of certain sections of the City Charter, giving the City Council power, to wit: 1. "To license, tax and regulate local carriers, and all others pursuing like occupation, and to prescribe their compensation. 2. To regulate the police of the city or village, and pass and enforce all necessary police ordinances. 3. to do all acts, make all regulations which may be necessary or expedient for the promotion of health, or the suppression of disease" Under these provisions the city authority claimed ample authority was given by the Legislature to the city to enforce against all street car companies this ordinance in question, requiring them to "cause their cars to be heated sufficiently to make them comfortable for the transportation of passengers at all times when in operation during the months of October, November, December, January, February, March and April of each year." The company defended on the ground that the city had no power to pass the ordinance in question, because such exercise of power was in violation of the contract existing between the State and the defendant railway company, made through the Common Council. The Court, (McConnell J.) construing the evidence.

1. *Held*, That the city of Chicago, under the General Incorporation Law, has no power by ordinance to require the defendant company to cause its cars to be heated sufficiently to make them comfortable for the transportation of passengers during the months of October, November, December, January, February, March and April of each year.

The receipts and expenditures of all the street railways has been summarized as follows:

ITEMS.	All Motive Power	Animal.	Electric.	Cable.	Steam.	Mixed and Inseparable.
RECEIPTS:						
Grand total.....	$91,721,844.74	38,403,748.62	$3,220,396.33	$3,798,414.36	$12,709,627.93	$33,589,657.50
From operation:						
Total.....	90,617,210.71	37.866,930.79	3,215,268.38	3 771,801.78	12.541,249.61	33.221,960.15
Passengers.....	89,711,329.39	37,536.924.08	3,125,871.49	3,718,541.80	12,464,962.10	32,865,529.92
Other sources.	905,381.32	330,006.71	89.396.89	53,259.98	76,287.51	356,430.23
Rentals and miscellaneous.....	1,104,634.03	536,817.83	5,127.95	26,612.58	168,378.32	367,697.35
EXPENDITURES:						
Grand total.....	87,388,006.65	37.066,110.78	2,994,802.27	3.476.075.55	11,700.492.06	32,150.525.19
Operating expenses.....	62 011,184.93	37,893,077.33	2,266,422.02	2,477,624.34	7,192.671.91	22,181,389.33
Fixed charges:						
Total	13,978,902.88	4,700,649.25	450,551.05	564,497.95	2,939,075.36	5,324.129.27
Rentals.....	2,561,342.50	615.232.01	19,436.55	1,525.30	288,631.00	1,636 517.64
Taxes and licenses.....	3,308,190.49	1.674,457.72	59,060.99	77.282.65	501.447.31	995.941.82
Interest.....	8,096,215.99	3,403,736.36	371,865.51	485,690.00	2,148,997.05	2,675,927.07
Miscellaneous	23,153.90	7,223.16	188.00			15,742.74
Payments from net income:						
Dividends.....	10,180,726 12	4.039.165.90	188,928,22	333,587.00	1.561,512.00	4,057,533.00
Miscellaneous	1,217,192.72	433,2 8.30	88,900.98	100,366.26	7,232.79	587.474.39
Total surplus for period.....	5,400,299 07	1,166.194.59	381,980.35	420,335.03	1,167,980.43	1.563,808.67
Total deficit for period.....	1,066,460.98	528,556.75	156.386.29	97,996.22	158.844.56	124,677.16
Net surplus for period.....	4,333,838.09	1,337,637.84	225,594,06	322.338.81	1,009,135.87	1,439.131.51

In conclusion, the balance sheet of eighty-one per cent of the operating roads will be found in the subjoined table:

ITEMS.	All Motive Power.	Animal.	Electric.	Cable.	Steam.	Mixed and Inseparable.
ASSETS:						
Cost of road and equipment.....	$315.547,761.38	$121,284,492.18	$7,840,482,49	$15,353,698.21	$66.319,165.49	$104,750.922 01
Other permanent investments.....	46,830,823.07	5.920,962.22	357 309.23	410.646.48	21,781,166.54	18 360,738.60
Value of franchise	14,597,444.00	4,842,362.40	1,225,000.00	1,192,581.60	20,000.00	7.317.500.00
Bills and accounts receivable.....	7.538,199.98	1,877,493,47	46.666.67	24,453,05	3,388,918.53	2,100,668.26
Cash on hand.....	7,774,860.61	4,064,015,98	186,323.25	82,524,56	1,030.295.21	2,411.701.61
Supplies.....	2,157.292.37	801,314,45	31,724.75	73,261.64	346,130.64	994.860.89
Miscellaneous assets.....	10,418,987.83	1.783,546.33	870,033.43	857,035.13	2.151,117 59	4,757,255 35
Profit and loss (deficits).....	3,610,082.15	2,281.954 35	116,055.94	467,358.34	345,222.91	399,490.61
Total.....	$408,475.451.39	$142,855,142.38	$10,673,595.76	$18,461,559.01	$95,482,016.91	$141.003,137.33
LIABILITIES:.....						
Capital stock.....	$211,277,798.08	$77,492,738,29	$5,705,687 67	$8,775,854.53	$44,465,583.34	$74,840,984.25
Funded debt.....	151,872,289.01	49 226,234 01	3,486,200.00	5,584,500.00	44,369,000.00	49,206,355.00
Bills and accounts payable..	16,325,347 01	4,926,246.03	1,163,022.84	299,653.41	1.525,841.55	8,410,583.25
Interest due.....	1,013,780.48	379,986 01	18, 20.05	21,712,50	290,619,41	303,342.51
Dividends due.....	191,119.25	51,008.81	405 78		45,268.90	94,435.76
Miscellaneous liabilities.....	12,838,218.52	2,366,366.04	156,284.27	2,754,730.59	2,674,488,79	4,886.348.88
Profit and loss (surpluses).....	14,956,898.97	8,412,563.19	146 875.15	1,025 107.93	2,111,264.92	3,261,087.73
Total.....	$408,475,451.39	$142,855 142.38	$.0,673,595.76	$18 461,559 01	$95,482,016.91	$141,003,137.33

2. That the ordinance cannot be justified as a police regulation; it is an attempt to burden the defendant company with the expense of certain comforts for the benefit of its patrons, and the power delegated to the city by the General Assembly is not broad enough to warrant the City Council to impose this burden upon street car companies.

3. That, whenever the legislature shall pass such a law, it will not be justified as a police regulation, but as the exercise of a power never surrendered by the state. Hence, the ordinance must fail.

People etc., ex rel. v. *West Chicago Street Ry. Co.*, Cook Co. (Ills.) Criminal Court, June 27 1891.

SPECIAL ASSESSMENT—RAILROAD RIGHT OF WAY—STREET RAILWAY PAVING STREET. Where the commissioners appointed to make a special assessment for a street improvement assessed a block belonging to a railroad company, and over which its road ran, in two parts, assessing one part higher than the other, and expressly accepting the right of way. The County Judge, upon application, for confirmation of the assessment modified the assessment, so as to make one assessment on the entire block in an amount equal to the sum of two partial assessments.

Held, 1. That this did not constitute an assessment on the right of way.

2. That assessing separately two parts of an undivided block is not erroneous, where the sum of the two assessments is not more than the benefits received by the entire block. (This case distinguishes the case of *Warren* v. *Chicago*, 118 Ill. 329).

3. That a street railway company, which is required to pave and keep in repair that part of the street which it uses, is not liable to special assessment for paving the rest of the street. (See, case of *Parmalee* v. *City of Chicago* 60 Ill. 267) heretofore reported in the STREET RAILWAY JOURNAL.)

Chicago etc. Ry. Co. v. *City of Chicago*, Ills. S. C., June 15, 1891.

INJURY TO PASSENGER BOARDING MOVING CAR.—Where the plaintiff, a young man in good health and unincumbered, stepped on the side of defendant's open street car as it was moving slowly, and had nearly stopped. And where in about a second, and before the car had gone eight feet, and before the plaintiff had got into the car he was struck by the hind wheels of a truck in the street. There was no evidence that either the driver or conductor saw the truck.

Held, in an action for damages for the injuries sustained that plaintiff should have been non-suited, for the reason that the injuries sustained by plaintiff seem to have been the result of an accident. And, if it was due to any negligence, it was due more to his own negligence than that of the defendant.

Reversed and remanded.

Mayhan v. *Second Ave. Ry. Co.*, N. Y., C. A., June 2, 1891.

Note: This is an important question. If negligence occasioned the injury, which of the two were the more negligent? It was not carelessness for the plaintiff to attempt to enter the car while it was slowly moving. Hundreds of young men get off and on cars daily in perfect safety while the cars are in motion. No negligence can be charged against the company merely because it did not stop the car for plaintiff. But for the wagon standing in the street he would have entered the car in safety. The real question therefore was, ought the company to have guarded the plaintiff against injury from the wagon in the street near its track? It was not bound to know that the wagon was temporarily there, so close to its track that there was danger that a person attempting to get into one of its cars might be injured by being struck. Especially is this true where neither the driver nor conductor saw the truck or perceived the danger. Plaintiff had the best opportunity to see the wagon to which a team was hitched, which was on his side of the car in plain sight in his immediate presence. If the conductor was bound to guard him against danger so was he equally bound to guard himself from peril. If the conductor was careless, he was more careless. It was his duty under the law to look for himself that there was no obstacle in his immediate presence outside of the car and track which made it dangerous for him to attempt to enter the car while in motion. The negligence therefore of the parties seem to have been compared by the court and the ruling was adverse to plaintiff on that ground.

INJURY TO TRAVELER—TRACK OUT OF REPAIR—DAMAGES—In an action for damages resulting to a traveler upon the street, upon appeal the court

Held, 1. That a municipal corporation, vested by law with control over its streets, is bound to keep the same in good order and condition, sufficiently safe to prevent injury to travelers thereon. And it may grant to a street railway company the privilege of building its tracks and running its cars thereon, with the obligation of keeping them in proper order and condition.

2. A street railway company which neglects to keep its road and tracks in good condition is liable to a party injured by a fall on a loose rail and protruding spike, in consequence of which his skull is fractured or perforated, and death ensues.

3. A party using due care and diligence when using such track has a right to recover from a railway company for injury inflicted by its gross fault and negligence, when the cause is proximate.

Cline v. *Crescent City Ry. Co. et al.* La. D. C., May 9, 1891.

Note: Here the plaintiff sued both the city and the company for damages, but the court held that the company alone is the responsible respondent.

STREET RAILWAY COMPANIES—THE RIGHT TO USE EACH OTHERS TRACKS—COMPENSATION—HOW DETERMINED. 1. Where a city charter (St. Louis, Mo.) provides that "any street railroad company shall have the right to run its cars over the track of another street railroad company on payment of just compensation for the use thereof, under such rules and regulations as may be prescribed by ordinance; and it shall be the duty of the municipal assembly to immediately pass such ordinances as may be necessary to carry this provision into effect."

Held, that an ordinance having been passed giving the right to use tracks, the only thing necessary to perfect the right was to have the "just compensation" ascertained, as provided by ordinance.

2. Where proceedings under an ordinance provided that when the right to use the tracks of one company has been granted to another company, and the two cannot agree as to compensation, it shall be determined by commissioners appointed by the Mayor, and such act does not involve the exercise of the right of eminent domain.

3. That the charter (Art. 10 Sec. 6) gives the city power to make rules and regulations, not only for running the cars of one company over the tracks of another, but also for ascertaining the compensation to be paid therefor. Hence, an injunction the Mayor restraining him from acting in such matter will not lie.

Union Depot Ry. Co. v. *Southern Ry. Co. et al.*, Mo. S. C., July 29, 1891.

INJURY TO PASSENGER RIDING ON PLATFORM—NEGLIGENCE—The plaintiff, on account of the number of passengers in the car and upon the rear platform, was compelled to stand upon the front platform of defendant's car, from which he was thrown and received very severe injuries, by his leg being run over and crushed by one of the car wheels. The court took the case from the jury, and directed a verdict for the defendant. Plaintiff appealed, alleging the violation of the following duties:

1. To provide and furnish plaintiff a safe and convenient seat or place to ride while being conveyed as a passenger; and to provide prudent, safe, and com-

petent agents to manage said car and to provide for his safety as such passenger; not to drive such car at such a rate of speed as to be dangerous to such passenger; to have a chain or guard across the passage way down the steps of the front platform extending across the passage way for the safety of passengers, etc.

2. That the driver and conductor wrongfully, recklessly and carelessly, mismanaged said car, by going at a high rate of speed, and without notice or warning to complainant, struck the horses a blow causing them to jump forward, thereby throwing the complainant from the platform, and while clinging and struggling to recover himself and calling to the driver to stop the car, he fell across the rail and suffered a crushed leg at the ankle.

The plaintiff introduced in evidence sections 4 and 5 of the revised ordinances, viz.:

Sec. 4. "Every street railway company in the city (Detroit) shall so inclose and guard the front platform of each car operated and run by any such company within the limits of the city, as to prevent passengers from getting on and off such platform."

Sec. 5. "No conductor or driver on any street railway car, while such car is in use shall permit any person to enter or leave the same by way of the front platform or forward platform; and no person, when the forward platform of any street railway car in actual use is inclosed or guarded, as required in the preceding section, shall enter or leave, or attempt to enter or leave, such car by the forward platiorm, and no person under the age of sixteen years shall ride on the rear platform of any street railway car, or get on or in the same while said car is in motion."

Testimony showed that no guard or chain was used to protect passengers while on the front platform; that plaintiff was suffered to ride on the forward platform, and that he was thrown off and injured in the manner set out in his petition.

Held, 1. That whether it is negligence in a street railway company not to guard its horse cars so as to prevent passengers from getting on and off the front platform is a question of fact for the jury, notwithstanding that the city ordinances require such cars to be so guarded.

2. Whether a passenger on a crowded horse car is guilty of negligence in riding on the front platform is a question of fact for the jury, and it was error to withdraw the cause, for which error the cause must be reversed and new trial granted.

Archer v. *Flwayne & Erie Railway Co.* Mich. S. C., July 28, 1891.

Note: In the case of *Upham* v. *Street Railway Co.* (Mich. S. C., February 27, 1891,) it is held that it is not negligence *per se* to ride on the platform of a street car, though there is room within; and an instruction that this fact will prevent a recovery for an injury to a passenger resulting from the negligence of the street car company is error. In this case the injured party, after finding seats for his companions, returned to the front platform through which they entered, and while standing with his back against ths door was thrown to the pavement by reason of the driver striking his horses and going over and around a curve and switch at a high rate of speed.

It is within the power of street railway companies to prohibit passengers from riding upon the platforms of cars or to give notice that those who ride there must do so at their own risk, or to limit the number of passengers which each car shall carry, and to require them to ride inside the cars. Until they adopt some such regulations and notify the public, it is but reasonable for courts to hold them liable for injuries resulting from their own negligent acts, to their patrons who are themselves in the exercise of reasonable care, whether riding upon the platform or within the cars.

THE largest passenger elevators in the world have just been completed at Weehawken, N. J. They carry passengers to the top of the Palisades, 150 ft. above high tide.

The Stillman Light Track Construction.

A short section of the main line of the Wood River Railroad at Hope Valley, R. I., was laid early in November with the Stillman construction, which was illustrated in our November issue. The rail weighs twenty-four pounds per yard, and is laid upon split stringers formed by sawing 6 x 6 in. timbers diagonally. The ties are placed nine feet apart, and the rails are arranged to break joints alternately with the stringers. This construction is said to be standing up well under the traffic, which consists of sixteen trains a day, with locomotives weighing twenty-two tons. This system is essentialy a stringer construction, the soil being tamped up thoroughly throughout the entire length of the stringer.

Notes on the Columbian Fair.

COMMISSIONER MCCORMICK writes from London that Mr. Armstrong will soon arrive in Chicago, his purpose being to present to the authorities of the Exposition a project to reproduce the Tower of London.

THE Council of the Society of Arts, which is the Royal British World's Fair Commission, have decided to appoint committees on finance, engineering, manufactures, electricity, agriculture, mines and metallurgy, textile industries and transportation, to promote the interests of British exhibitors.

THE Bureau of Construction of the World's Columbian Exposition have contracted for a 100 H. P. Armington & Sims engine for use in connection with their temporary light and power plant. The sale was concluded by the Pond Engineering Co., general Western agents for the Armington & Sims engine.

THE great dome of the Administration building, which will be the most conspicuous architectural feature of the Exposition, and the four smaller domes, will be covered with aluminum bronze, a newly discovered amalgam, which is said to glisten brighter than gold. The contract for gilding the domes has been let for $54,000.

THE "moving sidewalk" at Jackson Park was tested a short time ago and is said to have worked satisfactorily. It is the invention of J. S. Silsbee of Chicago. To satisfy the Exposition people of its practical value, the company put up an experimental loop of the platform on the grounds. The loop is 900 ft. long and is arranged to seat 900 people.

AT a recent meeting of the Western Society of Engineers a paper was read by Mr. A. Gottlieb, defending his work in putting in foundations for the World's Fair buildings at Jackson Park. A disagreement with Chief of Construction Burnham and other World's Fair authorities led to Mr. Gottlieb's resignation as chief engineer of the Columbian Exposition. Mr. Gottlieb claims that his work was in line with the best American practice.

THE *London Times* has completed the publication of a series of four articles, aggregating nine columns, about the Exposition, from the pen of their chief American correspondent, Joel Cook of Philadelphia. The articles are exceedingly favorable in their tone toward the Exposition. Mr. James Dredge, of London, has also begun the publication of a series of Exposition articles in his paper, *Engineering*, which are technical in style and are accompanied by numerous plans, drawings, etc.

THE managers of the Exposition have decided that transportation within the grounds, except by boat on the lagoon and the movable sidewalk, shall preferably be by electric railways. Bids will be asked about January 1 for the construction of five and a half miles of standard gauge track, elevated from twelve to twenty-five feet above the ground, for two stations, including a sort of central station, or union depot at the Transportation Building, and for about thirty electric motor cars and 100 passenger cars.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
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If Chicago is to Have Electric Railways they must it is claimed, be operated by an underground system The city authorities will listen to no project which involves the use of overhead wires. The city electrician believes he has solved the problem of operating electric lights by varied conductors, and he stoutly maintains that electric railway wires should be disposed of as effectually. For these reasons conduit systems are of especial interest in the metropolis of the West as the electrical fraternity has sometimes felt it was almost a reproach that Chicago was practically without an electric railway. In the near future two underground systems are to be tested on an extensive scale in the city, and the promoters of the enterprise feel confident they will meet with entire success. The particulars are given elsewhere in this issue. The results of the experiments will be awaited with no little interest by street railway men generally.

A Plan for a Model Power House with the best arrangement of machinery to make it convenient and insure economical practice, is one of the things for which the street railway companies are calling with the advent of the new year. We know of no one branch of electric traction that should receive more careful attention on the part of inventors and engineers than this, and we are sure that a good design will be readily adopted, and result in ample compensation to any one who shall solve the problem. The committee appointed by the American Street Railway Association at its last meeting to report on this subject, will doubtless be able to make valuable suggestions when the report is finished, but in the meantime there is a good opportunity for those who are studying the subject to present their views, and receive whatever credit their design may merit. In this connection it would be well for architects and engineers to work in harmony. Frequently the architect designs the building out of proportion to the requirements of the machinery, and when the latter is in position its efficiency may be curtailed by some oversight on the part of the architect.

Drivers on Late Night Cars are apt to become very lax in the performance of their duties, and frequently ignore the rules and regulations of the manager, owing, we suppose, to the fact that they are not watched as carefully as the day hands. We recently had occasion to take a long ride late at night over a line on which electric power was employed a greater part of the time, but the all night cars were run on long headway by horses. On this occasion the driver took a boon companion on the platform; then, with a cigar in his mouth he sat on the dash rail and chatted with his friend, apparently indifferent to his duties, while his team was allowed to proceed at a slow walk over the entire route. Such a disregard for the rules reflects not only upon the management, but has a demoralizing effect upon other employes, for an evil of this kind soon spreads to a greater or less extent, and is likely to contaminate the entire force unless promptly corrected. It will be found to be a good practice to overlook the night hands occasionally, but if the superintendent is too much occupied with other duties, he should delegate one of his inspectors or other subordinates to look after this matter. Careful inspection at all hours is the secret of good discipline.

Insurance Against Accident Claims is receiving more careful attention from Street Railway managers than formerly, and we find that those who have taken out policies with reliable insurance companies speak in the highest terms of the results obtained, and of the satisfactory manner in which the latter conduct their business. A policy which protects against all liability for any accident that may occur in the operation of a road enables the company to set apart each year a definite sum for this purpose, which assists in giving a definite basis on which to forecast the year's business. The practice relieves the management of a great deal of time and energy usually spent in investigating and settling claims, and provides that the energies of the company may be spent in the direction of improved service that will result in advantage to the company. In a few instances insurance companies have issued policies to large corporations at too small a premium, resulting in loss to the insuring company, but as the business is developed, more equitable rates will be established, and the plan is generally operating to the mutual satisfaction of both parties. The system, however, is not in high favor with the "contingent fee" lawyers, who are making a practice of trumping up claims against street railway companies.

The Trolley in Brooklyn, N. Y., will doubtless be one of the most important events marking the development of electric traction which we shall have the pleasure of noting during the year 1892, as the Board of Aldermen of that city recently, by a vote of thirteen to four, passed a resolution, in answer to the united application of the different street railway companies, granting them permission to erect poles and equip for electric power. This result of the combined efforts of the companies proves the old adage that "in union there is strength," and also marks the inevitable march of electricity, notwithstanding the strong opposition offered by ignorant and pre-

judiced parties. We know of no city in which application for electric traction has been made where the opposition has been so strong, and where the arguments for and against have been so thorough, nor where the defeat of the opposition has been so overwhelming. Of course, now that the action has been taken, a few cry "Boodle" and "Fraud," and fail to see that the justice of the cause has triumphed, as must always follow when people become thoroughly informed regarding the merits and advantages of electric traction. The history of the Brooklyn contest will doubtless serve a good purpose in assisting roads in smaller cities and towns to obtain similar concessions from the authorities. We venture the assertion that neither the Brooklyn companies nor the public will regret the change to electrical traction, and we congratulate the companies that they make the change at this time, when they can benefit by the experience of the pioneer roads, and reap the additional advantages of improvements in motors and reduction in prices of electrical appliances.

The Street Railway Problem in Chicago has assumed such importance that the mayor of the city has found it necessary to appoint a commission to consider the question and to report on the best means of providing additional facilities for the public. We do not think it will be denied by candid observers that at the present time the surface lines in the city are unable to meet the enormous demands made upon them at certain hours of the day. While this statement is generally true, we do not think that the companies deserve the harsh criticism which the local press heaps upon them. The enterprise of the Chicago corporations has been marvelous; they have been lavish in their expenditures for cable construction, and rolling stock; they have been untiring in their efforts to meet the extraordinary demands made upon them. Chicago has had a phenomenal increase in population, and already the World's Fair is beginning to attract vast numbers to the City. The business section of the city is small, and multitudes enter and leave it at practically the same hour. The increase has been so great within the last few months that the surface companies have been fairly overwhelmed. The number of cars on the down-town loops has become so great that the trains almost touch each other in running around the circuit; the capacity of tracks has been taxed almost to the utmost limit. The elevated roads are not completed and the surface companies have become the objects of unmerited abuse. The commission is searching for a remedy, and we trust they may be successful. If they attack the problem in the proper spirit they may accomplish good; but invective and unjust complaint will not aid in the solution. Elsewhere a summary of the situation is presented, and we also give a synopsis of the deliberations of the transit commission.

Street Railway Securities in general are at present attracting the attention of capitalists, and it is highly probable that in the near future street railway stocks and bonds will become the favorite security with investors. Considerable change in feeling among capitalists as a class is highly likely to develop in the early future over the question of investing in street railway stocks and bonds. It is being noted here and on the foreign exchanges that there is an insufficient quantity of good investments on the market to consume the capital seeking them. Quite a change has been taking place within the past year in investors' minds as to the merit in the securities which have heretofore been most active on our exchanges, and the opinion prevails, that had our crops been moderate or small this year, there would have been a large falling off in investment in steam railway stocks, etc. This is mainly on account of aggressive legislation, and the constant reduction of tariff charges due to the effects of our interstate commerce law, which, strange as it may seem, is throwing the cream of our transcontinental traffic into the hands of the Canadian Pacific Railroad, a matter which is fully explained in the Report of the Internal Commerce of the United States for 1890. Added to the growing discontent in England over our steam railway profits, are the troubles with South American and other foreign securities, which altogether tend to turn European and home capital toward our industrial stocks. Between these and the steam roads stand our street railway securities, which investors as a class have heretofore known too little about. But the striking agitation which extends pretty well all over this country regarding improved methods of rapid transit, is attracting attention to this class of securities, and they seem to promise better returns than the best of industrial stocks.

The Desirability, and consequently, the market value of any class of security, depends in part upon its convertibility. A stock or bond paying regularly six per cent. to its holder if sold in the open market, may not bring so much as a five per cent. stock or bond of equal reliability or intrinsic worth, simply because the latter is issued by a company whose standing is better known by the general public. And just here comes in the difference between the true value and the market value of any stock or bond. The former is based upon the present and future prospects of return on the money invested as well as the security of the capital itself. The latter is dependent upon a number of factors, but primarily, except in the case of inflated securities, upon the appreciation of the true value by the investing public. The more widely the real value of a security is known, the more nearly, generally speaking, will it be convertible, that is, will its true value be obtainable in the market. For this reason, the article in another column on methods of floating stocks and bonds, and the plea toward listing active street railway securities on exchange are worthy of attention. That street railway securities are a popular form of investment when the reliability of the company is well known is shown by the demand for the recent issue of $2,000,000 Baltimore Passenger Railway fives, where the application at the price named, above par, amounted to $3,000,000 before the time for subscription had expired. A similar result was experienced a few months ago at the sale of the $3,000,000 of Brooklyn City Railway five per cent. bonds. Other street railway securities ought to form a popular object of investment. There are many reasons which commend them, in preference to any other type of security. The surest way to keep them before the attention of the public is to put them on the list on the exchanges of some of our large cities. Then purchases and sales can be made easily and a market value will be found, depending upon the worth of the security.

The Underground Rapid Transit Scheme for New York, as proposed, is receiving a good deal of attention from capitalists in the vicinity of Wall Street, and

the weight of opinion seems to be that there is no money in it. People don't want tunnels, say others; the elevated roads are unsatisfactory, but the commissioners suggest nothing better, claim other investors. Note is taken of Mr. A. S. Hewitt's change of opinion after he visited the tunnel system of London. Before that, and when he was Mayor of this city, he favored the tunnel project; now he entirely disapproves of it, saying the bad ventilation of the underground roads and the general discomfort in many other ways is an experience that should not be repeated here. Mayor Grant returns from London with similar ideas and endorses Mr. Hewitt's language against the discomforts of the underground roads of England's metropolis. Other travelers return saying they prefer to go uptown in the open air. These, and many like opinions, which are strengthened somewhat by the fight of property owners along the proposed routes against digging through abutting streets, cause these investors to shake their heads. At the same time they all confess something must be done at once; the values of uptown realty are dependent upon greater rapid transit facilities for getting there. Not alone is New York anxious in this particular, but Chicago is in just as bad a plight, and proposes an extensive system of elevated roads for relief. Philadelphia, too, is crying out loudly for elevated roads, as the only solution of the vexed question of rapid transit for that city. These investors note the success, safety and advantages of our elevated system, and their opinions lead them to confess it is the most meritorious plan devised. While it has drawbacks enough, nothing better is shown, therefore they say greater facilities for extensions and improvements, and for additional elevated structures should be encouraged without delay.

The World's Fair is to be the greatest of all the great fairs that the world has ever known, but the public are only just waking up to the full significance of the undertaking. The grounds which have been set apart for the Exposition are located about seven miles from Chicago, on the shores of Lake Michigan, and embrace an area of more than 600 acres, of which 117 acres will be covered with buildings, some of them of enormous dimensions. The grounds have a frontage of two miles on the lake, besides two and a half miles of interior water course suitable for pleasure craft. The largest building will be about a mile in circumference, with a centre aisle having a clear span of 368 ft. and 206 ft. in height. Within the aisle could be placed the machinery hall of the Paris Exposition, with fifty feet to spare above the roof. The buildings are to be constructed of iron and steel, and will have a total floor space of upwards of 6,320,000 ft. What is being done to provide for a proper representation of the street railway interests at the Columbian Exposition, is a question we are frequently asked, but which we are not able to answer in any satisfactory manner. We hear it rumored that application has been made by the American Street Railway Association for 50,000 sq. ft. of space, but we are of the opinion that three or four times that amount will be required. In fact, two or three manufacturers of street railway supplies have informed us that their exhibit will require more than one-half of 50,000 ft. The attention of those interested in the street railway business is called to the fact that this interest should form no inconsiderable part in the exhibition. A committee to look after the street railway exhibits at the Fair was appointed by the American Street Railway Association, at its meeting in Minneapolis, in 1889, and consisted of the following named gentlemen: George W. Pearson, Washington, D. C.; G. Hilton Scribner, New York; Charles B. Holmes, Chicago, Ill.; E. B. Edwards, Philadelphia, Pa.; Henry M. Whitney, Boston, Mass.; Thomas Lowry, Minneapolis, Minn.; Charles Green, St. Louis, Mo.; Edward Lusher, Montreal, Can.; William H. Martin, San Francisco, Cal. Two of the above committee, Charles B. Holmes, Chicago, and Henry M. Whitney, Boston, have resigned, and their places have been filled by the appointment of Mr. John B. Parsons, of Chicago, Ill.; and Mr. Amos F. Breed, Lynn, Mass. Although the committee would seem to be late in taking hold of this work, they will no doubt make up for any tardiness by unusual zeal and energy from now onward. Probably the entire committee are not so situated that they can give any amount of time to this work, hence we suggest that a sub-committee of two or three be chosen who will be able to take up the work and give it the attention it deserves.

"I Feel Out of Place," said an official of a street railway company recently, while addressing an association of street railway men; "having come up from the old days of horse power, I feel that my days as a street railroader are numbered, unless I unlearn what I have learned and begin again." This position is partly right, but a good deal wrong. Once in the business a person should never allow himself to feel that he is out of place among any class of street railway men. It is well to forget some things relating to former practice, but it is never necessary to unlearn what one has acquired in practice with animal power in order to adapt himself to the requirements of mechanical traction. Neither is it necessary to begin again, for progress is the prime quality that is needed in the development of any system of traction, be it animal or mechanical. Hence, it is necessary to be learning all the time. When one ceases to learn he ceases to be useful, and the study required to become proficient in the use of mechanical power is no more difficult, but, on the other hand, is much more agreeable and fascinating than the study necessary along the old lines. Only recently we took occasion to congratulate the street railway fraternity on the fact that only in a few instances had it been found necessary to make a change in management with the introduction of improved methods of traction. We stated that, in almost every instance, superintendents and managers had broadened out and filled the new positions admirably. In fact, many of them had become experts in their line. No man in the work should allow that he cannot do what others have done. We have in mind certain men who may be said to be pioneers in the service but who stand in the very front of skillful managers, and are to-day doing the very best work of their lives. It is not safe, however, for any to rest contented with past experience and judgment gained in an extended practice. These are useful only as they are made to conform to progressive methods. Experience and judgment are good foundations on which to base new acquirements, but if they are one's only stock in trade, sooner later young men, or men who keep up with the development of the times must succeed to the other's place.

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The science of street railway traffic (for it is indeed a science) is new, and just now is subjected to rapidly changing conditions, owing to improved methods of trac-

tion. What was legitimate and judicious a few years ago in the conduct of street railway traffic is now regarded as obsolete, so that the chief requirement in the *personnel* of the urban traffic lines of the country is men *who are alive*, men who will readily change their methods and practices and conform to the correct principles of rapid transit as they may from time to time be developed.

The Rapid Transit Problem upon which so much attention is concentrated in some of our Eastern cities is also a topic of live interest at present in Chicago. The situation confronting those seeking a solution is given fully in another column, but may be briefly outlined by the statement that the needs of the city have grown faster than the transportation facilities. A special emphasis, however, is given to the problem, in Chicago, by the approaching World's Columbia Fair which will bring a large number of strangers to the city, and which makes it absolutely necessary that some decided steps be taken to secure relief. For its rapid transit Chicago at present depends upon surface lines which are either cable or horse, the two elevated railroads which have been partially constructed on the south and west sides not having yet been opened for traffic. The existing cable lines upon which the greater part of the burden of furnishing transportation devolves are admirably managed and equipped and daily carry large numbers of passengers within the city and to the suburban districts, but during the day, and especially the hours of greatest traffic in the morning and evening, seem insufficient to meet the demands for passage. The managers of these railways have for a long time recognized the present growing needs as well as the extra demands which will be made upon them at the time of the Exposition and have installed many improvements, and at the same time have made application for permission to carry out others, but nothing important of this character has been permitted by the authorities under conditions which would justify the investment by the railway company. In the meantime the present condition of affairs in that city has formed the basis of a number of vigorous attacks in the daily papers and technical press upon the management of the cable railway companies and the cable system of car propulsion. In the city of Chicago several so-called indignation meetings have been held at which denunciations have been freely indulged in and hostile legislation of various kinds threatened, but at which no remedy of a practical nature has been advocated. The claims brought forward by the *Railroad Gazette* and other papers in commenting upon the situation that the cable system *per se* is accountable for the delays, that the system is a failure under the conditions presented in Chicago, and that it is useful only within narrow limits are untenable and absurd. The situation is very similar to that in New York where the elevated roads afford the only rapid transit at present, or in Boston where the electric cars often find themselves blocked ; but neither of these facts proves the failure of steam or electric power in those cities. The needs of the city have grown faster than the roads. Capital has been unwilling to open new lines of travel without satisfactory guarantees that it will not be disturbed, and the greed of the municipality in trying to overreach the transportation companies, and not the avarice of the companies themselves, is the true cause of any lack of transit facilities.

Some Methods of Floating Street Railway Bonds and Stocks.

The basis of all street railway construction is the obtainment of the necessary capital. While bonds and stocks issued for such purpose in distant cities, are usually taken up by local capitalists, those who are most interested in the development of the real estate of their locality, it frequently happens, particularly in the rapidly growing towns, that capital can ill be spared for such purposes, owing to the innumerable demands made for its use. Especially is this the case in the South and West, where, in consequence, ready money becomes stringent and high rates of interest are demanded for cash loans. The chief relief in such cases is to seek aid from the large centres, like New York for instance, because there money averages in interest rates less than in any other locality. This is the distinguishing feature which makes New York the financial centre of the country; and the only change in this particular which may be reasonably expected, is when other large centres offer as good or better inducements of the same kind.

It is often a problem to investors who are not strictly intimate with Wall Street methods, why money rates in New York should be so much less than in the newer districts, like, for instance, in the more flourishing part of Texas. There it is a common thing for the National banks to ask from ten to fifteen per cent. to merchants in the way of regular discount; and there the same banks charge farmers from twelve to twenty per cent. for well secured loans. Of course such rates are against the laws of Texas, and National banks who practice this business run great risks. But the profits make these bankers shut their eyes and depend upon intimidation if anybody "kicks." The truth is, the merchants of that locality are glad to get money at any price, because nobody offers it on better terms, and the banks hold well together with their purpose in view. And the officers of these banks say that the borrower who would try and make trouble for them through the courts, would be ostracised at once, and fairly run out of his town, such being the force of established usage in spite of the law.

The problem alluded to then is, why does not the money of the large centres where no such interest rates are obtainable, flow to this district where more National banks have sprung into existence on account of profits than in any other part of the country during each of our recent twelve month periods? The main answer is, that capitalists prefer to loan their money where they can keep their eyes upon it. A New York capitalist learns of the high prevailing rates for the use of money in Texas, but as he is unacquainted with the people and local surroundings of that territory, he prefers to lend in New York at a half or a quarter of the Texas rates; consequently, he refuses to send his money to that state to restore an equilibrium between the two districts.

The result of this state of affairs, which undoubtedly will be remedied before the country gets much older, renders it difficult for many distant cities to build street railways, which, under lower rates for the use of money, would be quickly stimulated into existence. This means, of course, that it is for the immediate interest of all who sell to street railway corporations to aid any practical method by which these outlying districts can be relieved of their money pressure, and it is in behalf of general prosperity to bring this about as soon as possible. Again, it is not commonly expected that street car companies should earn over ten per cent. a year dividends; which percentage, from the New York investor's point of view, is thought exceedingly good. Such earnings cannot well compete with Texas bank loans at higher figures. While some roads pay more than ten per cent. a good many pay less, and it has been observed if the earnings much exceed that figure the populace of such a place are apt to rise up and demand legislative restrictions, through reduction in fares, increased taxes, or in some way so the investor will not reap too large profit—from the people's point of view—on the capital employed.

After a street railway corporation is formed, it often

becomes a subject for discussion among the directors, particularly if they desire an increase of capital for extension, improvements or to change over their system to electric or cable methods of operation, to learn how more money may be obtained with the least cost and trouble. While this is a vast subject requiring extended treatment, which from time to time we may describe in all details, for the moment we will speak of one point only, in relation to placing such stocks and bonds on the public exchanges.

There are no active street railway stocks or bonds on the New York Stock Exchange except those of the elevated road. What purchases and sales of such securities take place, are done privately or by means of what are called street brokers. It costs $500 to "list" a new stock on the New York Stock Exchange; and $250 on the New York Consolidated Exchange. The brokers on the larger board charge one-eighth of one per cent. each for either buying or selling; while the Consolidated brokers ask one-half that rate or one-sixteenth each way. The advantage to a street railway company in "listing" its securities, is the advertising it affords, and, what is more important, the ready cash market thus afforded for selling more securities or for borrowing purposes. Besides this, many stocks are increased in value by legitimate manipulation; about this particular we may speak at another time.



FIRST NEW YORK ELECTRIC ROAD—SECTION SHOWING TRACK CONSTRUCTION.

Street brokers buy and sell outside of the Exchanges, by means of verbal, written and printed communications, with investors in all parts of the country. These street brokers are all brokers, not members of the Exchanges, or who, being members, additionally do an outside business. Commonly street brokers ask $100 to introduce a stock through their correspondents, in addition to the brokerage for selling or buying, which may be either of the above rates, according to who the broker is. The street brokers say that a street railway stock should never be listed on the Exchanges, if a company desires to find an active market, and the Exchange brokers say, the only way it can be done is by means of the Exchanges. The street broker claims that a street railroad stock put on the Exchange sinks it out of sight, and prevents him from doing any business in it; and that the Exchanges are so wrapped up in the steam roads that the street road stock is lost in the maelstrom. In answer some Exchange brokers claim that "washed" sales, which are no sales, but only pretend to be such, must be resorted to; but they usually want their one-eighth per cent. brokerage each way, just the same as for real sales; unless some private agreement can be made to the contrary. Such sales systematically continued, they claim, will so advertise a stock into activity that eventually a good market may be found for it to any reasonable limit.

"Wash" sales are illegitimate and against the rules of all Exchanges, with penalties attached, nevertheless many Exchange brokers say it is the only way to make an unknown stock active. Street brokers claim it costs about ten per cent. of the stock's capitalization to "wash" it properly. That is, if the corporation is capitalized at $1,000,000, it costs $100,000 of that through the Exchange to get it before public attention.

There is not much advantage in having a stock listed which is not active, but if it is active and pays regular dividends there are many advantages, not the least being loans can readily be obtained upon it. The trust companies rarely lend money upon inactive stocks, and it is said they know the difference between a stock "washed" into activity and one that is normally active. The secret of placing stock profitably is the same as in every industry; it must be advertised until people are familiar with its sound. Stocks which nobody has heard of nobody wants at any price. There are stocks and bonds offered in Wall Street every day which possess double the intrinsic value of many of the active stocks on the Exchange, yet they will not bring as much money at auction. This is not right, of course, but it is one of those things that exist, and which all who operate in Wall Street are obliged to recognize. If a stock is active and is fair in quality any trust company will loan money upon it, because they can quickly realize the cash in case of foreclosure, but offer them bonds which may be three times as valuable intrinsically, and if there be no active market for them on the Exchange these trust companies will not advance a cent on them in the shape of a loan. The big banks reason the same way on the subject. J. M. B.

The First New York Electric Road.

Work on the electric railway which is being installed in New York City, The Hariem Bridge, Morrisiana & Fordham, is being pushed rapidly under the management of the engineer, Mr. L. H. McIntire. In the accompanying illustration is shown a view of a section of the track in process of construction. As will be seen, ties, stringers, and tie rods are used, the ties being spaced 3 ft. apart. The rails weigh 65 lbs. to the yard, are side bearing, and were furnished by William Wharton & Co. Copper rail bonds riveted through the web of the rail, and without any supplementary centre wire, are used for the return circuit.

A portion of the line extends under the elevated railway of the Suburban Rapid Transit Co., and it is the intention of the managers of the road to carry the trolley wires upon special tie rods attached to the lower portion of this structure. Elsewhere iron lattice poles supplied by Milliken Brothers will be employed to support the overhead wires.

The power house will be located on the Bronx River, West Farms, and will have a dock with a frontage of 350 ft. The building will be of brick with sandstone trim-

mings, and will have a length of 235 ft., with width of forty-five feet. Its height will be one story and a half. The chimney will be 150 ft. high. Power will be supplied by six compound, condensing Corliss engines having an aggregate capacity of 5,000 H. P., and furnished by the Watts-Campbell Co., of Newark, N. J. A large four story car house 200×350 ft. is also being constructed, and will be equipped with a huge elevator for raising and lowering cars to the different floors. The rolling stock to be equipped electrically consists of 300 cars.

Thomson-Houston motors will be used.

A Promising Rail.

The section of track on lower Fourth Avenue, New York, which was recently relaid with the Duplex rail, offers a remarkably smooth way for the passage of cars which cross this section, and is so free from the usual jolting at the joints that the feature is frequently noted by the passengers. Having had the pleasure of a ride over this line recently, we are pleased to add our personal testimony to the popular verdict. This track has not been long enough in service, however, to prove all the claims made for it (a limit of time not less than a year being necessary for any rail to develop its weak points), but it has many promising features. From what we have said in our columns of the almost universal failure of the ordinary rail joint, it will be seen that the call for the railway joint that will stand up under electric service is a pressing one.

The chairs of the Duplex rail are designed to rest on a concrete block 12 × 12 × 4 ins., which are made of the best material and fully seasoned before put in place. The tie rods are placed three feet eight inches apart and between every other chair, so there is little chance for the rails to spread.

Since the Fourth Avenue track was laid, the Duplex Track Co. have contracted to equip a section of road with their rail in the city of Richmond, Va., and have also made a contract to deliver several tons of rails to the North Chicago Railway Co. These will be put in service at once should the weather permit; if not they will be laid in the early spring.

Among other advantages, it is claimed for this rail that it will not be necessary to bond the rail for electric traction, nor will it be necessary to provide a supplementary wire return, the lap joint and keys making virtually a continuous return. In proof of this claim we quote the following communication from an expert to the editor of the *Electrical Engineer:*

NEW YORK, Dec. 24, 1891.

SIR: I have examined, according to your request, the section of track furnished to the Atlantic Avenue Railway Co., Atlantic and Third Avenues, Brooklyn, by the Duplex Street Railway Track Co.

The track is so keyed together for the purpose of securing mechanical continuity and strength that electrical continuity is at the same time secured, thus rendering the track a good electrical return for trolley or conduit roads, without any other bonding than that which is a part of the system and which does not involve extra expense, as do the ordinary methods of bonding.

I made a bridge test of the above mentioned section and found the resistance too small to give an indication on the bridge, although the latter showed .001 ohm very plainly. The test current had to pass through two keys and around one complete joint.

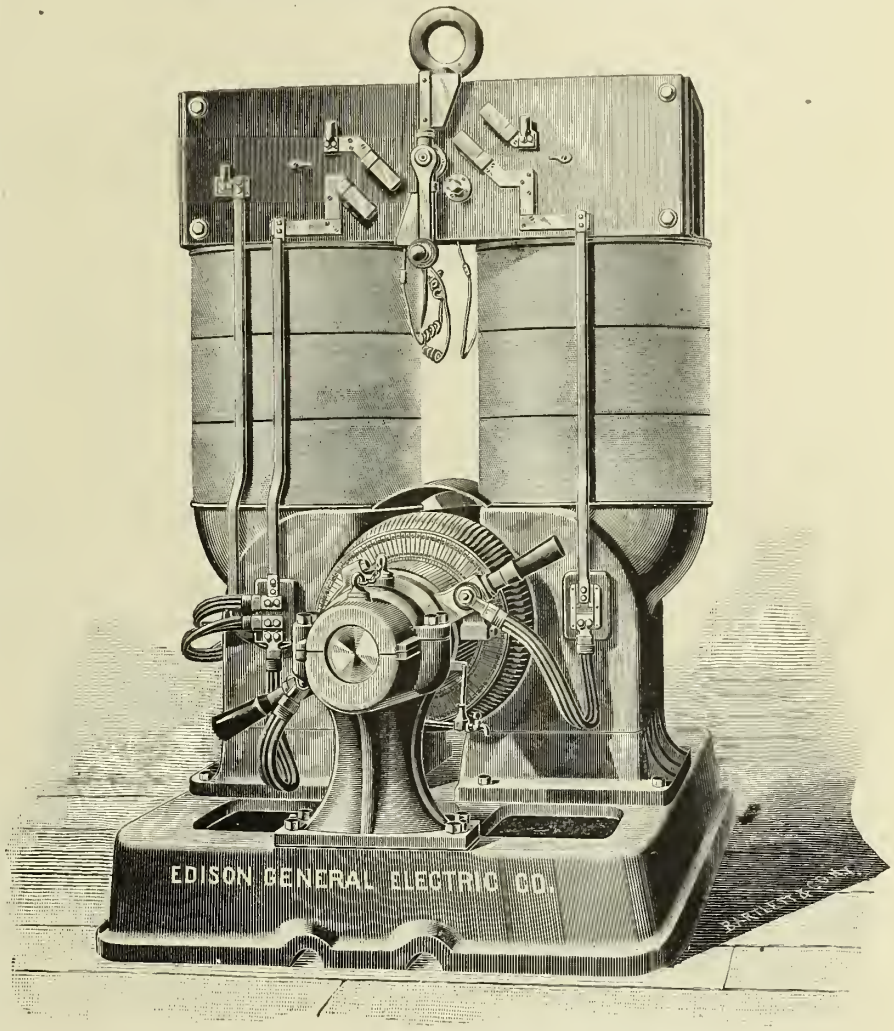
I think this track, when properly laid, will be found practically equal to a continuous rail both mechanically and electrically.

Yours sincerely, TOWNSEND WOLCOTT.

EACH of the 600 employes of the Rochester (N. Y.) Railway Co. was remembered by John N. Beckley, the president of the company, who presented each with a Thanksgiving gift.

Two Hundred Kilo-Watt Edison Generator.

In the accompanying illustration is shown the latest form of Edison railway generator of 200 kilo-watts capacity. As will be seen, it is of standard bi-polar type, the general features of which are so well known as to need no further description. To adapt this generator to the demands of electric railway service, its field has been supplied with a compound winding, easily adjustable to meet the necessary requirements by means of a shunt coil, which is conveniently placed in the back board of the keeper. The close adjustment obtained by this arrangement greatly facilitates the operation of generators in parallel, and forms one of the characteristic features of this particular type. The series field is composed of sections wound on spools, which are slipped separately over the cores, and then properly connected. In the event of a fault occurring, the spool in which it develops can be removed and another substituted at once; this not only prevents delay, but makes any repairs necessary a matter of comparatively small expense. The centre of gravity of the armature being low, due to the bearings being located close to the base frame, great stability is secured. Self oiling bearings and carbon brushes help to reduce to a minimum the attention necessary to the operation of the dynamo.



TWO HUNDRED KILO-WATT EDISON RAILWAY GENERATOR.

On November 1, the records of the Edison General Electric Co., showed installations of these railway generators the total capacity of which amounted to 52,822 H. P.

IT is stated that the steam power of the world is equal to the strength of 1,000,000,000 men, or twice the number of working men that exist. The horse power of England, as regards engines, is estimated at 7,000,000; of the United States, 7,500,000; Germany, 4,500,000; France, 3,000,000; and Austria, 1,500,000. These figures do not include the horse power of locomotive engines, of which it is estimated that last year there were in the whole world 105,000, representing horse power from 5,500,000 to 7,000,000

The Walker Manufacturing Co's Works and Products, Cleveland, O.

The accompanying engravings illustrate samples of products and interior view of the machine shop of the above works, the latter showing the equipment which enables the firm to turn out the ponderous machinery which has given the works a world wide reputation. The rope drive wheel, which is illustrated in Fig. 1, is one of four of equal size which the firm have recently manufactured under a sub-contract from the Pennsylvania Iron Works Co., for the power plant of the Third Avenue, N. Y., cable railway. These wheels are thirty-two feet in diameter, with a six foot one inch face, and are provided with thirty-two grooves for driving two and a quarter inch cotton ropes, the entire weight being over seventy-five tons. A large number of pinion wheels, being a part of the same order, are shown in different positions on the floor of the machine shop, and the large drum is also shown in position in the pit lathe in the rear of the shop. Although this firm have made a specialty for some years of cable railway machinery, including the Walker differential drums, which have made the name of the company a familiar one in street railway circles, 116 of which have already been put in operation, this line of work is by no means the exclusive product of the shops. They also manufacture hydraulic machinery of every description and large pulleys and gears for factory equipment.

Our readers are already acquainted with the fact that extensive new shops have been erected by the company during the past year, a partial description having been given in the April issue of the STREET RAILWAY JOURNAL, and an account of the formal opening in the July issue; but in order to form a correct idea of the vast extent of the works one must necessarily make a journey to Cleveland and visit the plant.

The new buildings cover about nine acres of ground and are fire-proof, being constructed entirely of brick, iron and glass. The works are situated in the west suburbs of Cleveland and face on Waverly Avenue, near the shore of Lake Erie. The walls present a continuous front of about 432 ft. The machine shop proper is about 170 ft. wide and is divided into three bays, one of which is illustrated in Fig. 2, each having a separate roof, supported by iron columns, placed twenty-four feet apart longitudinally. Two of the bays are 280 ft. long and the third is 430 ft. long; but it is the intention ultimately to extend them all to 500 ft. Each bay is equipped with an improved thirty ton traveling crane, which was manufactured by the company, and with modern tools, together with an enormous pit lathe capable of swinging a pulley thirty-two feet in diameter and eight feet face. Between the machine shop and foundry buildings is an open yard, having an ornamental wall and arched gate connecting the buildings and making the front a continuous wall along the avenue.

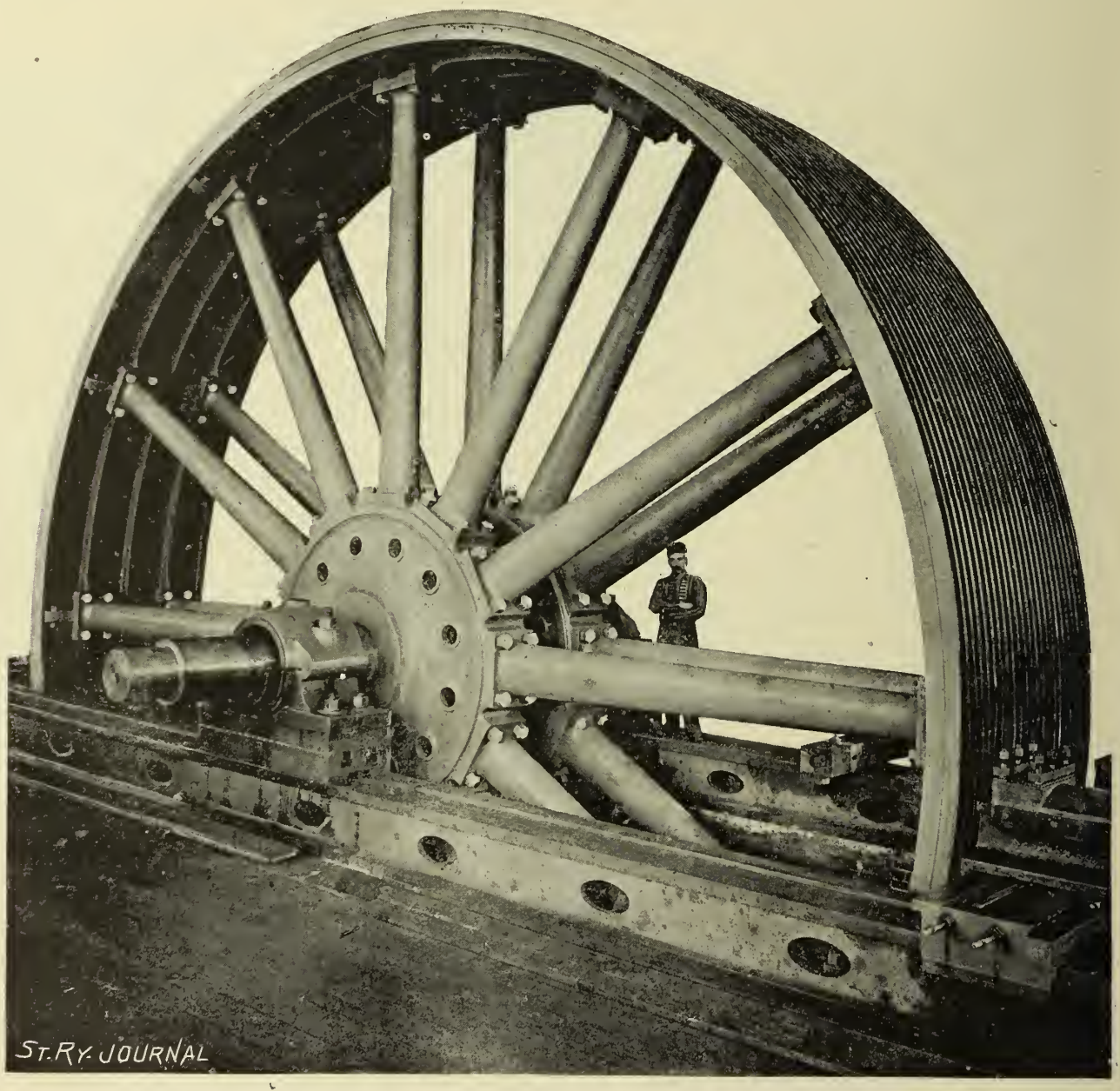


FIG. 1.—SEVENTY-FIVE TON, THIRTY-TWO FOOT ROPE WHEEL FOR THIRD AVENUE (N. Y.) CABLE POWER STATION.

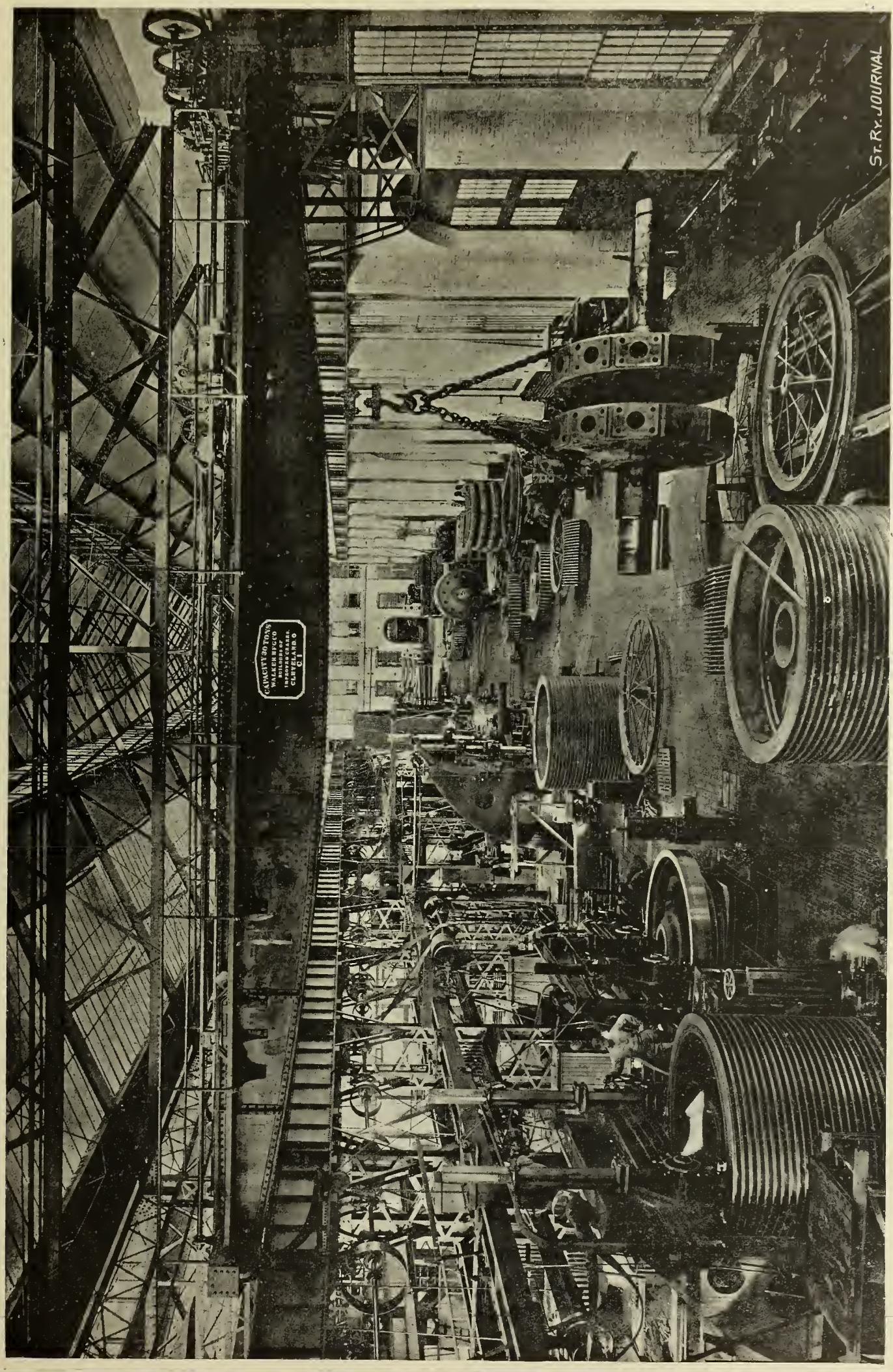


FIG. 2.—INTERIOR OF MACHINE SHOP—WALKER MANUFACTURING CO

No. 1 foundry is 118 ft. wide and 300 ft. deep, divided into three bays, the centre one being fifty-seven feet wide and the side bays twenty-six feet wide. The height of the centre bay is forty-one feet to the tie beams and sixty-two feet to the top of the skylight. Two thirty ton, rope drive traveling cranes are erected above the main floor, and in the side bays are four twelve ton traveling cranes. No. 2 foundry has five six ton cranes, and between it and No. 1 foundry is a second building thirty-four feet wide. Besides the cranes, the foundry equipment consists of the most improved machinery and appliances known to the art. There are four cupolas, three of them being, respectively, fifty-two, sixty and seventy inches inside diameter, and having an aggregate output of forty tons of iron per hour. The cupolas are equipped with the Walker patent door. The mechanism for supplying the air blast of the cupolas is of peculiar design, and is the same as has been in successful operation for years in the old foundry. The blast is generated by three cylinder, vertical blowing engines, the air cylinders being 48 × 30 ins., and the cylinder of the steam engine for driving the compressor is 14 × 30 ins. The engine and machinery were built by the company. A very elaborate system of hydraulic elevators is provided for elevating the material to the cupolas, and is automatic in operation. The accumulator is fourteen inches in diameter, with fourteen foot stroke. The casing is loaded to secure a pressure of 1,000 lbs. to the square inch. The differential pumps operate automatically according to requirement, and will work to a speed of 150 revolutions per minute, without pounding, when necessary. The elevator cages and guides are of iron, and the cage is capable of sustaining a load of 12,000 lbs. The entire hydraulic machinery employed was built by the company under the direction of Mr. E. W. Naylor. The manufacture of hydraulic machinery is an important part of the output of the works. The foundries are supplied with an elaborate system of water pipes and tanks, with suitable hose connection for sprinkling the moulding sand and for other uses.

There are five permanent casting pits, four of them being, respectively, twelve, sixteen, twenty and twenty-four feet in diameter and four feet deep, in which large pulleys, drums and gear wheels are cast. The fifth is twelve feet in diameter and twenty-five feet deep, for casting cylinders and other end work, the traveling cranes being of sufficient height to lift a casting from the twenty-five foot pit and place it in any portion of the foundry. There are two core ovens, one 24 × 30 ft. and the other 20 × 30 ft. These are connected by a passageway with the ovens of the old foundry. The ovens have each double tracks, arranged with two trucks on each track, and are so arranged that all of them can be joined together and operated simultaneously, each being provided with a crank and gearing, so that they are readily moved by one man. The ovens are fired from the back and have covered fireplaces inside to shield the cores nearest the fire. Flues are provided under the oven floor, with openings near the top, the openings being larger as they approach the top, in order to equalize the heat at both ends of the oven. The usual smoke and damp chimneys are used, and an additional damper is placed at the top of the oven to let off the smoke and heat before the doors are opened, thus cooling off the oven more readily and preventing the smoke and heat from entering the foundry when the doors are open.

The gearing and moulding machinery with which the foundry is equipped is complete in every detail, including both fixed and portable machines, also striking machines of the most improved form, all of which were invented by Mr. John Walker, general manager of the company. The crane ladles are very substantial, and range in capacity from three to twenty-five tons, and are so arranged that the metal can be poured from either side and from any position that may be necessary. The sand pits, of which there are fourteen, for storing the various kinds of sand, consist of brick arches built under the yard, but opening into the side of No. 1 foundry. The sand pits are drained by a six inch pipe, thus keeping the sand always in good condition. A narrow gauge railway is constructed in the yard, and by means of turntables leads to the elevators and other points where material is to be delivered.

The general offices for the accommodation of the officers and their assistants are situated at one corner of the machine shop, on the ground floor, front, and are 75 × 57 ft., and are divided into four compartments. The walls are fire-proof, and the interior is finished in antique oak. The windows are of orange colored cathedral glass, giving a rich tint to the interior. In the rear of the general office are the fire-proof vaults for storing valuable records. This room runs the whole length of the office, and is divided by a passageway twelve feet wide. On each side of the passageway are sixteen foot brick vaults, with massive iron doors, the doors being 5 × 6 × 14 ft.

The draughting room is located over the office, and is reached by a stairway, the steps of which are of iron, with a rail of polished oak. The draughting room, which is of the same size as the general office, is lighted both from the sides and roof, and is provided with gas and electric lamps. The furniture of the draughting room consists of twenty-four tables, and the interior is finished in the same style as the office below, and the floors are covered with the best quality of Linoleum cloth, which serves to deaden the sound of footsteps. Adjoining the draughting room is the blue print room, which is well appointed and equipped with all the necessary appliances for reproducing the tracings. In the rear of the draughting room are the fire-proof vaults for storing the blue prints and tracings of the same size and number as the vaults of the room below. Above the draughting room is the office dining room and library. There is also a coat room and lavatory for the use of the employes.

Electric Street Car Heating.

By W. R. B. Willcox

During the past three seasons nearly 100 electric roads in this country and Canada have tried electric heaters and found them in every way satisfactory. In certain cases the heaters have been reported inefficient, but examination has revealed the fact that in each of these cases the trouble lay with the traction company. Regarding one case to which we refer, the heaters had been set up within the paneled car seats, with a single small opening for the passage of heat to the interior of the car, by far the greatest amount of heat thus being confined beneath the seats. A less apparent but surer cause for inefficiency was discovered in another case. Heaters were ordered to be operated upon the so-called railway or 500 volt circuit, when, in fact, the maximum E. M. F. did not exceed 420 volts. Since a proper relation between the resistance of the heaters and the voltage of the circuit upon which they are to be used is the principle of the heaters' operation, the importance of having the one correctly adapted to the other is evident. It is perfectly practicable to construct a heater for a circuit of any voltage, but, if made for 500, it is furnished with only 420 volts, it is like feeding a stove with a spoon—a lump at a time.

The heater customarily used consists of two corrugated iron castings, holding in the intervening space resistance wire so protected as to prevent its oxidation. Four such heaters, twenty-seven inches long by eight inches wide, mounted upon iron legs raising them four inches above the floor, comprise the equipment for an ordinary street car. They are placed two at each end of a car, under opposite seats. The group is so wired that, with the combination switch furnished with each set, they may be operated either in parallel series of two or in direct series of four. Provision for such an alteration in circuits is made in order that a car may be heated rapidly before starting on a trip, while during the time it is out a continuous current of lesser amperage may sustain a comfortable temperature. No. 10 or No. 12 triple braid, weather-proof wire should be used in connection with the heaters. Leaving the main circuit on the line side of the motor switch, it should pass from heater to heater and make its ground connection at the regular ground binding post on the car truck. Best results, furthermore, are

obtained when the heaters are set within tin cases, so constructed as to reflect the heat into the car and prevent, as far as possible, any distribution beneath the car seats. In cases where the seats are paneled, the panel directly in front of each heater should be removed, and the reflectors so arranged that all the heat from the heaters will be reflected through their respective openings. While not necessary, an improved appearance is obtained by having screens fitted to the openings. The electric heater is a perfectly clean device, the dirt and smell of the regulation car stove being wholly absent. There is no combustion whatever inside the car. Therefore the accidental firing of a car from its heating apparatus, and the consequent loss of equipment, is an absolute impossibility.

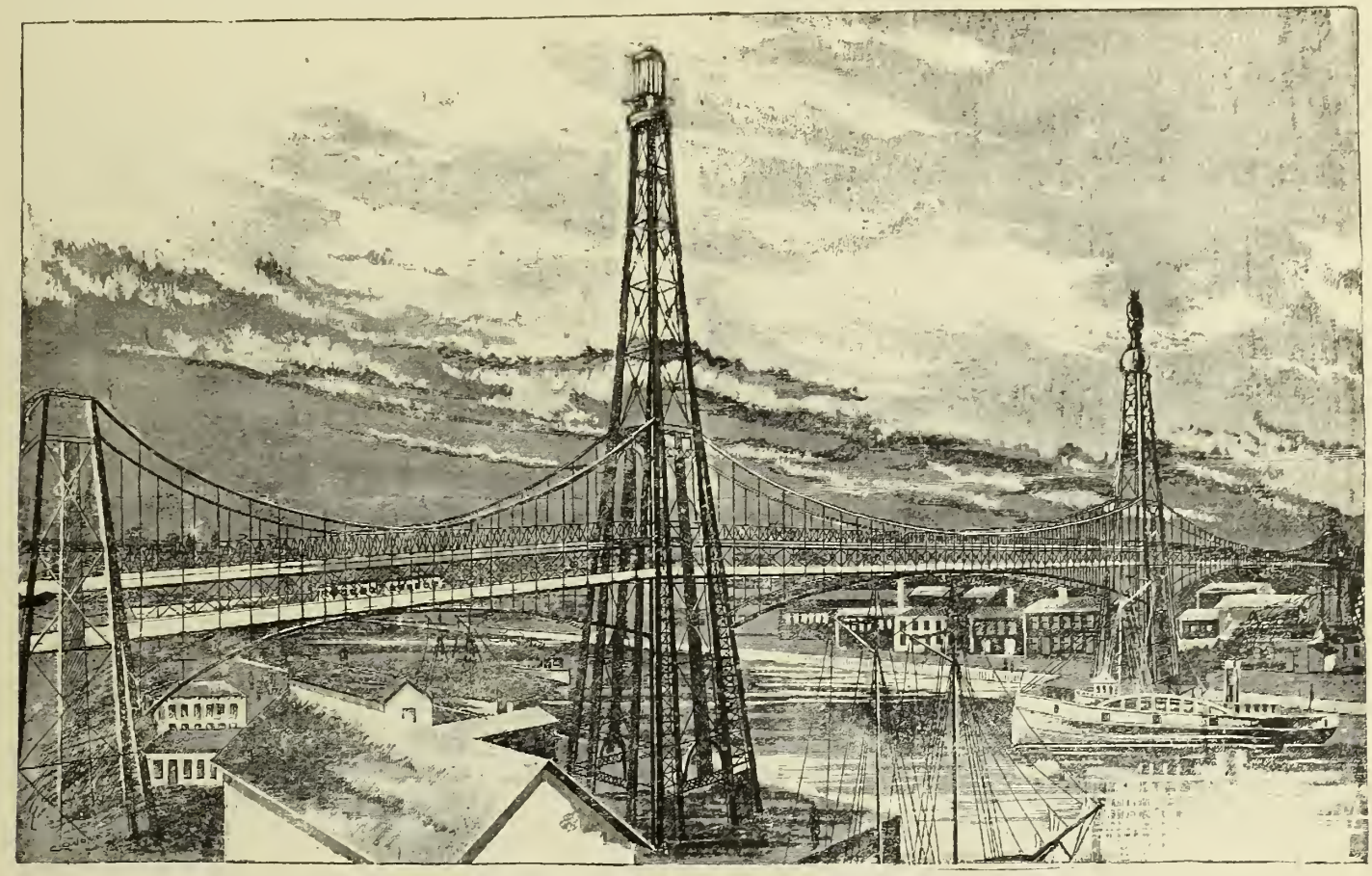
While an electric heater combines all the desirable points of an ideal heating contrivance, giving abundant and evenly distributed warmth and at the same time being absolutely safe, its one grand feature is economy. Stoves last on an average about three seasons, and frequently during that time their consumed parts must be replaced. They require the purchase and cartage of a particular kind of fuel, and in addition considerable attention of conductors. They shorten the life of cars by frequently burning and scorching the car ceilings. The electric heater, on the other hand, will last longer than the car in which it is placed; it cannot injure the car in any way; and with the least care it will never need refitting. If, when heating rapidly, the heaters remain in parallel circuit for more than thirty minutes at a time, there is danger of oxidation of the resistance wire, when, of course, new wire would be necessary. Such loss, however, would only result from pure carelessness. With the electric heater the same fuel which furnishes light and motive power for a car also warms it. Indeed, since it can be so, why for the sake of either light, heat or motive power, shovel coal in two places? All the work attendant upon the use of electric heaters is the movement of a simple switch, conveniently placed upon the hood of the car, which requires not three minutes per day.

It may be added that not only does a direct benefit accrue to a street line by the use of electric heaters, because of their unquestionable merits, but also an important, indirect benefit, due to the honest appreciation of the patrons of the road of such a desirable and convenient system of heating.

Proposed Suspension Bridge at Chicago.

Among the proposed means of promoting rapid transit in Chicago is one which contemplates the connection of the north and south side boulevards of the city by a system of bridges. To fulfil the conditions demanded by such a system, the Day method of bridge construction has been devised.

As will be seen, this is a new departure in the suspension principle for bridges, its characteristic feature being a second pair of cables curved upward and connected with the upper cables by vertical or oblique tension members. By this means a complete tension frame is formed with rigidity sufficient to resist flexure in any direction and avoiding the so-called elasticity which is the characteristic of most suspended structures.



PROPOSED BRIDGE AND ELECTRIC RAILWAY—CHICAGO.

From some figures on the weight of structures by Prof. Fleeming Jenkins, a 400 ft. single span, such as is proposed for this bridge, would, neglecting the roadway, weigh as a simple suspension bridge eighty-three tons; as a girder bridge, 475 tons. With the addition of the lower cables, as in the Day system, there will be, of course, an increase in the weight of the structure, but there will still be a large margin in its favor as compared with the girder type of bridge.

The present plan provides in connection with the 400 ft. span for a pair of handsome towers 400 ft. high, to stand on either side of the river, the one surmounted by a lighthouse and the other by a colossal statue of Columbus. Elevators at cross streets give access to these bridges, whose aggregate length will be more than a mile, and the elevator shaft will be placed in the supports of the span.

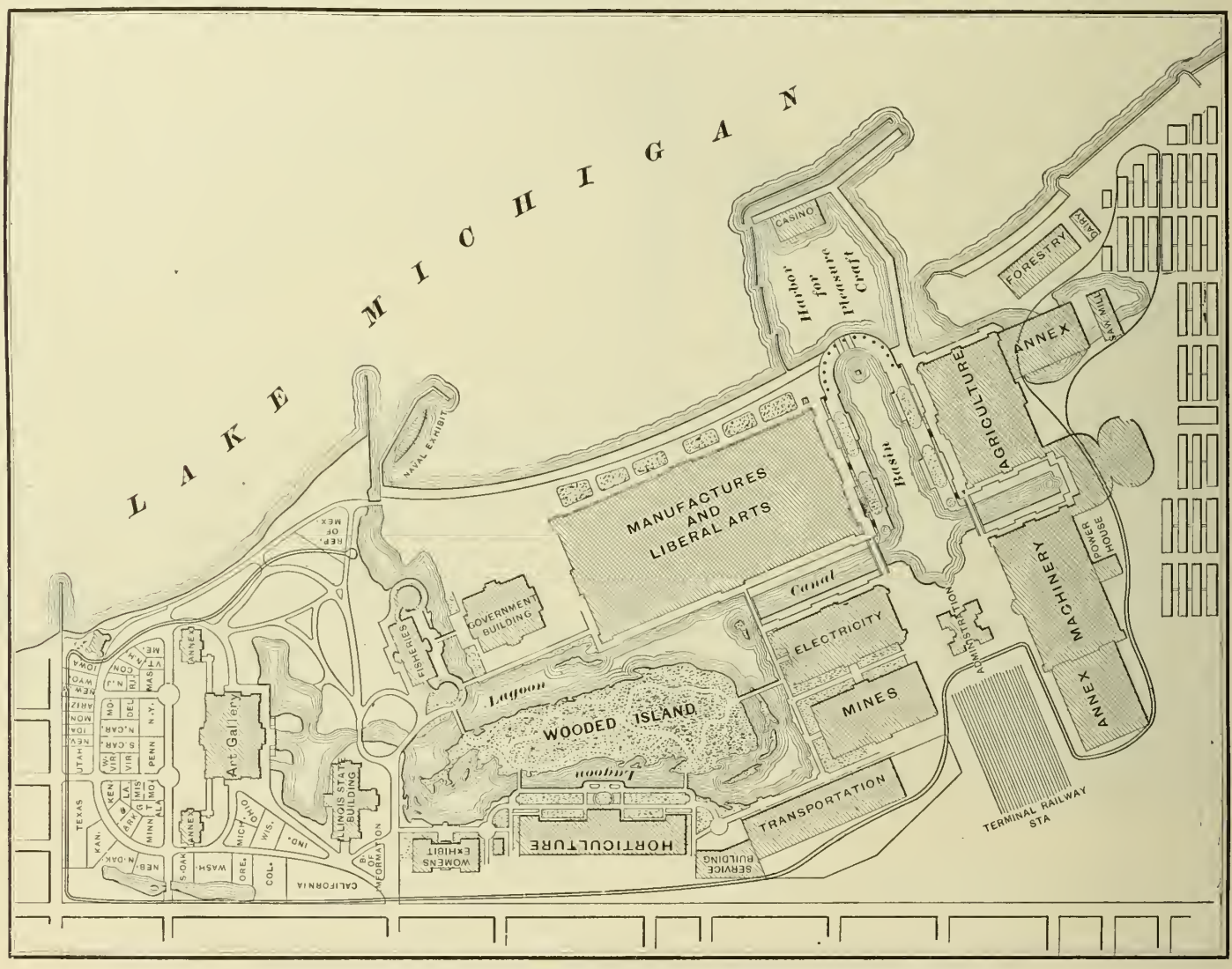
The height of the bridges will prevent any interference with shipping, and the grade be so arranged that it can easily be ascended by horses drawing a heavy load.

A company has been formed with an aggregate capital of $19,000,000, and it is to be hoped that construction will be begun in the near future.

Means of Transportation in the World's Fair Grounds.

The principal means for transportation in the World's Fair grounds will be an elevated railroad. This has been generally agreed since the Fair project took definite shape. The authorities are opposed to tracks upon the grounds. There are to be found persons who do not entirely agree with the Exposition authorities in this matter. They contend that visitors at the Fair would prefer to walk from one building to another rather than to climb a stairway to reach an L station.

The proposed route of the road is shown in the accompanying diagram. This has not been decided upon definitely, but in all probability no radical change will be made.



MAP OF JACKSON PARK, SHOWING PROPOSED ROUTE OF ELEVATED RAILWAY.

The specifications call for a road five and one-quarter miles in length. There will be a double track with a loop at each end, as shown in the drawing. Standard gauge has been specified. Twenty-four stations have been provided, with a Union depot at the Transportation Building. An equipment of thirty motors and ninety coaches is called for. It is estimated that with this rolling stock a train can be dispatched every minute, making the circuit in about thirty minutes.

It has generally been assumed that electricity would be adopted as the motive power; in fact a number of statements to this effect have been published. It is true, undoubtedly, that the Fair officials are in favor of electricity as an agent for furnishing power for all purposes practicable within the grounds, but they have not committed themselves in the case of the elevated railway.

In all probability the construction department will soon issue a circular calling upon those interested to submit propositions of this elevated railway. Propositions from all companies explaining transportation systems are desired. The construction department only specifies the general conditions that the systems shall be safe and not unsightly. The propositions will be passed upon by the construction department, which will recommend that a certain system be adopted. The road will either be purchased by the Fair company and give the bidding company a certain percentage of the receipts, or it will allow the bidder to construct the road, taking a certain percentage of the receipts as consideration for the franchise.

While the elevated road will be the principal means of transportation, a number of companies are seeking for privileges. P. J. McMahon is anxious to operate his ammonia engine on the grounds. Mr. McMahon is alternate Fair Commissioner from Louisiana. The International Railway Co., which is exploiting the Applegate underground electric railway system, is desirous of illustrating the scheme on an extensive scale within the enclosure. The Movable Sidewalk Co. wishes to install several miles of its interesting system on the grounds. The company has now in operation a small exhibition plant at the Fair grounds. The system has been frequently described. It consists of a walk built in parallel sections, each of which moves at a different speed. The outside one may move at two miles an hour, the next at four miles, and the third at six miles. One can step from the ground to the first section or from one section to another without receiving any perceptible jar. If a system of walks of this kind were built the company thinks it would greatly facilitate the movement of visitors. The plant at the Fair grounds at the present time consists of two sections, one moving at two and a half and the other at three miles per hour.

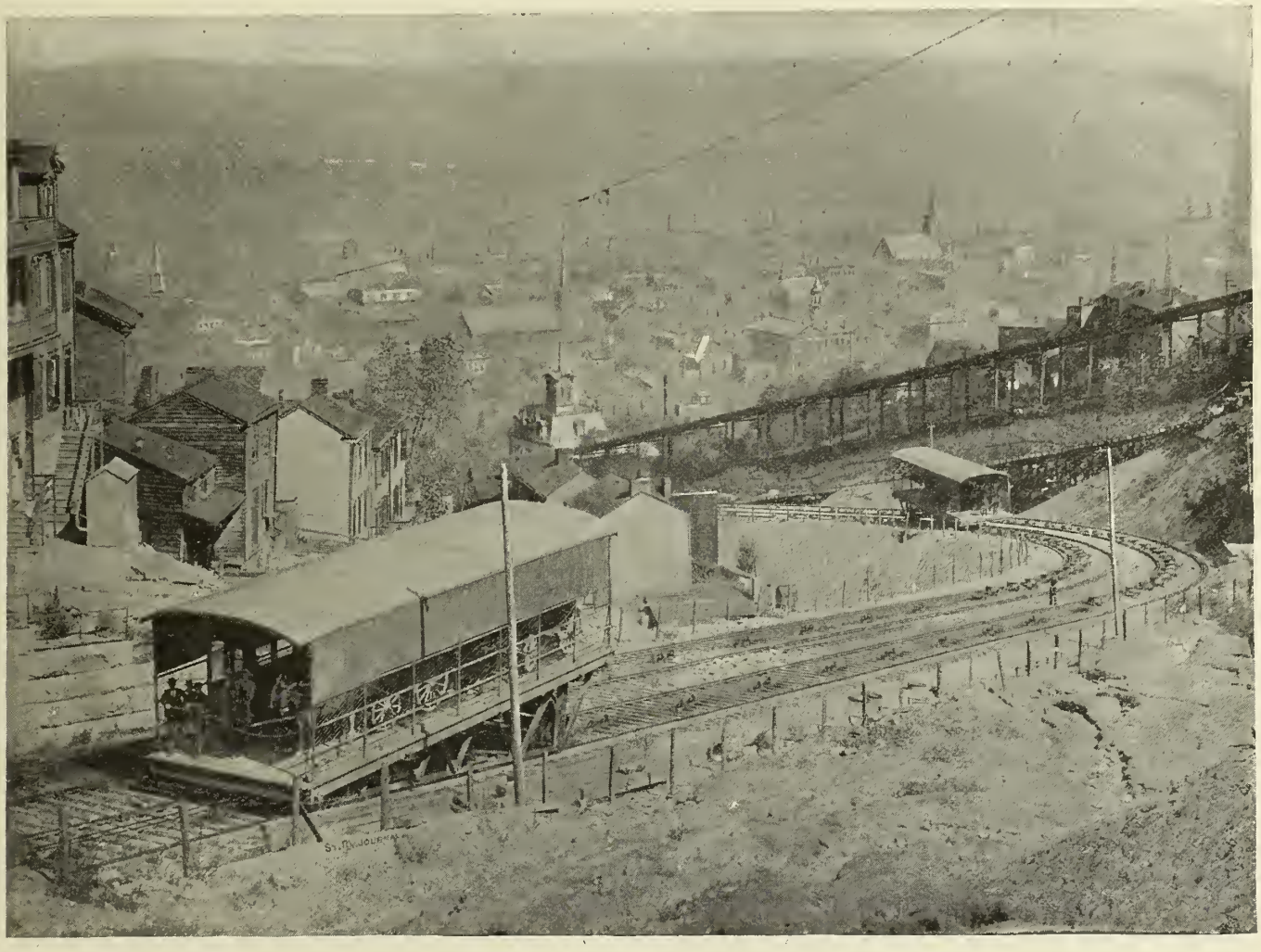
During the Fair visitors may go from one part of the

grounds to another in electric launches, which will navigate the lagoons. There will probably be sixty of these boats, which will be sold outright to the Exposition company or be operated by a company giving a percentage of its results to the Fair.

Outside of the Electricity Building an electric railway will be operated. The track will be about a mile and a half in length. It will be a purely exhibition road, and no fares will be collected. It is proposed to show overhead systems, conduit systems, and storage battery systems. The road will probably be so built that cars will have to travel a five and a ten per cent. grade.

Inclined Planes as a Feature of Rapid Transit.

The Souvenir edition of the STREET RAILWAY JOURNAL which was issued in honor of the Pittsburgh Convention, contains among other things a full description of the inclined planes of Pittsburgh and Allegheny, Pa. One of the most interesting of these was the Knoxville incline which is illustrated in the accompanying engraving. This is located near the Mount Oliver incline which is shown in the background. This is the longest of the inclines, being 2,640 ft., in which distance it has a rise of 375 ft. The peculiarity of this construction, which differs from that of most inclines, is that the tracks make an eighteen degree curve for 350 ft. at a point about 1,000 ft. from the lower terminus. The driving ropes are carried around the curve on thirty-six inch pulleys which are located in each track. The cars are 16 × 47 ft. on a triangular truck and are designed to carry fifty tons or more. The fare is only one cent, and there is a very heavy travel both of foot passengers and wagons.



KNOXVILLE INCLINE, PITTSBURGH, PA.

THE number of passengers carried on the Buffalo, (N. Y.) Street Railway during the year ending June 30, 1891, was 17,768,570.

The "No Seat No Fare" Business.

A Very Sensible Article From the Chicago Evening Journal, December 6, 1891.

Evidently the proposed street car measure, which is called "no seat no fare," is the most impracticable of any that has been suggested as a cure for over crowded and too few cars.

Instead of remedying the evil, if it could be applied, it would make the evil greater. To prohibit the companies from carrying more than twenty-four passengers in a car would leave thousands and thousands without any means of transportation, if the cars should run less than a rod apart.

To establish a rule that street car doors should be closed when the seats are full and that no further stoppages should be made to receive passengers, would create a riot at every street corner afterwards reached.

Uncomfortable and exasperating as it is to be compelled to stand up and hang on to a strap for a ride of two or three miles or more, it would create greater discomfort and exasperation if people should be prohibited from entering cars.

Men and women by thousands must get downtown by certain hours, and if there are no seats in the cars they must "stand it," so to speak, and make the best of it. They cannot wait, and must ride, seat or no seat.

There is another thing. Under such a regulation, if enforced, the cars would be crowded with standing passengers who would get on board for the mere purpose of securing a free ride. The "beats" would be in a majority of the passengers. They would more than overload the cars, and would make it more uncomfortable for paying passengers on the seats than it is at present with the greatest crowds.

No; this would be no cure. The only cure is for the

street car corporations to use all the facilities that they have or can add to the present equipment of the lines, and then must come, or rather immediately should come, elevated roads.

Even then this vast surging mass of the population of Chicago, after all shall have been done that shall be possible, will find the discomforts of the "rush" hours too much for any but the most even tempers and the most patiently disposed.

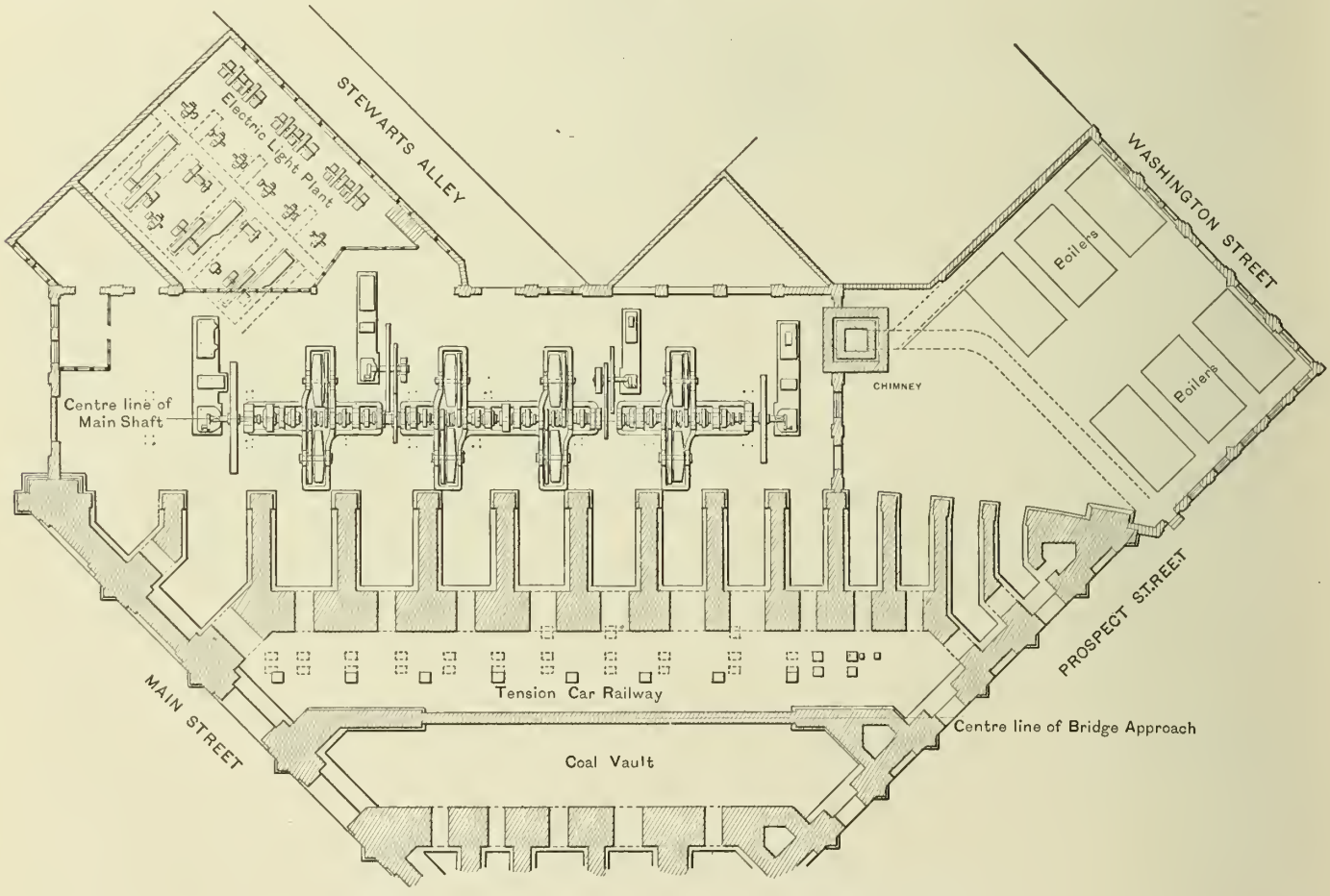
There is one other source of relief that might be added. Let women who come downtown only for shopping purposes do so early in the day, and go home before the "rush" hours. They will find the stores less crowded as well as the street cars.

Favorable Testimony.

In conversation with Mr. H. A. Everett, formerly of Cleveland, now general manager of the street railway lines of Toronto, Can., he stated that the great importance of electric traction lay in its possibilities, but no one could estimate these, for when a system was once established it required a constant outlay to keep up with the inevitable growth of the city and the increased traffic incident thereto, and that he knew of no electric lines in this country that had been operated long enough to determine when a halt could be called in the line of development. "When we first introduced electricity on our lines in Cleveland," said Mr. Everett, "we were operating sixteen cars, and it was estimated that the cost of changing to electric traction would be about $40,000. We have already expended over $450,000 and are now operating ninety cars. Notwithstanding the enormous sum that we have spent in experimenting with electricity on the East Cleveland lines, we would gladly do it all over again, if it were necessary, to secure the advantage of this method of traction. We have not decided what system we will adopt in Toronto; in fact, we think there is very little difference in the systems. Each of the prominent motors has some points that are better than others, and if it were possible we would be glad to employ a system embodying the good points of all the systems. In the meantime we are experimenting with a number of the more recently improved motors on the Cleveland lines for the purpose of satisfying ourselves as to their relative merits before deciding what system to employ on the Toronto lines. Among the motors which we shall try will be one of the Short single reduction motors, also one of the Westinghouse single reduction, and the Edison single reduction, the Wightman motor, and the motor manufactured by the Detroit Electrical Works."

Brooklyn Bridge Cable Power Plant.

The accompanying engraving illustrates the ground plan of the new power plant designed for operating the cables on the Brooklyn Bridge railway. The engine and boiler rooms have recently been enlarged, and the power equipment will be increased by the addition of one new engine and the erection of two sets of winding drums.



GROUND PLAN, CABLE POWER STATION—BROOKLYN BRIDGE.

The new drums will be mounted on an extension of the main shaft of the present equipment which consists of the two drums, shown to the right of the plan. The drums will be driven by means of differential gearing, the same as the original drums, the device being the invention of Mr. G. Leverich, associate engineer of the Brooklyn Bridge. The tracks of the bridge railway are to be in duplicate, not, however, far enough apart for trains to pass, but the new rails will be laid about six inches from the rails of the present track. When completed with the new approaches, it is intended to operate two of the cables at the same time, while two are kept in reserve. Additional particulars of the new construction will be found in the annual report of the trustees printed in another column.

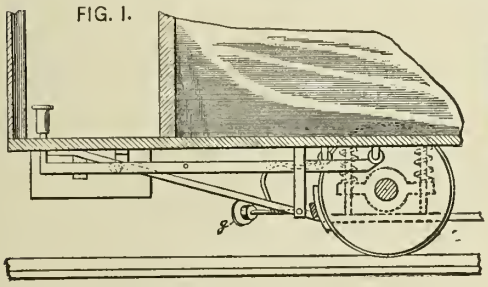
THE Short Electric Railway Co. have just closed a large contract with the Atlanta & Chattahoochee Railway of Atlanta, Ga., and the plant will be installed immediately. The contract calls for the new Short single reduction motors, and the Short slow speed multipolar generators of 200 H. P. each.

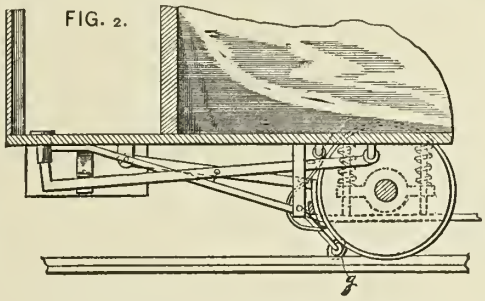
New Track Switch.

The accompanying illustrations show a device for operating a tongue track switch from the car, the invention of Jeremiah Young of Boston. For electric lines where there are no horses in advance of the car to move the tongue the advantages of a simple and effective method of switching which shall be under the control of the drivers, is apparent.

Fig. 1 shows a vertical longitudinal section of a portion of a car equipped with the device. A bracket is secured centrally to the bottom of the car directly in front of the wheel truck. Two laterally projecting rods, one of which only is shown, are swiveled at their ends in the bracket, in such position that their outer ends are in position to be directed into engagement with the track. These rods are provided on their outer ends with a roller having an annular flange or disk, which rests against the outer edge of the track when the rods are lowered.

Each roller is connected by a system of levers with a button on the front platform, so that each can be lowered





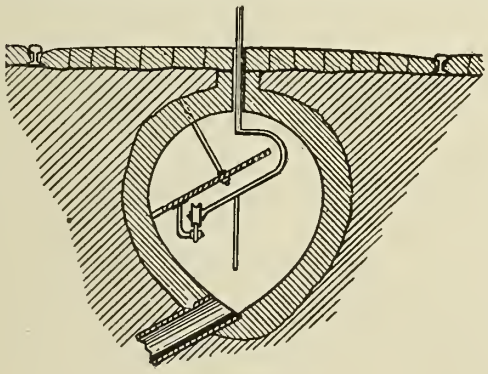
into position at the will of the operator. Its appearance when in this position is shown in Fig. 2.

The use of the device is then easily understood. For directing the car to a turnout on the left, the left hand button on the front platform is pressed down by the driver or motorman. This lowers the roller which engages the outer edge of the rail, as described, as near as possible to the point of contact between the wheel and rail. Thus the ordinary flange of the wheel is held closely against the inner face of the rail, and as it reaches the branch track it is caused to be directed therein instead of running straight on the main track.

As soon as the foot piece is freed it is forced upward by a spring and the roller is taken out of connection with the track.

An Electric Railway Conduit.

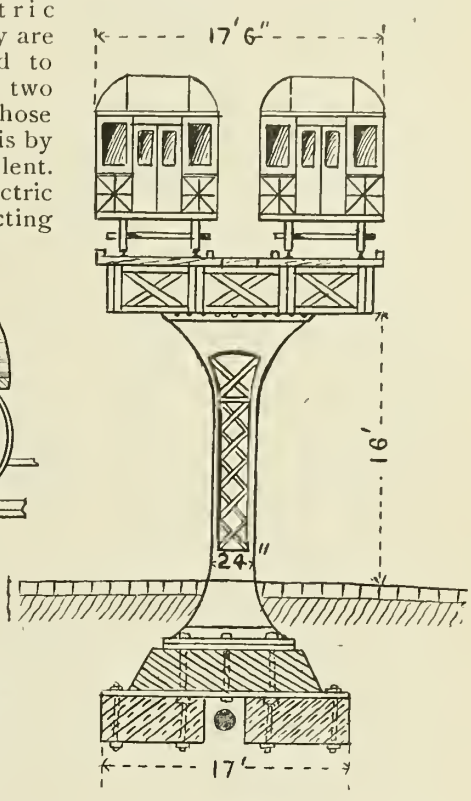
A new type of electric railway conduit, using an open slot, has been devised by S. D. Nesmith of Cleveland, O.,

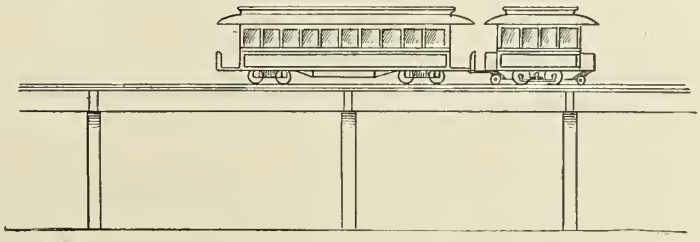


a cross section of the device being shown in the accompanying engraving. As will be seen, the conducting wire is supported upon a short bracket, protected by and supported upon a metal plate extending longitudinally in the conduit and fixed at an angle of about forty-five degrees from the horizontal. The trolley arm or plow is of a peculiar shape, adapted to the conditions of the conduit, the main portion being curved so that it clears the metal plate, and at the same time, at its lower end, makes contact with the trolley wire by means of an ordinary trolley wheel. To this trolley arm is affixed a depending branch arm to which a brush may be attached for sweeping out the bottom of the conduit. At suitable intervals along the bottom of the conduit are provided sluiceways leading to the sewers for drainage. At crossings, curves and switches a slot is made crosswise through the protecting plate for the passage of the trolley arm.

Chicago & Evanston Electric Railway.

The residents of Evanston, a suburb twelve miles north of Chicago, are greatly interested in the Chicago & Evanston Electric Railway Co. They are at present obliged to depend upon two steam railroads whose suburban service is by no means excellent. Should the electric railway connecting Evanston with Chicago be constructed it would greatly enhance the value of the former as a place of residence. The projectors of the road are energetic. It is stated that they have now secured the consents of property owners from Clybourne Avenue on the north side to Evanston, with the exception of about 1,500 ft. It is the intention of the company to build a surface road to Clybourne Avenue where an elevated structure will commence. This will pass over Hawthone Avenue to Larrabee Street, a distance of about a mile and a half, and on Larrabee Street and Chicago Avenue to Kingsbury Street, and on the latter to Kinzie, thence to State and across the river, with the possibility of a loop through the courts between South Water and Randolph Streets. It is proposed to build the elevated structure on a single line of columns, which will be located in the



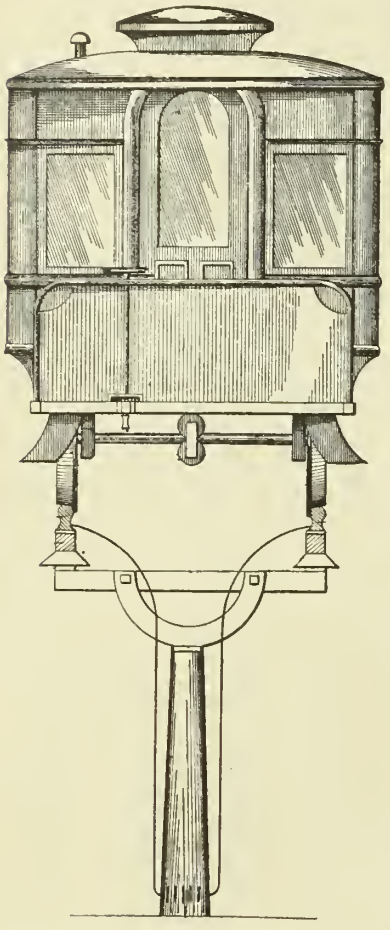


space between the surface tracks. These supporting columns will be placed every thirty-five feet. As soon as the required frontage is obtained, the company will ask for a franchise, When this privilege is granted, the Edison company will take charge of the construction of the railway.

THE Lindell Street Railway Co. of St. Louis are operating two Short gearless motors. The first trip was made November 25, and the electrical apparatus has been in constant use since that day, with the best possible results.

The Green Electric Railway Patents.

The Patent Office issued on December 15 two patents to George F. Green of Kalamazoo, Mich., covering inventions in electric railways, which, it is claimed, will have an important bearing on the electric railway interests of the country. The application for Mr. Green's first patent (No. 465,407) was filed September 15, 1879, but owing, it is said, to its being prepared by himself and to his unfamiliarity with patent matters, it did not meet all the requirements of the Patent Office in regard to technical description, though the invention was pronounced patentable from the start.



For these and other reasons the application was rejected. But Green's claims, covering the broad matter, were persistently prosecuted by way of an appeal to the Supreme Court of the District of Columbia, and the latter tribunal overruled the Patent Office, thus securing to Green the claims for which he had been so long contending. An experimental railway, which is claimed to have been the first full sized electric railroad ever operated from a stationary source of electric energy and capable of carrying passengers, was built by Green in 1878. But his invention was made long prior to this date, as shown by a small model of an electric railroad built and operated by him about the winter of 1874–75 for the purpose of exhibiting his invention to capitalists and demonstrating its practicability.

Fig. 1 is a reproduction of the drawing illustrating Green's first patent. The object of the invention, as stated by the patentee, is to operate cars readily and easily without the annoyance of carrying the source of energy by which the cars are propelled. To accomplish this Green states that independent conductors can be used, but that he prefers the rails be insulated, one rail of the track being connected with the positive pole of the source of electrical supply, the other being connected with the negative pole. The motor is carried on the car and supplied with electricity by metallic connections with the track, either through the wheels or otherwise. The fourth claim awarded by the patent is as follows :

The combination of a railway track, one or more stationary means of electric supply, electrical conductors extending from said means of electric supply along the lines of said track, and consisting wholly or in part of the rails thereof, moving along said track, rotating electro-dynamic motors fixed upon said vehicles for imparting motion thereto, and wheels supporting said vehicles upon the track, and also serving to maintain electrical continuous connection between said means of electric supply and said rotating motors, substantially as described.

In the second patent (No. 465,432) the application for which was filed May 15, 1886, the object of the patentee is to secure, with the system described in the former patent, a method of motor control. To accomplish this he places a pole-changing switch in circuit with the motor, so that the current in the latter can be reversed in direction by one movement of a lever. The first claim made in this patent is as follows :

The combination of one or more stationary sources of electric current, a conducting circuit formed wholly or in part of an insulated line of rails of a railway track, a wheeled vehicle movable upon or along said line of rails, one or more rotating electric dynamic motors mounted upon said vehicle for propelling the same and included in said circuit of conductors, and a circuit controller placed on said vehicle and also included in said line of conductors, substantially as described.

Both of the patents described above have been assigned by the inventor to Oliver S. Kelly, of Springfield, O.

Wire Rope Dressing.

Cable railway managers who find it difficult to procure a satisfactory dressing for wire ropes will do well to follow the practice of the Third Avenue Railway Co., of New York. We are informed by Mr. F. L. Hart, mechanical engineer, that for the last six months they have been using for cable dressing on the Tenth Avenue and 125th Street cable lines a tar made by the Improved Pine Product Co., whose offices are at 5 and 7 White street, New York. This is distilled tar, free from moisture and acid and can be used pure without a mixture of lime or oil, and applied direct to the cable without being heated. The price per barrel is the same as for ordinary tar, and since the line began using it it requires about twelve barrels and two weeks' time to fill a cable, where formerly it required thirty barrels and an application during five or six weeks to get a rope in proper condition, and the action of the rope upon the driving drums is more satisfactory.

The Columbia Railway Incandescent Lamp.

An incandescent electric lamp is now being manufactured by the Columbia Incandescent Lamp Co., of St. Louis, Mo., which is especially constructed and adapted for use on electric railway circuits. The filament is anchored at the bottom of the lamp with platimum hooks, and is so made that it will stand quite a fluctuation in voltage. By this method the filament is strengthened at the point where breakage is most apt to occur, and is also stiffened throughout its length, preventing the destruction of the lamp by the carbon coming in contact with the glass and cracking the globe through the vibration of the car.



A number of these lamps are already in use upon many of electric railways throughout the country and are reported as giving excellent satisfaction. The lamps are made to fit all the standard sockets.

This company have had a large experience in lamp manufacture, and also supply commercial lamps for use in central stations and isolated plants. They claim for their lamp long life, high efficiency and full candle power, and that the lamp will maintain its candle power to the highest degree during its life, and that there is scarcely any discoloration of the bulb.

Return Circuit for Electric Street Railway Systems.

By GEORGE K. WHEELER.

The above subject is one which has not received the careful attention it should have from electrical engineers and contractors or railway companies who have in operation or are about to install an electric railway system. It is the purpose of this paper to bring to the notice of such the importance that this part of the installation bears to the operation of any road commercially, satisfactorily and economically. The return circuit may be constructed so that the coal consumption will be largely in excess of that required to operate the road, and the writer regrets to say that a large number of roads are now operating with power house expenses frightfully in excess of what they should be, on account of unbalanced circuits.

The following are the different methods that have been and are now in use, with mention of their advantages and disadvantages: The first method, the oldest, is that of bonding the rails with a No. 4 bare, soft copper wire about thirty-six inches in length, having soldered on each end a copper rivet three-eighths of an inch in diameter. The manner of connecting is to drill a three-eighths inch hole in the rail about eighteen inches from the end, pass the rivet through the hole from the inside of the rail and head it down securely; in addition to this, the bond wires are connected together about every 500 ft. with a copper wire of same size as the bond wire, and all connections are carefully soldered.

The objection to this method is the great liability of poor connections, owing to the large number of soldered joints necessary to secure the rivets to the bond wires, and the liability of bond wires of this size breaking by reason of poor joints in track and by teams running on track where paving is not used, and the vibration of track causing the wire to break away from the rivet. Further, the carrying capacity in amperes of this circuit is only sufficient for small lines operating a limited number of cars.

The second method of construction only differs from the first by the use of iron instead of copper wire. This method has only one advantage over the others; that is, its low cost to install. It is, in the writer's opinion, the poorest kind of a return, and after it has been laid for a few months is but little better than the track itself, without bond wires. It is well known that the life of a No. 4 galvanized iron wire when suspended in the air, is about seven years, and its life when underground must be considerably less than this, on account of the great liability of corrosion. Bond wires of copper are used to obtain high conductivity at the joints of the rail, which cannot be obtained by means of the ordinary plates and bolts on account of the rust which will accumulate at these points; therefore it seems useless to construct the return circuit with iron wire, which has a conductivity considerably less than that of copper. The efficiency of this return is considerably reduced by reason of the rusting away of the wires where they are connected to the rails. Railway companies intending to equip electrically will do well to shun the wire return if low cost of operation and maintenance is desired.

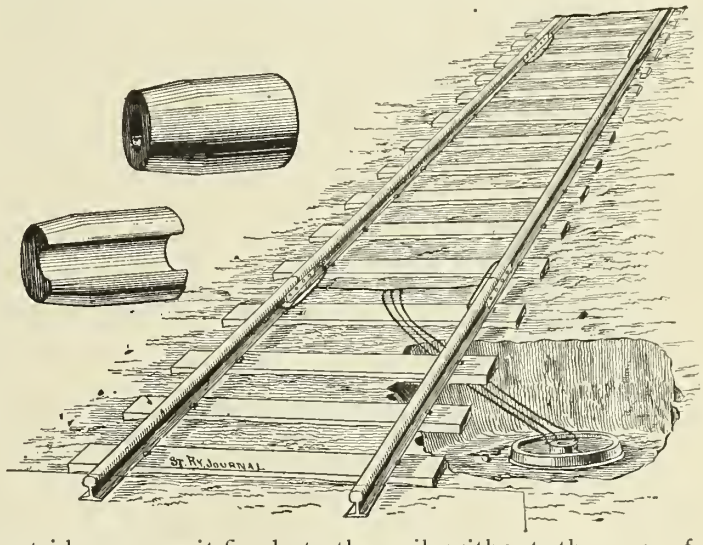
The third method, one which has been generally used and has given good results in a number of cases, is to construct the return circuit in the same manner as in the first method, but in addition to this, use a No. 0 soft drawn, bare copper supplementary wire which is laid between the rails in the centre or on the side, as may be desired, and connect each of the bond wires to this wire, soldering all connections. But the same objections apply to this as in the first method, with the exception that it gives a much better return on account of the addition of the No. 0 wire. On some roads of great length where a large number of cars are used, it has been found necessary to run out track feeders in addition to the supplementary wire since the conducting capacity of the rails has not been and could not be fully utilized when No. 4 bond wires were used. Railway companies have often objected to using the supplementary wire on account of the increased cost of track construction, which is about $300 per mile, and have preferred to put that amount of money into overhead feeder lines, so that in a great many cases this has been done, incurring a needless expenditure of money, though without benefiting the system one particle.

The writer has given considerable attention and study to this subject and has made a number of experiments on all forms of return circuits during the past few years, for the purpose of obtaining the most efficient method and one that could be more economically constructed than the third method, where the No. 0 supplementary wire is used, and for the past year has recommended the following form of construction, which may properly be called:

THE IDEAL RETURN CIRCUIT.

This circuit is constructed in the following manner:

Drill in the rails, about eighteen inches from each end, a hole nine-sixteenths of an inch in diameter with a twist drill, and connect to each rail a No. 0 soft drawn, bare copper bond wire by means of a channel pin of either pattern, illustrated at the right in the accompanying engraving. Placing the bond wire in the hole from the inside of the track and driving the channel pin in from the



outside, secures it firmly to the rail without the use of solder; this is a very decided advantage gained over other methods of bonding, as there is no possible chance of connections being corroded, as there is when solder is used. The cost of labor is also largely reduced as the connection can be made in a very short space of time. In addition to this, the rails are cross-connected every 300 ft., connection being made to the bond wires at these points by means of a copper wire, the same size as the bond wires. This method gives a large carrying capacity, the safe carrying capacity in copper being 260 amperes, in addition to the amount that must necessarily be carried by the rails. The cost of this, including all material and labor, is about $300.00 per mile of single track, and as compared with the third method where supplementary No. 0 wire is used and which costs $550.00 per mile of single track, a saving is made of $250.00 per mile, and a much better return is obtained with less liability of breaking of bond wires and corrosion through poor soldering.

In addition to this, on roads over five miles in length, the writer recommends the following

EARTH RETURN.

This is constructed in the following manner and can be used in connection with any form of return circuit: Place an old car wheel deep enough in the soil between the tracks to reach moist earth, connecting the car wheel by means of channel pins to two or three No. 0 copper wires, and connecting the same to the bond wires at that point, and at the power station sink several car wheels in moist earth, the number to be determined by the number of wheels placed in the soil between the tracks, and connect the same by means of wires of sufficient size to the

negative side of the generators. This will, in addition to the rails and bond wires, give an earth return which will largely assist in the economical operation of any road, providing the roadbed is not constructed upon ledge rock. This form of construction has been used on several large roads and excellent results have been derived, the motor cars moving very quickly when the current is applied, at all times using a small amount of current, and greatly reducing the coal consumption at the power station.

On roads where track feeders are required, it is advisable also to install supplementary wires placed in the centre of track and connected to each bond wire. This is much more economical than constructing track feeders overhead and there is less liability of short circuiting the system.

RIVER RETURN.

Good results have been obtained by use of river returns in addition to the rail and earth returns, and they should be employed wherever possible. If a river runs adjacent to any point of track and the power house, it would be well, in addition to the rail and earth returns, to sink in the river bed old car wheels or metal plates, copper preferred, of sufficient area, and connect the same to the bond wires of the rails by means of No. o copper wires. A similar connection should also be made with plates or wheels at the power house and the same be connected to the negative poles of the generators.

On a number of roads which have been constructed the negative poles of the generators have been connected



NO. O COPPER WIRES EATEN AWAY BY ELECTROLYSIS.



NO. O COPPER WIRE IN PERFECT CONDITION.

to the overhead line, making the rails positive, and the current has passed from the supplementary wire (if used) and bond wires to rails, from rails to wheels, through wheels to motor, through motor to overhead line and back to the generators at the power station. This is bad practice and will invariably work great injury to any system in a very short time on account of electrolysis, which occurs by reason of the positive current passing from the copper supplementary or bond wires to the iron rails, causing the copper to be rapidly eaten away, making poor connections, obliging the generators at the station to work at all times under a heavy load and increasing the coal consumption and the liability of injury to the apparatus. The writer has some samples of No. o wire which were in the oil but a few months, with the positive poles of generators connected to the rails,whic hare in a very bad condition, being almost entirely eaten away. They were laid in soil that was not affected by any gases or salt water, and the action can only be due to electrolysis. All systems, in the writer's opinion, should be connected with the positive pole of the generator of the overhead line, and he believes that this is to-day the standard practice and conformed to by all engineers and contractors.

There is one thing more that is equally as important as the installation of the return circuit, and that is, the attention that bond wires should receive after a road has been put into operation. They should be carefully inspected by the trackmen whenever possible, and a broken or defective bond wire can be readily discovered at night, as there will always be a flash at the wheels when the motor car is passing that point. Defective or broken bond wires should always be immediately repaired. There is always a marked decrease in the amount of current used in the operation of an electric railway during rainy weather; this is due to the fact that the moisture assists in making a perfect contact between the wheels and rails, and also allows the current to pass defective bond wires by way of the earth. A great many of the larger roads use a water tank car, which is arranged to allow a flow of water to run on both rails, this keeping the rails wet at all times. On these roads it has been found that considerably less power is required to operate, and that there is an entire absence of sparking at the wheels.

In conclusion, the writer would certainly advise all railway companies who equip electrically to be sure that they obtain the best possible return circuit, and one that will be ample and sufficient for their needs, and he would suggest to those who are at present operating electrically equipped roads that they increase the return circuits which they are now using by adding the earth return above referred to, and also the river return, whenever possible, and thus establish a marked reduction in expenses of operation and maintenance.

Notes from the Field.

Albany, N. Y.

For some time rumors have been industriously circulated, by parties hostile to electric traction, to the effect that the operation of electric railroads by the overhead system was not so great a success as has been claimed, owing to a greater depreciation in the appliances than had at first been anticipated, for which reason a number of roads had come to the conclusion that all that glitters is not gold, and were regretting that they had equipped their lines with this method of traction.

If there are still any sceptics in regard to the value of electric traction in situations that are favorable to this method they have but to visit Albany, N. Y., and study the operation of the lines of the Albany Railway Co., which are now all operated by the Thomson-Houston overhead system, when we are quite sure, all their doubts will be removed.

Having spent some time in Albany recently, we are able to give our readers reliable information in regard to the operation of these lines. Mr. John W. McNamara, general manager of the Albany Railway Co., in answer to our questions, replied that, had they to start over again to change from horse power to electricity, in the light of experience gained after eighteen months of practical operation, they would do just as they have done, taking advantage, of course, of the improvements which have since been made in motors and electrical appliances; that the lines were being operated with better success and with far less annoyance from electrical failures than they anticipated when they decided to adopt electric traction; that the operations of the road improve with age, and that it requires less power to operate the same number of cars than when the lines were first equipped, and that the lines were being operated for sixty per cent. of the gross receipts, not a single passenger having been injured since the lines began to be operated with electric power and no serious injury having been done to pedestrians. There had, however, been a few more accidents to vehicles, with which the motors had come in contact, than formerly. Owing to the method employed of ground return, known as the Sabold system, there was no interference whatever with the telephone service; the service had proved acceptable to the patrons, and travel had increased to such an extent that it had become necessary to add ten new eighteen foot cars to the equipment.

There are so many interesting features connected with the operation of these lines that are worthy of imitation that we feel justified in mentioning them in detail,

although the power station and general equipment has been fully illustrated and described in the June, 1890, issue of the STREET RAILWAY JOURNAL.

Five separate lines are now operated from a central power station. These are known as the State Street line, which runs to West Albany, the Pearl Street line, Hamilton Street line, Clinton Avenue line, and Madison Avenue and Park Street line. The State Street line was the first to be electrically equipped, and was put in operation in April, 1890. Owing to the physical characteristics of the route, it is one of the most interesting in the country. The grade on State Street from Pearl Street to the Capitol, is eight per cent. From State Street to Washington Avenue the line makes a compound curve, a portion of the way on a four per cent. grade, and continues past the Capitol on Washington Street A branch has recently been added to the State Street line, leaving the main line at the foot of Washington Avenue and passing through Steuben Street to Broadway, terminating directly opposite the Union Depot. This is a single track line, with two turnouts. The whole route from Pearl Street to Eagle Street is on a uniform grade of eight per cent.

The speed of the cars over the grade on State Street is five miles per hour, and the speed on the remainder of the road varies from eight to twelve miles. It is interesting to note that before the adoption of electricity, steam motors were tried on the State Street hill, and, when the track was in good condition, were able to ascend the grade, but were obliged to continue the ascent without stopping. Electric motors start readily from any point and make the ascent without difficulty when the cars are crowed with passengers. It is necessary, however, to keep the track thoroughly sanded, a requirement which is accomplished both by the use of sandboxes on the cars and by having a man stationed on the hill, whose duty it is to apply the sand to the rails at frequent intervals; this he does by means of an ordinary watering pot with a long spout. Sand is applied to both rails of the down track, but to only one rail of the up track, the other being left clean to provide for proper electrical contact. The trucks of the cars on the State Street line are equipped with the Flood car starter, or dog, which we have previously illustrated, and which is employed to prevent the cars from running backwards when it is necessary to stop on a steep grade. At a point just above Pearl Street where the regular stop is made to take on passengers, every other row of paving blocks between the track is left an inch or two higher than the ordinary level to provide a firm footing against which the dog may rest. The dog is under the control of the conductor, and is let down when the grades are approached and lifted free from the track when passing over level portions. The use of this device is highly commended by the management. The trucks are also provided with slipper or track brakes, which are employed in connection with the wheel brakes when the rails are slippery. There are conditions of the track, however, when it is found impossible to stop the cars even with the slipper brakes, but by their use the speed is reduced below the danger limit.

The cars composing the original electrical equipment were manufactured by the Gilbert Car Manufacturing Co. of Troy, and give every appearance of standing up well under the severe duty imposed upon them. They are kept scrupulously clean and are not disfigured by advertisements. The cars are mounted on the Manier non-oscillating truck, and the journals have the Meneely roller bearings. These bearings give excellent satisfaction and very materially reduce the power required for hauling the cars.

The ten new cars before mentioned were built by the same company, but are mounted on the Taylor truck, which was illustrated and described in the November, 1891, issue of this paper. These trucks are equipped with the Meneely roller bearings, and will be provided with a slipper brake of a new design and will be equipped with the Lewis & Fowler sandboxes and with the Flood car starter. The electrical equipment consists of two fifteen H. P. Thomson-Houston single reduction water-proof motors. The striking peculiarities of the Taylor truck are that they are provided with elliptical springs in place of the spiral springs usually employed. On each journal box are placed half springs supported by side bars, and at each corner of the frame full fourfold elliptical springs are placed which support the body of the car. The car is attached to the frame in such a manner as to positively prevent the body from tilting or rocking. The trucks, without the motors, weigh about 3,600 lbs.

The new cars, with the exception of being longer by two feet, are of the same style and finish as the former equipment, being painted in straw color or light buff, with the main panel of claret color. The window frames are of mahogany, and the headings are of quartered oak artistically decorated.

The overhead construction of the Albany lines, as we have before noted, was done in a thorough and substantial manner, the poles being of the Hilton type and the trolley of No. 0 copper wire.

The experience of the Albany Railway with their tracks has been an interesting one, and their experiments will prove valuable to the railway world generally. The metallic construction which was employed on a portion of their lines proved inadequate for electrical traction and, with the exception of two miles, has been replaced with the girder rail. About two miles of the metallic system has been relaid on cast-iron chairs. On State Street and some other portions of the line the Lewis & Fowler girder rail is employed, and so far this rail is standing up splendidly under the traffic and gives promise of very long life. On other portions the Johnson girder, with the standard joint, has been employed and is also giving excellent satisfaction.

The company will extend their Greenbush line in the spring, and will build about four miles of new track on which it is intended to place the girder rail upon stringer construction, after the method employed in Boston. In case, however, this construction does not prove to be durable, as there is strong probability that it will not, a different construction may be adopted.

In discussing with the general manager the question of rails and joints, he claimed that it would require at least a year of service to determine whether any rail or joint would be durable under electric traction; that several kinds of rails tried had given satisfaction for six or eight months, and after that time had broken down.

The power station of the Albany system is located on Pearl Street, near Third Avenue, about 500 ft. from the river and beside the railroad track, so that coal is delivered from a siding directly into the yard adjoining the power house. The power equipment, which we have before described, consists of five Babcock & Wilcox boilers of 125 H. P. each, and three compound, McIntosh & Seymour high speed engines of 250 H. P. each. Originally each engine was designed to drive two Thomson-Houston eighty H. P. generators, to which they were connected by direct belting; but two of them are now driving six generators, three being coupled to each engine, and the third engine is now arranged to drive four generators, the shaft being equipped with three fly-wheels. The engines make 200 revolutions per minute and the armatures of the generators 900 revolutions. It requires but eight and a half tons of ordinary buckwheat coal per day to operate the entire twenty-six cars which are now running.

The water which is drawn from the river is purified by a Hyatt filter and fed from a National heater. Half hour readings of the appliances in the power station are made, and a daily report is made to the general manager. Ordinarily the maximum power required to operate the twenty-six cars now employed is 400 H. P., or about 16 H. P. per car, while the average power required does not exceed 250 H. P. Owing to the increased speed of the electric cars four cars handle the traffic on some of the lines where formerly seven horse cars were required. The increase of traffic on the State Street line for the first year under electric traction was 365,963 passengers over the last year's operations with horse cars. The fare on the State Street and other hill lines is six cents or twenty tickets for $1. On Pearl street—a level line—the regular fare is five cents. No transfers are given.

In reply to our question, Mr. McNamara stated that

the cost for building one mile of straight double track similar to the Albany construction, including the paving and overhead equipment, would be about $18,500, not including the power equipment or rolling stock.

Troy, N. Y.

The electric lines of Troy, which now operate over eighteen miles of track (seven more to be put in operation in the spring) with thirty-five cars, have a somewhat earlier history than the Albany lines, having been running about two and a quarter years. Three of the cars are equipped with Thomson-Houston and the balance with Edison motors.

Mr. Charles Cleminshaw, president of the company, in speaking of the success of electric traction, repeated substantially what we have quoted above from the remarks of the general manager of the Albany lines, to the effect that the Troy company would repeat their experience, were it necessary, and under no circumstances would they go back to horses, and further, that the patrons of the line would not submit to it were such a movement proposed.

The Troy company are still operating four and a half miles of road by horse power, and the operating expenses of the two methods of traction furnish a striking proof of the advantage of electric traction, the cost of operating expenses per car mile, being less with electricity than with horse power. In reply to our question as to the system he would recommend a new line to adopt, were his advice sought, Mr. Cleminshaw stated he would not attempt to say, until he had made a more careful test of some of the new motors recently put upon the market, but that companies now contemplating electric traction would have a great advantage over the pioneers, owing to the reduction of price of electric appliances, and that the Troy equipment could now be duplicated for much less than the original cost. In view of increasing the equipment with new motors, a car equipped with the Edison single reduction motor is now being operated experimentally by the company.

While pleased with the success of electric traction, the most serious question connected with the operation of electric lines is that relating to a proper rail and joint. On being asked what type of rail and joint he would recommend, Mr. Cleminshaw stated that he could not give any advice, that they had tried four kinds of construction, and with none of them were they satisfied, and that they were designing a rail and joint that would be different from anything now in the market, and with which they would experiment during the coming season. The best success so far had been had with the Johnson sixty-three pound girder rail and the new standard joint made by the same company. They were intending to equip an additional track with the same construction with ties only eighteen inches apart, from which they expected better results than from anything heretofore tried. Incidentally it was mentioned that on a single track where the motors run in both directions the joints stand up much better than when the cars run continuously in one direction. The grades on the Troy lines are not severe, the heaviest being an eight and a half per cent. grade 500 ft. in length.

The poles employed for supporting the overhead equipment on the Troy lines were manufactured by the Syracuse Tube Works and are giving excellent satisfaction. The power equipment of these lines has recently been increased by the erection of a new power house on Front Street, near the river, diagonally across from the car house, in which has been installed a 425 H. P. Greene engine, manufactured by the Providence Steam Engine Co., which is belted direct to two 212 H. P. Edison generators of the latest improved type, which are illustrated on page 33. The belts, which are twenty-four inches wide and fifty feet long, from centre to centre, were manufactured by Barnum Bros., Co., of Troy, N. Y. The steam equipment consists of two batteries of Babcock & Wilcox boilers of 186 H. P. each, together with the usual equipment of pumps, filters and heaters. Foundations are laid beside those in use, for duplicating the entire equipment. The switchboard is of slate, and provided with the very latest electrical switches and appliances, sufficient for ten generators. Water is drawn from the Hudson River, and coal is hoisted from boats to coal sheds alongside the boiler house.

The original power equipment, situated in Lansingburgh, four miles from the city, consists of one 400 H. P. Greene condensing engine, which is belted direct to three No. 32 Edison dynamos, and two 150 H. P. Corliss condensing engines, which transmit power through a countershaft to three No. 32 Edison generators. There are also three 500 H. P. Babcock & Wilcox boilers.

The entire system of electric lines is divided into five sections, with such arrangement of independent feeders, cut-out boxes, etc., from both power stations, that not only can the entire system be operated from either power station, but any section can be instantly cut out without affecting any other section.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Advantages of Splicing Cars.

LINDELL RAILWAY CO.,
ST. LOUIS, December 12, 1891.

EDITORS STREET RAILWAY JOURNAL:—

Replying to your communication of 6th inst. relative to the advantages of splicing cars, in which you ask the following questions:

1st. What is the economy of building long car from two short cars?

2d. What is the cost of new eight wheel car?

3d. What is the estimated value of long car built of two short cars?

4th. What is the cost of reconstructing one long car from two short cars?

5th. Under what condition would you favor selling old cars and buy new, rather than rebuild into long cars?

I hereby submit answers to each question, as follows:

1st. On all roads where travel justifies the operation of trail cars the long car is the most economical, and for such roads as have a full equipment of twelve, fourteen or sixteen foot cars, either trail or motor cars, the advantage of operating a long car, as compared with a motor car and trailer, as hereinafter mentioned, is certainly in favor of the former.

2d. New eight wheel cars, about forty feet in length, can be purchased at from $1,800 to $3,000, according to the design and finish.

3d. The estimated value of long cars built from two short ones depends largely on the estimated value of the two short ones, before such alteration is made, and the amount expended in finishing the same where said cars are joined. If properly constructed, framed and joined it would unquestionably increase the life of the two cars so rebuilt at least fifty per cent., as it dispenses with jerking, incident to the operation of trail cars, which is alike injurious to framing of motor and trail car, not to mention damage to platforms and drawbars. The long car mounted on double trucks also eliminates that rolling, rocking motion noticeable on short cars with single truck, and which is damaging to the entire framework of car.

4th. The cost of reconstructing two short cars into one long car depends entirely on the length of the former and the length required for the latter, also on the general design and finish. The writer has just completed two long cars, such as were illustrated in the October issue of the STREET RAILWAY JOURNAL, each forty-four feet long, rebuilt from sixteen foot cars, as follows:

From each sixteen foot car we took the hood and platform from one end and placed the said ends facing, alowing a space of four feet. We then connected the tops with an iron framing properly bolted to each car,

building an iron or wood transom at opposite ends for the pivotal truck, and connecting thereto iron or steel "I" beams, or long sills properly trussed. This completes the framing. The space between the two cars, known as a vestibule, is finished in accordance with the general appearance of the cars, and equipped with hinged doors and sliding vestibule seat, as well as a reversible step.

The estimated cost of the change is as follows:

Framing, including all iron and wood work, and labor of same	$125.00
Reversible step	30.00
Doors, ceiling, roof, floor and seat of vestibule, including labor	85.00
Painting and varnishing vestibule to match balance of car	10.00
Total	$250.00

For each long car so built there are two platforms, two hoods, two draw-bars, two brake staffs two handles, two bells and one register not used, estimated at fifty dollars, all of which should be securely stored away for repairs and renewals at each end of long car, leaving the net cost of the above charge, exclusive of trucks, $200.

A car rebuilt in this manner, in operation by the Lindell Railway Co., of St. Louis, has been in constant service for upwards of four months, carrying on one load 138 passengers, besides motorman and conductor, and, being repainted, has the general appearance of a new car.

5th. No short car, twelve, fourteen or sixteen feet in length, having sound framing, should be disposed of by sale and replaced with new long cars when they can be readily and cheaply rebuilt into commodious long cars at a trifling cost and oe made to give years of service.

Two twelve foot cars, with four foot vestibule, would make one long car thirty-six feet long, including platforms.

Two fourteen foot cars, with four foot vestibule, would make one long car forty foot long, including platforms.

Two sixteen foot cars, with four foot vestibule, would make one long car forty-four feet long, including platforms.

We do not find the latter too long, for it must be remembered two sixteen foot cars, coupled together with draw-bars, are forty-nine feet long.

The following are some of the many advantages in favor of the operation of long cars, as compared with short car and trailer attached:

1st. They dispense with one conductor.

2d. The load being all on motor trucks, they give greater adhesion to the rail, and consequently require less power.

3d. The brake question is solved, for it has been a source of much annoyance to railway managers how to brake the trail car.

5th. From this cause, and the fact that passengers will insist on getting on and off the front platform of the trail car, over seventy-five per cent. of accidents are due to operation of trail cars.

6th. The car repair account is decreased very materially, incident to the decrease in cars and parts.

7th. When license is assessed on cars, this charge is reduced fifty per cent.

8th. One register only is required.

9th. Cars with double trucks ride much easier than single truck cars.

10th. With the vestibule and side entrance, experience shows that passengers are as readily discharged as though riding in two separate cars.

11th. The wheel base being much shorter, curves are more easily rounded.

12th. Long cars are better adapted for crowded thoroughfares and heavy travel than motor cars with trailers, because they require less room and are more easily controlled.

13th. Passengers like them better.

14th. One car may be made a smoking apartment without interfering with passengers in the other.

15th. One part may be built open, the other closed.

16th. Passengers may pass from car to car without danger.

17th. Absolute freedom from danger of being run over by rear trucks is secured to passengers.

Yours truly,
G. W. BAUMHOFF.

WEST END STREET RAILWAY,
BOSTON, December 5, 1891.

EDITORS STREET RAILWAY JOURNAL:—

Yours of December 3 received, requesting that I give you my opinion regarding the economy and also practicability of splicing long cars from two short cars, and also the difference in cost of the new eight wheel cars, compared with the spliced cars.

To begin with, I would say it is a difficult matter to now dispose of any of our old sixteen foot horse cars. If they are ten or twelve years old people do not want them, but they are willing to buy a young car, say, three to five years old, and pay a good price for it. The best price we got for a sixteen foot horsecar, which was thrown out of service on a particular line by the introduction of electricity, was $800. These we consider our best cars, run only a few years, built by Jones and made up in the best style. We do not take a car of this kind for splicing, for the simple reason that the value of the two horse cars would be $1,600; cost of splicing, $450, making a total of $2,050 as the cost of the large car. What we do is to take our oldest cars, for which we can get but $300 for the body. The first cost of two bodies will then be $600; splicing, $450, or a total of $1,050.

The cost of the new cars, such as we have put on of late, is about $1,600 or $1,650, according to style and finish of the car. This makes a saving in equipment of about $600. I wish to emphasize the fact that the cars are practically just as good for our business, earn as much money and ride as well, though they, perhaps, do not look as well; otherwise they fill the bill admirably. Our method of splicing is to take two sixteen foot cars and keep as near to twenty-five feet for length of body as may consistently be done, being guided by the number of windows. The cars, also, must be of the same pattern to an eighth of an inch, made from same templets when first built. We were unfortunate enough to build over a couple of cars, one of which was one-quarter inch wider in the dome and one-half inch higher than the other, and this made some trouble. These things have to be looked into very sharply before starting in to do any of this kind of work.

My advice to companies desiring to undertake this splicing is, that it depends entirely upon whether they can dispose of their cars. If they have only one, two, three, a half dozen or a dozen cars, I would say sell them, if possible, at almost any figure; but where a company has four or five hundred cars to dispose of, the question presents another aspect, and the most economical method is, do as we have done—splice.

Yours truly,
L. PFINGST,
Master Mechanic.

Street Railways and the World's Fair.

The main part of the strictly street railway exhibit at the World's Fair will be located in the Transportation Building. Here will be illustrated all means for conveying passengers and freight from one point to another. Of course many other buildings will contain displays of special interest to street railway men. In the Electricity Building, for example, will be located the exhibits of electrical apparatus for railways. The electric generating station in Machinery Hall will be a marvel in its way, as its capacity will be at least treble that of the similar department at the Paris Exposition. The work on the Transportation Building is proceeding rapidly. Mr. Willard A. Smith, chief of the Department of Transportation, says those interested in street railway work should now begin to consider how much space they desire, and how they wish to have it divided.

The Short Gearless Motor.

The Short Electric Railway Co. of Cleveland, O, is working its shops day and night on a heavy factory order for gearless and single reduction motors. The first large road to be equipped with the single reduction motors will be the Trenton Passenger Railway Co. of Trenton, N. J., work upon which is now progressing very rapidly, with the expectation that the road will be in operation on or about February 1. The first gearless motors of the final type will go to Albany, Washington, Louisville, Indianapolis, Rochester, St. Louis, Chicago, Cleveland, Denver, Houston, Brooklyn and elsewhere, in filling large contracts already secured by the Short company.

Although the Short company had a commercially successful gearless motor as early as last July and could have made shipments in quantities at that time, it foresaw that the financial situation would be such that very few large contracts would be closed before fall, and therefore determined to complete all experiments upon its gearless motor before sending it out in large numbers. The wisdom of this course has been justified, and the "Perfected" gearless is now not only the simplest but the most economical motor on the market. The magnetic circuit has been greatly improved by imbedding the armature coils entirely in the armature core, and extending the pole pieces so as to "present" at the top as well as at the sides of the armature. The armature has also been cross connected so that the brushes are both on top and extremely easy of access. The frame has been made rectangular instead of circular as before, so that it can now be easily placed on a thirty-three inch wheel with four inches clearance over the track. The method of connection between the hollow armature shaft and the truck has also been simplified. It will be remembered that the original plan provided a spring connection between a disk keyed to the hollow shaft and the car wheels. The second method was to do away with the springs, keying a three legged spider to the hollow shaft and providing wheels with special lugs cast on their spokes. This, while an extremely simple arrangement, had the disadvantage of calling for special wheels. The final method now adopted is to key a disk directly to the car axle close to the end of the hollow armature shaft, upon the latter being placed a two legged spider connecting with the disk through flexible rubber bushings, the car being driven both ways upon the same side.

It is interesting to note the development of great manufacturing corporations in the electrical field. Two years ago the Short Electric Railway Company was hardly known outside of a limited circle of believing friends. Its past reputation for never failing success is high, and it may also be noted that it has rarely failed to start a road successfully and without a hitch.

NOTES ON THE SHORT SYSTEM.

AT Battle Creek, Mich., the Short Electric Railway Co. have installed an electric railway which is a model of completeness and careful workmanship. The line was opened for traffic late in November last and has an equipment of six electric cars, each equipped with two Short standard, double reduction motors. The cars were furnished by the St. Louis Car Co. At the power station are two 100 H. P. dynamos of the standard Short pattern. Both rolling stock and generating station are doing excellent work.

THE Jamestown Street Railway Co., of Jamestown, N. Y., although one of the most difficult roads in the country to operate, is still one of the most successful. It has just purchased from the Short Electric Railway Co. a large amount of additional apparatus for its spring necessities, which will include, by the way, one of the finest private cars yet built, which will be equipped with the Short single reduction motors. The station is to be largely increased, and the Short 200 H. P. multipolar generators are to be used.

Personal.

Mr. S. S. Leonard of the Hill Clutch Works paid us a visit during December.

Mr. F. L. Hart, mechanical engineer of the Tenth Avenue, New York, Cable Railway, called at our office recently.

Mr. H. A Everett, general manager of the Toronto (Can.), Street Railway Co., was a welcome visitor at our office one day last month.

Mr. Alexander von Babo, representing the firm of Siemens & Halske of Berlin, Germany, has opened an office in the Times Building, New York City.

Mr. E. J. Wessels has been appointed in charge of the New York City office of the Short Electric Railway Co. of Cleveland. Mr. Wessels was formerly of E. J. Wessels & Co., who own and operate the Wessels line of steamers between Jamaica and New York. He has had a wide business experience both at home and abroad.

Mr. W. H. Eckert has been appointed general agent for the sale of Kerite insulated wires and cables, *vice* Mr. Geo. B. Prescott, Jr., who has resigned on account of ill health, Mr. Eckert has for a number of years been connected with the Metropolitan Telegraph & Telephone Co. of New York, and is well known among the electrical fraternity.

Mr. Julius Meyer recently resigned his position as chief engineer of the Milwaukee Electric Railway Co., and will for the present be connected with the New York office of the Edison General Electric Co. Under Mr. Meyer's supervision over forty miles of track on the Milwaukee lines have been reconstructed for electric traction since July last. The new construction consist of seven inch girder rails spiked directly to the cross ties and connected at the joints with six bolt fish plates, the bolt holes in the plates being punched staggard.

Mr. C. D. Wyman, vice-president of the Central Park, North & East River Railway Co., called at our office during the month. In conversation Mr. Wyman stated that when he found a suggestion in our paper relative to a change or improvement in service, he usually called the foreman of the department, to which the improvement related, to his office, read the article to him, and discussed the matter with him, and when it was thought best directed that he should put the suggestion in practice.

Mr. J. S. Sloan and Mr. D. S. Caylor of the J. S. Sloan Co., dealers in heavy machinery of 42 Rue du Louvre, Paris, France, have been spending some time in this country inspecting rapid transit systems, and have made arrangements with the Short Electric Railway Co., of Cleveland, O., and also with the Walker Manufacturing Co. of that city to represent their interests abroad, and act as agents for introducing such American appliances as relate to electric and cable roads. These gentlemen sailed on their return voyage on the 26th of December, but before sailing gave us the pleasure of making their acquaintance at our office.

Mr. H. H. Littell, general manager of the Buffalo Railway Co., following his usual custom when in New York, paid the JOURNAL a visit last month. In conversation Mr. Littell confirms what has been said in an interview in another column of the rapid development of the street railroad business following the introduction of electric traction. On one of the Buffalo lines which was opened with twelve cars twenty-five are now being operated, and if they had them thirty-five could be filled during the rush hours of morning and evening. A good deal of controversy is going on in Buffalo between the railway company and the City Council over the application of the former to change the franchise of the Crosstown Line which was originally started as an opposition line, but which is now under the management of the Buffalo Railway Co. The original contract provided for paying into the city treasury eleven and three-quarters per cent. of the gross receipts, and the present company finding it impossible to operate advantageously under this requirement, has asked to have the rate reduced to three per cent.

Obituary.

Louis de Bebian, president of the Christopher & Tenth Street Railway Co. of New York, and one of the best known of New York's French residents, died of heart disease at his home, No. 165 West Fifty-seventh street last month. Mr. De Bebian was born at Guadaloupe, West Indies, in 1831, and came to New York when fifteen years old. He was a man of exceptional energy and besides his connection with the Christopher & Tenth Street company, was a director in various banks, gas, insurance and trust companies, and a member of the Chamber of Commerce, as well as being identified with a number of charitable and social organizations. Mr. de Bebian was one of the most active workers for the success of the French exhibit at the Centennial Exposition in 1876, and was treasurer of the American Committee on the Bartholdi Statue. He leaves one daughter.

A Testimonial.

At the last meeting of the executive committee of the National Electric Light Association, a very complimentary and deserved resolution was unanimously passed thanking Mr. John Carroll, of the Eugene F. Phillips Electrical Works, of Montreal, Can., for his untiring and eminently successful labors in connection with the reception of the Association during its convention at Montreal. These resolutions were ordered engrossed and presented to the above mentioned gentleman.

English Electric Railways.

The outlook for electric railways in England at present seems to be very bright. The Brush company are reported to have some very important and valuable contracts on hand, among which is the application of electric traction to the Liverpool Overhead Railway and the South Staffordshire Tramway Co. This corporation and its affiliated company, the Electric Traction Co., seem to be taking a leading position in the immense field which is opening up for electric traction, and some of the most important provincial tramways, notably the Glasgow Tramway, and in close negotiation for the application to their systems.

A Reorganized Car Company.

The Northern Car Co. of Minneapolis have recently been reorganized, and their capital stock increased to $250,000 in order to accommodate the many orders of which the company are constantly in receipt. The new officers of the company are: President, C. P. Jones; vice-president, W. E. Steele; treasurer and general manager, D. M. Gilmore, who was with the Gilmore Furniture Co. of Minneapolis for seventeen years, and secretary, George P. Stearns. The superintendent is C. B. Manier, who was for three years with the Gilbert car company of Troy, N. Y., as workman, general foreman and superintendent.

At the location of the factory at Robbinsdale there are at present three buildings, each 60×150 ft., to which will be added immediately a paint shop 75×100 ft. On the pay rolls of the works are 200 names, and the capacity of the works at present is one car per day.

The impetus given to the car manufacturing trade by the wide adoption of electric power throughout the country has been felt greatly by the Northern Car Co., and the manufacture of electric cars constitutes a most important part of their business. They have built a large number of the recent electric cars installed on the Minneapolis Street railway, and number many other prominent street railway companies in the West and Northwest, especially, among their customers.

The R. D. Nuttall Company.

These well known manufacturers present as their report for the past year a very extensive record of business in all lines of electrical supplies manufactured by them.

The popularity of the Nuttall trolley is self evident, from the large amount sold since placing it on the market nine months ago, the number being 683. Among the street railway companies which have recently adopted the Nuttall trolley upon all of their cars are the Second Avenue Passenger Railway Co., and Citizens' Traction Co., of Pittsburgh, Pa. and the Wheeling Railway Co. The Nuttall company have made extensive improvements in their pattern of trolley during the past few months. and it, at present, is so much improved over the original patent that they say that the two are hardly to be compared. They have lately brought out a steel railway pole made of spring steel drawn in one solid piece without brazing, and tapering from end to end. This pole is practically indestructible, and when bent can be straightened cold without injury to the metal. Orders have been booked during the past month for 1,065 poles, fitted with improved trolley harps and side contact springs.

The Nuttall company expect soon to place on the market a new departure in railway motor gearing made of rawhide throughout, under patents granted recently to Mr. J. F. Pfetch, manager of the principal street railway company at Erie, Pa. Mr. Pfetch has in Erie, Pa., one car now equipped with this gearing, which has been operating for the past fourteen months, and in all that time the car has not once been laid up for repairs to gearing, the original wheels being still in place and doing good service.

The gear trade in general has been growing very rapidly with the Nuttall company during the past year. Since they went into this business upon an extensive way they have added much improved machinery and appliances of their own design, which have enabled them to place a superior article on the market at almost 100 per cent. less cost than the same could be had two years ago. The Nuttall gears have, therefore, made a name for themselves, which the managers of that company attribute to the extensive experience had by them in the manufacture of these articles, and the improvements they have been making from time to time, and are still making.

The Nuttall rawhide pinions are in such demand by street railway companies, that though the number produced at their factory at present is fifty per day, the company find themselves unable to get a stock of these goods ahead. Their production in gears and pinions, for the different systems, in the past year has been about 18,000 including all. If the trade in same keeps up in the future, as it has in the past, they think that their next year's business will be almost double this number. They have also added in the past six months a commutator department to their factory where they are at present producing commutators for all systems in large quantities.

They have also just completed new patterns and tools for the production of motor gearing made of cast steel, and have booked some very large orders for cast steel gears this month.

They have lately made arrangememts to open a branch house in St. Louis, and have appointed T. C. White & Co., general agents in that city. This had to be done as their trade in this section has grown very rapidly in the past six months, and was too much to handle from the home office. They expect to have their new catalogue ready for distribution the first of the year. It will embrace cuts and general descriptions of all the articles of their manufacture, giving prices, numbers of articles, and a telegraphic code for the facilitation of their many patrons. It will also give a few instructions in regard to the care of motors, and electrical railway machinery generally.

Street Railway News.

General.

Austin, Tex.—The Austin City Railroad Co., have awarded a contract for the electrical equipment of their lines, consisting of about five miles of road, with motor cars to the Thomson-Houston Electric Co.

Baltimore, Md.—The Traction syndicate is said to be negotiating for a controlling interest in the York Road Railway, and the Union Passenger Railway. If the Traction company get possession both roads will probably be cabled.

THE Baltimore City Passenger Railway Co. have awarded the contract for cabling the Red and White lines to E. D. Smith & Son, formerly from Philadelphia, but now of Baltimore.

THE Baltimore Traction Co. have purchased the Epworth church property to be utilized as the site of one of the cable power houses. The same company have received several new open cars, canary colored and having a seating capacity for twenty-four persons, recently ordered by them from the Brownell Car Co., of St. Louis.

THE contract for cable castings for the Baltimore City Passenger Railway has been awarded to Reed, Stickney & Co., agents for the Davis & Thomas, of Catasauqua, Pa., for twenty-eight dollars per ton. This contract includes such material required, except a previous order given to the Pennsylvania Steel Co.

Boston, Mass.—A municipal ordinance has been introduced prohibiting a speed of electric cars of more than seven miles an hour, unless the car be provided with proper fenders.

Brooklyn, N. Y.—The General Term of the Superior Court last month confirmed the report of the Commissioners in favor of the application of the Coney Island & Brooklyn Railroad Co. for permission to operate their road by the trolley system to Ninth Street. The change in the power will probably soon be made since the consent of the State Board of Railroad Commissioners has been secured. The property of persons opposed to the trolley in Ninth Avenue has been purchased by the company. Active work upon the electric equipment will now probably be begun in the spring. The conditions set forth in the report of the Railroad Committee to which the street railway companies will comply are that the wires shall be attached to iron or steel poles, not less than twenty feet in height, erected on the curb lines of the streets, save where there are elevated railroad tracks, where the wires may be attached to the superstructure, The rate of speed is to be such as to secure to the public the advantage of more speedy transit, the rate not to exceed ten miles an hour. Each company shall be under a bond of $150,000 for the faithful performance of the conditions of the franchise.

A NEW compound engine has been put on the Kings County Elevated Railroad. There is a high pressure cylinder, twelve and a half inches, on one side and a low pressure cylinder, twenty inches diameter, on the other. The engine is reported as giving general satisfaction.

Canton, O.—Superintendent A. G. Davids has resigned his position with the Canton Street Railway Co. Mr. Catlin, the assistant superintendent, will succeed Mr. Davids, temporarily.

Chicago, Ill.—At a conference held last month between General Counsel Grinnel of the Chicago City Railway Co. and the Council sub-committee on streets and alleys, south, the company agreed to built cross lines on Thirty-fifth, Forty-seventh and one other street this winter, to be followed by two more cross lines in the spring. In return for these concessions the sub-committee will probably report in favor of passing an ordinance for the new Wabash Avenue loop desired by the company. In order to relieve the crowded condition of the cars on the main lines the company will make a trial of the Pullman double decked cars.

JOHN A. BELL was appointed a receiver of the Russell Street Carette Co., December 22, in place of Dr. Frederick Pond. The change was made at the request of stockholders who thought a different appointment should be made because Dr. Pond is interested with Senator Evans in a $10,000 mortgage on the property of the company.

AT a recent meeting of the City Council a preamble and resolution were introduced setting forth that the street railroad companies had issued an order directing that passes should not be issued to police officers not in uniform, and providing that a committee of three be appointed by the Chair to wait upon the three street railroad companies and, if possible, arrange for the issuance of transportation to such members of the Police Department, whether in uniform or otherwise, as the Superintendent of Police may request and Sanitary officers.

THE enlargement of the plant of the Cicero & Proviso Street Railway Co. is well under way. The Pond Engineering Co., through their Chicago office, are reconstructing the pipe work and are furnishing an 800 H.P. Hoppes exhaust feed water heater, two Pond separators to insure dry steam and a large boiler feed pump of improved construction.

Denver, Colo.—The Denver Tramway Co. will build a large brick car house and repair shop at Twenty-first and Gilpin Streets, to cost in the neighborhood of $27,000. The dimensions are 265×125 ft. The floor of the shop contains eleven tracks and other side tracks for storage purposes. The space underneath is excavated for repairing the motors. The completion of this building will result in the abandoning of the storage house at Colfax and Broadway.

THE Board of Supervisors have passed a bill regulating the size of street cars. The length of cars is not to be over thirty-seven and a half feet, including platform, and the width not over seven feet ten inches; only one trailer will be allowed.

Dubuque, Ia.—Dr. W. L. Allen has announced his intention to retire from the presidency of the Dubuque Electric Street Railway, Light & Power Co.

Gloucester, Mass.—Mr. A. Martin has resigned the superintendency of the Gloucester Street Railway.

Helena, Mont.—The Denver & Helena Investment Co. have sold the line of the Union Electric Railway to New York capitalists, represented by J. H. Lawrence. The New York syndicate made the purchase for the purpose of consolidating with the Steam Motor Co.'s property in this city. The consideration in the deal was said to be $85,000, of which the Denver parties took stock to the amount of $40,000 in the new concern.

Houston, Tex.—The Houston City Street Railway Co. will at once commence to build a large car house and car shops on Commerce Street.

Ishpeming, Mich.—It was expected that cars would be running over the Ishpeming-Negaunee electric line not later than Christmas.

Ithaca, N. Y.—A majority of the stock of the Ithaca Street Railway is said to have been recently purchased by A. C. Robinson & Co., of Wilkes-Barre, Pa. The road will probably be extended and improved.

Kalamazoo, Mich.—The Knickerbocker Trust Co. filed a petition in the United States Court last month for a receiver to be appointed for the street railway company here. The petition was granted. W. R. Adams, of New York, was appointed. By the arrangements Mr. Adams is authorized to issue $10,000 of receiver's certificates to secure all creditors.

Kearney, Neb.—It is said that the Kearney Electric Co. sell for $1 per month tickets good for any number of rides. Burton heaters have been adopted on the road.

Lansing, Mich.—A deal has taken place here by which the Continental Trust Co. of New York have taken an interest in the City Railway. The stock of the company is increased from $50,000 to $175,000, the larger part of which is owned by the trust company, Hollister & Skinner retaining an interest and Messrs. Nelson Brady and O. M. Barnes each taking $1,000 of the stock. The road, from one end to the other, will be relaid with new forty-five pound T rails. A new power house will be built immediately on a site yet to be selected, and the company will furnish their own power for the entire line.

Laramie, Wyo.—The Laramie City Tramway Co. have issued their bonds and will now build six miles of road, receiving subsidies to the amount of about $40,000. They have two miles more of road under consideration. The franchise of the company is exclusive, and runs the full constitutional limit of the time.

Lebanon, Pa.—Two new and handsome cars have recently been received by the Lebanon & Annville Railway Co. from the works of the Lewis & Fowler Manufacturing Co., of Brooklyn, N. Y.

Logansport, Ind.—The electric road put in operation during the last week of November has been running very successfully. The Edison system is in use.

Los Angeles, Cal.—The electric line on Maple Street has been put in operation.

Lynn, Mass.—President A. F. Breed of the Lynn & Boston Railway Co., is quoted as saying that the seventy miles of track in the city will be equipped with electrical apparatus within another year.

Milwaukee, Wis.—The Milwaukee & Wauwatosa Rapid Transit Co. have purchased the electric light plant at Wauwatosa. It will be used to operate the suburban railroad line built a short time ago by the Transit company. The plant is equipped with two 225 light incandescent dynamos and the necessary engines for their operation. It is probable that the building will be remodeled so as to adapt it to the needs of the railway company, but the electric lighting of the streets in Wauwatosa will also be continued.

Minneapolis, Minn.—A number of changes have been made during the past month preparatory for the winter. A number of cars have been equipped with Burton electric heaters, and several snow plows have been purchased.

W. F. CARR has resigned his position of chief engineer of construction of the Minneapolis Street Railway Co. He will spend the winter in the South.

THE company have placed an order with the Northern Car Co. for sixteen new eighteen foot electric cars for local use, the same size as those now running. They will be numbered from 523 to 539, painted yellow and finished in cherry.

Montreal, Can.—Mr. R. A. Mainwaring of 147 St. James Street, in regard to the proposed electric railroad in Montreal, gives the contemplated length of single track as about twenty miles. The gauge will be 4 ft. 8½ ins., and about fifty cars will be used. The rail inside the city will be a girder rail, outside the city a T rail of fifty-six pounds. Electricity will be the motive power used, but whose system is not definitely settled. As soon as the franchise is obtained a company will be organized under the charter of the Montreal Elevated Railroad Co., with a capital of $1,000,000. If the franchise is awarded building will commence about next April.

Nashville, Tenn.—Stoves have been installed in the cars of the Citizens' Rapid Transit Co.

Natick, Mass.—The Natick Electric Street Railway Co. have voted to issue scholars' tickets. These tickets will be sold in packages of thirty-three for $1.

New Haven, Conn.—Work on the new Winchester Avenue line is being pushed. When this is completed through cars will be run from Newhallville to the depot.

THE State Street line people are laying double tracks upon a considerable portion of their route.

New Orleans, La.—The city will offer at public auction on February 10, 1892, at the City Hall, right of way over a number of streets.

ON December 1, the Mayor sent a lengthy communication to the Common Council stating that, in his opinion, the best interests of the city would be conserved by the adoption of the overhead system for its street railways. As New Orleans has heretofore opposed the overhead wires vigorously, the communication was received with more than ordinary interest.

IT is thought that the New Orleans & Carrollton Railroad will be granted permission to use the overhead system.

New Rochelle, N. Y.—The New Rochelle Railway & Transit Co. have completed a new piece of track on Huguenot Street and laid their tracks on Bridge Street. Cars are already running over the section. A sixty pound centre bearing rail with Johnson switches and curves was used on this extension. Patrons along the line of route can now ride directly from the railroad station to their homes in New Rochelle without leaving shelter on stormy days.

Newburyport, Mass.—James F. Shaw, superintendent of the Black Rocks & Salisbury Beach Street Railway Co., has temporarily resigned for the winter, in order to give his time to the introduction of his new patent trolley wheel.

THE new brick car house of the Newburyport & Amesbury Electric Railway Co. has just been completed, and it is said to be one of the most convenient and handsomest in the State.

A COMPANY is being formed by Lowell and Haverhill capitalists to build a new road from Lowell through Lawrence to Haverhill, thence to Newburyport, via. Merrimac and Amesbury. Capital $600,000.

HON. E. F. SHAW, president of the Black Rocks & Salisbury Beach Street Railway Co. of this city, and connected with many other roads in New England, has been elected Senator in the Fourth Senatorial District of Massachusetts.

New York, N. Y.—John McQuade, sub contractor with William Wharton Jr., & Co., on the Third Avenue Cable Railway, has brought suit against the Philadelphia firm for work done on the cable road.

THE New York & Queens County Tunnel Railroad Co. have been organized with a capital stock of $40,000, the road to be constructed for a length of three and a half miles under the waters of the North and East rivers, and to be operated by steam, electricity or other motive power. The directors include: Joseph F. Carey and Joseph Lowery of Brooklyn; Jason W. Broadhead and Joseph H. Jones of New York City, and Robert Morris, of Greenville, N. J.

A PROTEST has been made by a number of Madison Avenue residents against the proposed tunnel of the Rapid Transit system under that avenue.

COMMISSIONER Gilroy, who in the early part of December announced that on the tenth all work on the Third Avenne Cable Road would have to be stopped, reconsidered his decision, and allowed it to go on as long as the weather permitted. The contractors are using every diligence to hurry the work, and gangs of men are working night and day on the road.

A COMPLICATED railway suit was brought last month to the Superior Court, special term, before Judge O'Brien. The case is one involving the right of the Twenty-third Street Railroad Co. to run their cars in Fourteenth Street, between Ninth and Fourth Avenues, over the road owned or leased by the Christopher & Tenth Street Railroad Co., and the Central Crosstown Railroad Co. The plaintiffs complain that, according to a lease made in 1884 between defendants and themselves, the right to run their cars over the Fourteenth Street tracks as far east as Fourth Avenue was established. Their present action is to enjoin the defendants from interfering with their use of the Fourteenth Street road. Defendants say that they do not so understand the terms of the lease.

EXPERIMENTS are being tried on the Broadway road with the Pintsch gas system for illuminating the street cars. Some very satisfactory results have been obtained.

Northampton, Mass.—E. C. Clark has been appointed superintendent of the Horse Railroad Co. The number of passengers carried for the year ending December 1 was 372,290. Number of miles run, 83,534. Number of trips made, 13,053.

Norwich, Conn.—The Norwich Street Railway Co. have fitted their closed cars with the Lewis & Fowler stoves.

Oakland, Cal.—Track laying on the Mountain View cemetery branch of the electric road and on the Piedmont district is progressing rapidly. In accordance with a petition of the property owners on Booth Street, which is macadamized, the Board of Supervisors inserted a clause in the franchise of the company to macadamize the road seven feet on each side of the track.

IT is stated that the Oakland Consolidated Co. will not build an electric power house at Seventeenth and Wood Streets, where they bought land, but will obtain power for their cross town road from the present power house at Temescal.

THE road of the East Oakland Street Railroad Co. will probably be in operation in a month. The tracks are completed to Fifth Avenue and East Eighteenth Street. The roadbed will be completed before many weeks.

THE Haywards road is being built and a power house is being constructed at the Warner tract.

Ogden, Utah.—Col. R. M. Spivey has been appointed General manager of the Ogden Electric Street Railway system to succeed H. C. Gilbert, resigned. Colonel Spivey has had wide experience in railway and land matters, and the street railway company may be congratulated on his acquisition.

Oswego, N. Y.—At a meeting of the directors of the Oswego Street Railway Co. held lately E. A. Van Horne was elected general manager of the road, Mr. Callenen retiring from active management.

Ottumwa, Ia.—The Steam Heat & Electric Light Co. and the Electric Railway Co. were consolidated last month into one, called the Ottumwa Electric Railway Co., and the capital stock increased from $200,000 to $500.000. Three members of the old street railway company, Messrs. Merrill, Mahon and Garner have retired.

Paterson, N. J.—The electric system in Paterson began running regular trips December 14, on fifteen minutes headway, between Passaic and the corner of Main and Market Streets. There is now complete electric communication between the centres of Paterson and Passaic, a distance of about five miles. The line construction was done by the Field Engineering Co. of New York.

Philadelphia, Pa.—It is virtually settled that the Thirteenth and Fifteenth Streets Railway is to become a part of the Traction company's system. The terms are said to include a rising scale of guaranteed dividends, beginning at ten dollars per share per year and increasing until the maximum of twelve dollars per share per year has been reached, at which rate they will remain.

THE Traction company's declaration of their intention to parallel the lines of the People's Passenger Railway by running omnibuses on Broad Street and Girard Avenue has taken tangible form in the application of David H. Lane to Chief Bullock of the Bureau of Highways, for licenses for 100 "buses" to be controlled by the Philadelphia Traction Co. The proposed route is on Broad Street from Germantown Avenue to Snyder Avenue, and on Girard Avenue from Belmont Avenue to East Norris Street. This action is regarded as a move to enable the Traction company to more easily secure control of the People's line, which, it is said. the Traction company are trying to accomplish.

Pittsburgh, Pa.—The Pittsburgh & Birmingham Traction Co. have assumed control of the Pittsburgh & Knoxville Incline Plane Railway under an agreement and will at once commence the construction of the system of hill top street railways contemplated by the Knoxville company.

THE Pittsburgh, Knoxville & St. Clair Electric Railway were lately sold at the suit of the receiver, to Murray Verner; for $2,500, subject to a mortgage of $60,000 and receiver's certificates amounting to $18,000, $78,000 in all, making the price of the road $80,500. This was the first electric road built in Pittsburgh. It is said that it is the intention of the Birmingham Traction Co. to make use of a portion of these lines in completing the system of railways proposed for Allentown, Knoxville and vicinity. That portion of the old road below Washington Avenue will be abandoned.

RUMORS of a consolidation between the Duquesne Traction Co. and the Pittsburgh Traction Co. have for a long time been current, but on December 17 the subject was submitted to the stockholders of both companies. The basis of the adjustment is said to be that the earnings of both lines will be pooled, the expenses and interest on the bonded indebtedness paid from the common fund and the balance of the earnings divided on a ratio of fifty-five for the Pittsburgh company to forty-five for the Duquesne. This arrangement will be perpetual.

E. W. DAVIS, superintendent of the Fifth Avenue traction line, has tendered his resignation, to go into effect on January 1. It is understood that William Elkins, son of the president of the company will take Mr. Davis' place.

THE all night cars put on last month by the Duquesne company have been doing far more business than was expected of them. Nearly 200 passengers have been hauled every night thus far, but the officials think this will not continue, and as soon as the novelty wears off the patronage will settle down a little, but an average of even 100 passengers per night will pay all expenses.

AT the recent fire which occurred at the barns of the Second Avenue Passenger Railway Co., of Pittsburgh, it was discovered, in making an investigation of the wreck, that the Westinghouse electric motors had passed through the fire without injury and could immediately be put into service. The railway company since the fire have purchased from the Westinghouse company additional equipments to replace all those of other make which were destroyed by the fire. The small horse cars belonging to this line, which at present are used on the Tenth Street bridge division, will be abandoned, and the line will be equipped electrically. Mr. J. C. Riley has recently been elected secretary in place of C. G. Milnor, resigned.

THE Citizens' Traction Co., at the annual meeting of the stockholders, elected the following board of directors: James Verner, John G. Holmes, James J. Donnell, John B. Jackson, C. L. Magee, H. S. A. Stewart and John Gripp. The board re-elected the old officers. The comparative exhibit of passenger business of the road for the year ending November 1 last, as reported at the meeting, is as follows: 1891, 12,508,969; 1890, 11,640,532; gain, 836,437.

Portland, Me.—It looks now as if Westbrook would be connected with Portland by an electric railroad next summer. A proposition to this effect is before the city government.

Providence, R. I.—Several car bodies for the electric street railway have arrived from Newburyport, Mass. The cars are thirty-five feet long and of the standard width. The base frames are of hard pine, with ash cross beams and of cherry finish. The opening of the road will occur January 1, if possible.

Rochester, N. Y.—Another 150 H. P. generator was received at the power house of the street railway company last month and was put in operation. The management hope to have electric cars running on all the lines of the city by the middle of the summer.

GENERAL MANAGER C. K. MINARY has resigned.

THE Charlotte Electric Railway Co. have voted to double the equipment of the road. The present plant located just this side of Charlotte, consists of one 250 H. P. engine and two eighty H. P. generators.

St. John, N. B.—Charles D. Jones, manager for the Eastern Electric Co., in this city, has been appointed general manager and a managing director of the St. John City Railway Co.

St. Joseph, Mo.—The barn of the Union Railway Co. was burned on November 30. Thirty cars equipped with electric motors were burned. The loss is $50,000; fully covered by insurance.

St. Louis, Mo.—A new cable rope has been installed on the Broadway cable line from Pine Street north. The length is about nine miles. The cable taken out rendered good service, running 63,000 miles in little less than a year.

St. Paul, Minn.—The car barns of the street railway company on West 7th Street burned to the ground last month. The barn had recently been used as a storehouse, and twenty-three disused cars stood in it. The loss is $2,000 on the building and $8,500 on contents fully insured.

Salem, Mass.—The Naumkeag street railway has absorbed the Essex electric road of Salem and Peabody. The roads will be continued as nominally separate corporations, but practically as one, and there will, no doubt, be some important changes.

THE managers of the consolidated roads have appointed J. F. Hickey general manager of the two roads; James Learey, traffic manager (a new office) and John H. Bickford electrical engineer. The positions of division superintendents are abolished.

San Francisco, Cal.—At the annual meeting of the San Francisco & San Mateo Electric Railroad Co., Behrend Joost, C. C. Butler, Fabian Joost, J. W. Hartzell and W. F. Thomas were re-elected directors. The old officers were chosen. The secretary reported that twenty-one miles of single track had been constructed, beside power and car houses. He reported, also, that the road would probably be running to the Holy Cross cemetery about January 1, 1892. He reported, further that the officers had filed the required notice that $50,000 had been expended on work within the time set by law, and the board had accepted the report.

San Jose, Cal.—F. Chappellet states that the Patton motor may be used on the line between Haywards and San Jose.

Santa Cruz, Cal.—The Santa Cruz, Garfield Park & Capitola Electric Railway was opened November 25.

Spokane Falls, Wash.—The public is greatly divided over the question of whether it is to the best interests of Spokane to grant to the Spokane Street Railway Co. authority to haul freight cars over their various lines in this city. The franchise asked for simply gives the company the right to move freight cars during the night between 12 o'clock, midnight, and 6 A. M.

Springfield, Mass.—The Springfield Street Railway Co.'s stables were lately damaged by a fire which originated from a furnace and soon reached three barrels of oil, which exploded with deafening report. The flames spread rapidly, but all the electric cars on the ground floor were removed without loss. The damage to the building is estimated at $10,000, fully covered by insurance.

Superior, Wis.—Three additional motor cars have been received by the street railway company. These make nine new cars in all received recently.

Toronto, Ont.—Engineer Cunningham has presented a very large and elaborate report on the system of electric street cars to be adopted in the city. He visited Buffalo, Cleveland, Pittsburgh, Allegheny, Washington, New York, Newark, Albany, Boston, Springfield, and other American cities, and inspected the various systems very carefully. A mass of information is given in the report, and the engineer concludes by recommending the adoption of the overhead trolley system in Toronto.

Vancouver, B. C.—The electric tramway to connect Vancouver and Westminster has been completed and the traffic is even greater than was expected. The electric tramway systems of Victoria and Vancouver have been very successful and considerably extended, and a third established in Westminster.

F. L. DAME, superintendent of the Vancouver Electric Railway, Light & Power Co. has resigned, and has taken a position with the Thomson-Houston Electric Co. as district engineer, with headquarters at Portland, Ore.

Vicksburg, Miss.—The long fight between the city and the street railroad has finally culminated in the execution of the former's repeated threat to destroy the road's track. The railroad company made no effort to stop the work by injunction, but, it is understood, will sue for damages in the United States Court.

Washington, D. C.—In a recent interview Senator McMillan of Michigan, chairman of the Senate Committee of the District of Columbia, expressed himself as opposed to the further extension of the overhead system in the City of Washington,

Windsor, Ont.—When the electric railway was being built in Windsor there was some friction between the Council and the company about running powers on the streets, and pending a settlement the Mayor ordered work to be stopped, and arrested four men who were subsequently released on bail. These men now propose to have redress, and their solicitor has served notices on Mayor Flemming and the police officers that they would at once begin suit for false imprisonment. They want 5,000 damages.

Worcester, Mass.—The annual report of the Consolidated Street Railway Co. contains the following figures: Passengers carried, 607,100; round trips run, 17,000; receipts, $273,000; expenditures, $223,000; horses owned, 457, rolling stock forty-five box and forty-six open cars.

T. FAIRBROTHER has been appointed superintendent in place of J. B. Chapin, resigned.

Extensions and Improvements.

Atlanta, Ga.—The Atlanta Consolidated Street Railway Co. recently voted to build a two mile extension.

Boston, Mass.—The West End Street Railway Co. have been granted permission to extend the overhead system and lay double tracks on Mt. Auburn Street in Cambridge.

Chicago, Ill.—The Calumet Electric Street Railroad Co. propose to extend their lines on Michigan Avenue from Kensington Avenue to 119th Street, west on 119th Street to Wentworth Avenue, thence north on Wentworth to 116th Street and east on 116th Street to Michigan Avenue. The company, it is stated, have secured consents from the owners of 90,500 ft. out of a total of 155,000 ft. The present line of the company is on Ninety-third Street.

Columbia, S. C.—A bill has been introduced to authorize the consolidation of the Columbia Electric Street & Suburban Railway & Electric Power Co., and the Congaree Gas & Electric Co., under the name of "The Columbia Electric Street Railway, Light & Power Co."

Columbus, O.—The Columbus Consolidated Street Railroad Co. are making arrangements to largely increase their steam plant in the near future.

Corsicana, Tex.—The Corsicana Street Railway will probably be equipped with electric power.

Dallas, Tex.—It is reported that the entire property of the Dallas Cable Railway has been purchased by a syndicate which will immediately commence work with the object of placing it in operation.

THE Dallas & Oak Cliff Dummy Co. propose equipping their lines with electric power.

Detroit, Mich,—An application has been made by Capt. W. H. Stevens and Frank E. Snow for a street railway franchise over Atwater, Griswold and Shelby Streets and Michigan, Washington, Woodward and other avenues to Pallister Road.

Du Bois, Pa.—The street railway company intend to extend their line to Falls Creek next year and equip with electricity.

Dubuque, Ia.—It is reported that storage batteries will be abandoned on the Rhomberg line in the spring, and that overhead wires will be adopted.

Gadsden, Ala.—The Gadsden & Attalla dummy line will probably be equipped with electric motors.

Harrisburgh, Pa.—The East Harrisburgh Passenger Railway Co. are pushing their road to Steelton.

Hartford, Conn.—The Hartford & Wethersfield Horse Railroad Co. have received permission from both boards of the Common Council to run trolley cars been the City Hall and the East Hartford bridge. The road bed and overhead system are all ready for the new cars.

Malden, Mass.—The East Middlesex Street Railway Co. have petitioned for location of double track on Main, Salem, Ferry and other streets.

Marlboro, Mass.—The Marlboro Street Railway Co. have asked for permission to extend their road to Hudson and Westboro.

Milwaukee, Wis.—A number of important extensions of the street railway system here are proposed.

Muskegon, Mich.—Great improvements are to be made by the Muskegon Street Railway Co. They are to increase their power by the addition of a 250 H. P. engine, and a new dynamo. They contemplate extending the line to North Muskegon and making a loop line of the Sandford Street route. They will probably extend from Muskegon Heights to Mona Lake, providing the owners of the property there convert it into a park.

New Berne, N. C.—It is said that the Electric Street Railway Co. will extend their line to Polloksville and Trenton. It is said that this company has paid a nineteen per cent. dividend for the first twelve months.

New Haven, Conn.—The West Haven Horse Railroad Co. have petitioned the Board of Public Works for permission to lay a temporary track on Chapel Street from Temple Street to College Street.

Newark, N. J.—The Newark Passenger Railway Co. have been given permission to lay tracks in South Fourteenth Street, to connect the lines of the Rapid Transit and Orange systems. It was stipulated that the poles should be ornamental iron ones, and that temporary wooden poles may be used between Central and Ninth Avenues until the latter thoroughfare is graded.

THE extension of the Rapid Transit railroad's electric power house is nearly completed, under the direction of Architect Albert Phillips, and 1,000 H. P. will soon be available for electric railroad service. This will double the capacity. The Orange extension of the line is about completed.

Norwich, Conn.—At a recent meeting of the stockholders and directors of the Norwich Street Railway Co. it was voted to introduce electric rapid transit on their lines immediately after obtaining the consent of the Common Council. The company intend to lease power of the Norwich Electric Light Co., if possible, or failing in that to set up their own plant.

Oakland, Cal.—The work of changing the Telegraph Avenue horse car line into an electric road will probably be begun by the first of this year.

THE Oakland & Berkeley Rapid Transit Co. are now building a branch from Fortieth and Grove Streets to Mountain View cemetery, two miles long, with a double track. They are also building the road across the Sixteenth Street marsh. They will build from Wood Street along Eighth to Grove and from Grove to Thirteenth Street, and as soon as they get a franchise from the City Council, which has been applied for, will extend the road from Second and Broadway along Second to Market.

Peterboro, Ont.—The charter for the new electric road in this city, for which there are two companies applying, includes a stipulation that the company applying and obtaining it shall provide and keep in repair eighteen inches of roadbed on either side of the track with stone pavement.

Ottawa, Ont.—Messrs. Ahern and Soper, managers and principal owners of the electric street railway, who recently purchased the controlling interest in the old horse car company, will make application for an amendment to the charter to enable them to equip the line with electricity.

Portland, Ore.—The Portland & Fairview Railway Co. have been granted a franchise to lay down and operate a street railway on the road forming a portion of the east boundary of the city.

THE City & Suburban Railway Co. have been authorized to construct and operate a double track road on Morrison Street from Front to Fifteenth.

A CONTRACT has been made between the City & Suburban Railway Co. and the promoters of the Portland & Fairhaven system, by which the former company have bound themselves to build a line on G Street from Fifth to Twenty-eighth, thence to Rosenthal's place, northeast of Mount Tabor.

Richmond, Va.—A petition from the Richmond Railway & Electric Co. asking permission to extend their road from Twenty-first and Broad Streets along Broad to Twenty-fourth Street to connect at both ends with the present track, has been presented to the Council.

Sacramento, Cal.—The Central Railway Co., which has purchased the lines of the City Railway Co., propose to commence immediately to equip all the lines with the electric system.

Saginaw, Mich.—The Saginaw Union Street Railway Co., are having prepared plans for a new power house to be erected this winter at some convenient point on the river front and which, with engines, boilers and buildings, will cost about $25,000. It will be provided with four 150 H. P engines, three Babcock boilers, and an additional 150 H. P. dynamo.

St. Cloud, Minn.—The Board of County Commissioners has granted the right of way to the street railway company for laying a track along the county road to the Great Northern shops. Work will be commenced at once. The overhead system will be used.

St. Joseph, Mo.—The People's Street Railway Co. are making some important improvements in their rolling stock.

Seattle, Wash.—The Board of Trustees of the South Seattle Electric Railway Co. have let the contract for the furnishing of electric cars and other fittings to the Northwest Thomson-Houston Electric Co. The present line down Commercial Street from King Street to South Seattle, a distance of two and a half miles, is to be changed from a steam motor into an electric line, and is to be extended up Commercial to Main Street. It was proposed to have the work completed by the beginning of this month (January).

Tacoma, Wash.—Three largely signed petitions have been circulated in the Fourth ward asking the Tacoma Railway & Motor Co. to extend their line to Wright Avenue.

New Roads.

Alexandria, Va.—The officers of the newly organized Alexandria & Fairfax Passenger Railway are D. E. Leech, president, S. W. Speer, secretary and treasurer. The president is a New York capitalist and financier. J. S. Swartz, of Philadelphia, president of the Red Star steamship line, is also interested.

Aspen, Colo.—J. R. Pemberton of Detroit and T. J. Flynn of this place, are organizing a street railway company.

Astoria, N. Y.—The Astoria street railroad company have been incorporated. The road is to run from the foot of Fulton Street, East river, to the town of Newtown, is to be two miles long and have a double track. The capital stock is $100,000. The directors include Edward M. Tyrrell of Brooklyn, Michael E. Conway, James Robinson and James E. McWilliams of Long Island City, and John J. Delaney of College Point.

Benton Harbor, Mich.—F. S. Hopkins has presented an ordinance asking for a franchise for the Benton Harbor Street Railway Co.

Brantford, Ont.—A proposition entailing an outlay of $60,000 has been submitted to the Brantford Council for the establishment of a system of electric street cars. The company ask for exemption from taxation for ten years and a franchise for thirty years, with the option of purchase by the city at the end of that time.

Brooklyn, Md.—Curtis Bay will have an electric road in operation from this place by April 1. Power and car houses will be built at Curtis Bay. A 300 H. P. steam plant will be in the power house, which will be 50×90 ft. while the car house will be built of iron 60×150 ft. The station will be built at Brooklyn, near Acton's Park.

Brooklyn, N. Y.—Consents are being secured from property owners in Bedford Avenue by Henry B. Buckhout and Frederick R. Jorgenson for a street railway under the name of the Bedford Avenue & Flatbush Railroad Co.

Bucyrus, O.—The Crawford County Commissioners have granted a franchise to a company to construct an electric railway between Bucyrus and Galion. The work is to begin at once. C. W. Fisher is president.

Burlington, Vt.—The Vermont Electric Co. propose to construct an electric railway through the city from Winooski to the Oak Lodge property. The overhead system will be used. The company will use the water power at the "gorge" near the twin bridges, and will furnish electric power to stationary electric motors. Four cars will be installed at first.

Chicago, Ill.—The Chicago, West Ridge & Waukegan Electric Railway Co. have been incorporated to operate an electric street railway from Chicago to Waukegan and the state line; capital stock, $15,000,000; incorporators, Orrin T. Maxson; Frank H. Doland, Frederick S. Capron and Charles Steinbess.

A CERTIFICATE of incorporation has been issued to the West Side Rapid Transit Co., capital stock, $2,000,000 to construct elevated railways on several streets; incorporators, Oscar W. Rogers, K. L. Baldwin and G. M. Miller.

THE U. S. Rapid Transit Co. have been incorporated with capital stock of $5,000,000 for constructing and operating mechanical appliances for rapid transit of U. S. mail, passengers, etc.

THE International Electric Railway Co. have been organized in Chicago to exploit the Applegate electric railway system. The capital stock is $2,500,000 and the officers are C. B. Holmes, president; Henry P. Daily, vice-president; W. H. Applegate, treasurer; W. S. Garvey, secretary.

PERSONS interested in property near Seventy-fifth Street, Chicago, are anxious to have a street railway constructed on that street by the Chicago City Railway Co. At a recent meeting of property owners it was agreed to guarantee the company $40,000 if they would build the road.

Columbus, Miss.—The City Council have granted a charter to a stock company to build a street railroad. The latter agree to have everything in working order by April 1.

Columbus, O.—The directors of the new Worthington, Clintonville & Columbus Street Railway Co. have elected O. W. Aldrich, president; F. F. Tuller, vice-president; R. M. Weaver, secretary; H. C. Cooke, treasurer. The capital stock is $10,000.

Council Bluffs, Ia.—The Council Bluffs Transit Co. have been granted permission to install an electric line to the Chatauqua grounds.

Delaware, O.—The council have awarded the bid for an electric street railway over the principal streets of this city to J. K. Newcomer, and have authorized the construction of a street railway.

Des Moines, Ia.—The Des Moines Water Power & Electric Co. have been incorporated. The capital stock is $225,000, and the incorporators Lowry W. Goode, Fred D. Goode and C. K. Mead.

East St. Louis, Ill.—The Venice Transportation Co., East St. Louis, with a capital of $10,000 have been incorporated.

Florence, Neb.—The Omaha & Florence Street Railway Co. have filed articles of incorporation. Authorized capital $200,000. The incorporators are H. G. Clark, E. H. Walker, R. H. Olmstead, Frank E. McCoy and Owen T. Smith.

Fort Wayne, Ind.—The Industrial Park Land Co. will build a short line on John Street to the Park. Horse power will probably be used.

Fostoria, O.—Certain parties in Findlay and Fostoria are quietly pushing a scheme to connect the two cities by an electric street railway. The distance is only sixteen miles and the idea is feasible.

Galveston, Tex.—The South Texas Construction Co. propose the construction of an electric railway.

Grand Rapids, Mich.—The Grand Rapids Electric Street Railway Co. have asked for permission to construct an electric railway in Spring, Louis, Campau, Fulton and Waterloo Streets and Godfrey, Clyde, Park and Burton Avenues.

Hamilton, Ont.—C. J. Myles, one of the lessees of the Hamilton & Dundas Street Railway, is forming a company to build an electric railway from Hamilton to Grimsby camp. The road will be twenty-two miles in length and will cost $175,000; $75,000 has already been subscribed, and as soon as a charter is obtained the road will be commenced.

Haverhill, Mass.—Charles Goss, L. J. Marston, N. Y. Ellis and others have incorporated the Haverhill & Amesbury Street Railway Co., with authority to construct and maintain a surface railway with electricity or other approved motive power.

Jacksonville, Ill.—The Jacksonville & Suburban Railway Co., with a capital stock of $15,000 have been incorporated to operate a railway by animal, steam or electric power; incorporators, William S. Hook, Marcus Hook, Francis Hook.

Lowell, Mass.—Alexander B. Bruce of Lawrence, Charles W. Morse of Haverhill, Joseph S. Brown of Lowell and others, have incorporated the Lowell, Lawrence & Haverhill Street Railway Co., with authority to construct and operate a surface railway between said cities.

Lynchburg, Va.—A charter for an electric road has been requested by Peter J. Otey, C. M. Blackford, W. H. Dulaney and others.

Marion, Ind.—D. Babst, Jr., has accepted the street railway franchise granted by the City Council. This assures the building of Marion's street railway.

THE Kokomo Electric Street Railway Co. have been granted a franchise to build a street car line from Marion to Jonesboro, in Grant County, a distance of four miles.

New Haven, Conn.—The New Haven & Allingtown Horse Railroad is now said to be an assured thing, and unless the city put some obstructions in the way of the purchasers of the old charter, the work of building the road will be commenced at once. L. H. Hinman is interested.

New York, N. Y.—Articles of incorporation were filed last month by John W. Hyatt, of Newark, Thomas W. Alcott, Louis Adler, Philip Payne and Benjamin Tuska, of New York, composing the newly formed New York Electric Railway Co. They propose to construct and operate railways of all kinds—surface, elevated and underground—and other improvements throughout the country. The total capital stock is provisionally fixed at $25,000.

A CORPORATION calling itself the "Harlem & Kingsbridge Railway Co." was organized last month in the office of Luke T. Cozans in the Stewart Building, New York. The proposed route is as follows: Beginning at point adjoining the Mott Haven Depot of the New York Central & Hudson River Railroad Co., thence along 138th Street, across Madison Avenue Bridge over the Harlem River, thence along Madison Avenue to 135th Street, through 135th Street to St. Nicholas Avenue, through that avenue into the Kingsbridge Road, along the Kingsbridge Road over the Harlem Ship Canal and Spuyten Duyvil Creek connecting with the Kingsbridge stations of the New York Central & Hudson River Railroad and the New York & Northern road, thence along Broadway to the city limits at the Yonkers line. Double tracks will be used. The capital stock for the present has been fixed at $300,000. Officers are Charles E. Runk, president; Wm. Forster, treasurer, and George P. H. McVay, secretary

Niagara Falls, Ont.—The commissioners of the Queen Victoria Jubilee Park, have reached an agreement with the syndicate who propose building the electric railway along the bank of the Niagara River. This line will in time run from Niagara, on the lake, to Fort Erie, but for the present work will be done only on the section between Chippewa and Queenstown. The syndicate, it is said, gives a bonus of $10,000 and agrees to pay a rental of $10,000 a year. Surveyors are now mapping and staking out the route.

Ouray, Cal.—Articles of incorporation have been filed with the Secretary of State for the Ouray & Ironton Electric Railroad, Light & Power Co. The directors are Otto Mears and Fred. Walsen of Denver, Charles Munn of Ouray, J. H. Casonova of Phillipsburg, Pa., and W. A. Wallace of Clearfield, Pa. The capital is $800,000. It is said that the construction of the road will be pushed at once. Should this road be built as projected it will be one of the most marvelous pieces of railroad building in the country.

Philadelphia, Pa.—The Quaker City Elevated Railroad Co. have incorporated to operate a line from the intersection of Ridge Avenue and Lehigh Avenue. Length of line, twelve miles; capital stock, $150,000. Among the directors are Edwin Mechever, J. W. Kucker and William B. Stout, all of Philadelphia.

Pittsburgh, Pa.—The stockholders of the proposed Grandview Electric Railway on Mt. Washington & Duquesne Heights lately elected directors, who chose the following officers of the road: President, W. B. Lupton; secretary, F. W. Gordon; treasurer, W. T. Bowen. About $20,000 of stock has been subscribed for and steps will be taken at once to get a charter.

BOTH branches of Councils have passed the ordinance giving the West End Passenger Railway Co. an almost exclusive right to build street railways in the West End.

Pomona, Cal.—The Pomona & Ontario Electric Railroad will be begun next spring. The electric system will be used, the current being generated by water power.

THE Pomona Electric Power Co. have sold stock to the amount of $275,000.

Portsmouth, Va.—The Portsmouth Electric Railway Co. have applied for a charter, with Virginius Butt, A. J. Phillips, Edward Mahoney and others as corporators. The capital stock is to be not less than $10,000 nor more than $100,000.

Richmond, Va.—The Petersburg Street Railway Co., with a capital of $100,000, has been incorporated by George Beadle, Alexander Hamilton, Augustus Wright, and Walter S. Phillips.

St. Augustine, Fla.—The bond to guarantee the construction of the street railway here has been filed with the mayor.

San Francisco, Cal.—At the meeting of the Board of Supervisors lately an order was finally passed granting Irwin C. Stump, P. N. Lillienthal, Abner Doble, W. R. Hearst, William Hollis and others a franchise to build and maintain a street railroad from Mission and Sixth Streets, down Sixth to Brannan, along Brannan to Eighth, along

Eighth to and across Channel and Townsend, and so on along various thoroughfares to Railroad Avenue and Sixteenth Street in South San Francisco.

ELECTRIC Railway Development Co., of San Francisco have been incorporated with a capital stock of $500,000. Directors: Dr. De Witt, Clinton Moore, George T. Dunlap, J. W. Dunlap, William M. Fitzmaurice and Ira V. Hitchcock.

THE San Francisco & Eastern Railway Co. have been incorporated for the purpose of operating a steam or electric railway from Alameda through El Tejon Pass to Rogers, a distance of 380 miles. The capital stock is $14,000,000. J. R. Howell is the principal stockholder.

Sandusky, O.—An application for permission to build an electric street railroad from Soldiers' Home in Sandusky to Milan was presented to the Erie County Commissioners last month. The application was signed by H. C. Post, George Barney, W. H. Gilcher, J. C. Gilchrist, G. H. DeWitt and others.

Shanandoah, Pa.—The work of building the Mahanoy City, Shenandoah, Girardville & Ashland Electric Railway has been commenced. This line will be about eighteen miles in length and will connect the four towns. The contract for the building of the power house foundation has been awarded to August Kudel of Mahanoy City.

Staten Island, N. Y.—The Port Richmond & Prohibition Park Electric Railroad Co. have been incorporated, with a capital of $50,000, for constructing a surface road about two miles in length. The largest stockholders are E. D. Clark of New Brighton and Isaac K. Funk of Brooklyn.

Steelton, Pa.—An electric street railway from Steelton to Middleton is now an assured thing. All the necessary stock has been subscribed and the negotiation closed for the right of way over the turnpike. Application for a charter will be made at once, and the work of constructing the road commenced as soon as possible. The road is expected to be finished by April 1, 1892.

Velasco, Tex.—An electric railroad will be built here by the Velasco & Surf Side Railway Co.

Equipment Notes.

J. F. Barry & Co. of New York City, have recently been appointed consulting and constructing engineers of the Atlantic Avenue Street Railway Co., Brooklyn, N. Y.

S. A. Day of New York has issued a circular to the public stating that Mr. W. H. Eckert has been appointed general agent for the sale of the well known Day Kerite insulated wires and cables.

The Newburyport Car Manufactnrlng Co, of Newburyport, Mass., have just finished five electric snow plows for Worcester, Mass., and three for Lawrence, Mass. Mr. James F. Shaw of this company has invented a self-lubricating trolley wheel, which is said to have a great many desirable features.

Chas. A. Schieren & Co., of New York, have recently shipped to the Franklin Electric Co., of Franklin, Pa., a twenty inch, perforated, electric, double ply leather belt. This order is a strong endorsement of the results attainable by the Schieren belts since the Franklin company have already a number of perforated electric belts in their works.

The Lewis & Fowler Manufacturing Co., of Brooklyn, have moved into their new building at 29 Walworth Street. The offices of the company occupy half of the entire second floor and are exceedingly commodious as well as very inviting. Arrangements seem to have been made for every department of this extensive company, and each person has been provided for. A view of the works of the Lewis & Fowler Company can be obtained from the rear windows of the new building.

The American Electrical Works of Providence, have sent to their many customers and friends a memento of the holiday season, consisting of an illuminated card, to which is attached a fir twig and minute cornucopia. Upon the card is printed the following message, "Xmas '91. We deeply regret that it is impossible for our many customers to be present with us at our Christmas festivities, but remembering and desiring to be remembered, we send a twig from our Christmas tree."

The Lee Composite Manufacturing Co. of New York are doing an excellent business in the sale of their products for railway use. The requirements to be met in a durable roof for smith shops and similar classes of railway buildings, has long been the aim of roofing experts. Acids and gases are constantly at work from the underside, while the atmospheric changes from without add to the difficulties. These conditions, however, seem to be fully met in the permanent brand of the composite manufactured by the Lee Composite Co. for this special purpose.

The Jewell Belting Co., of Hartford, Conn., have received the order for a sixty inch double belt and four sixteen inch double dynamo belts for the new station of the Newark Rapid Transit Co. of Newark, N. J.; also an order for two forty-eight inch, three ply belts for electric work. Their factory is very busy in the department for driving belts, and the following is a list of belts now in process of construction besides the ones mentioned above: 310 ft. of twenty-four inch double, 620 ft. of thirty inch double, 325 ft. of thirty-two inch double, 110 ft. of forty-inch three-ply, and seventy feet of twenty-six inch three-ply.

The Perfection Oil Purifier Co. of New York, have a purifier which is pushing to the front and they are consequently doing a thriving business. The simplicity of their device is attracting the attention of users of oil and commending itself as a most practical solution of the question of purifying and saving dirty oil. All they ask is a trial to convince any doubters. Among their latest sales are purifiers to the Richmond Railway & Electric Co., Richmond, Va.; Allegheny County, Electric Light Co., Pittsburgh, Pa.; Edison General Electric Co., Schenectady, N. Y.; New York Life Insurance Co., New York; Post-office, Chicago, and others.

The John Stephenson Co., Ltd., of New York, have in their extensive factory cars for all parts of the world, almost. Among the shipments soon to be made are some cars for Mexico and Venezuela. Among the electric cars which this company are at work upon are a number for the Second Avenue line of Pittsburgh, Pa. The order for these was given November 21, and the first installment of five cars as shipped on the 22d of the following month. Among the cable cars in the works of the Stephenson company, are some for the Washington & Georgetown Railway Co. This order is for seventy grip cars, and one partly built shows that they will contain six benches, and will present a handsome and substantial appearance.

The Watts-Campbell Co., of Newark, N. J., have recently closed a contract with the William Clark Co., spool thread manufacturers of Pawcatuck, Conn., for a pair of twin tandem, compound, condensing engines with cylinders 22×40×60. These engines are capable of developing 1,200 H. P. The fly-wheel is twenty-six feet in diameter, 101 in. face, and is turned for four belts. The Watts-Campbell Co. are also building three tandem compound engines of 300 H. P. each for the Lynn & Boston Railway Co., and three tandem of the same dimensions for the Harlem Bridge, Morrisania & Fordham Railway Co., of New York, and two for the Trenton Electric Railway Co., of Trenton, N. J. The engines of this company are attracting much attention in the street railway line.

The Reliable Manufacturing Co., 53 State Street, Boston, have completed their large factory in Everett, Mass., and are now ready to fill all orders promptly for their celebrated Reliable sand box, which is claimed to be superior to any on the market. It has been adopted by many of the leading car builders and street railway companies in the country, and is rightly named, for it is reliable and can be depended upon to do the work required at any time with either wet, dry, coarse or fine sand. It is also very convenient to use in distributing salt. The Reliable Manufacturing Co. also manufacture the Collett ratchet brake. This is the only brake that does away with the revolving of the handle both in setting and letting off the brake. It embodies the elements of simplicity, facility of adaptation to any style of car without change in conditions, and unites strength with efficiency.

The Wightman Electric Co. of Scranton, Pa., have made a most satisfactory record in electric railway work during the past year, and the reports from the railroads using their system have been of a very gratifying character. During 1891 the Wightman company have taken contracts for a large number of car equipments for roads in Scranton, Easton and Altoona, Pa., Wheeling, W. Va., North Attleboro, Mass., Auburn, N. Y. and Cleveland, O. Besides their contracts for motors, the Wightman company have done an immense business in electric street railway supplies, their sales of the Wightman standard trolley wire insulators for the past year footing up in the thousands. The Wightman speed controller is also being rapidly adopted by many roads in connection with some of the other well known street railway systems. They say that the prospects for a splendid business during 1892 are most encouraging.

The Stillman Light Railway Development Co., of Providence, R. I., send us word of a test of th eir system, described in a recent issue of this JOURNAL. The rail system, during the test, was inserted in a short section of the main line of the Wood River Railroad at Hope Valley, R. I., where, sixteen times a day, it was subjected to the wear of trains drawn by twenty-two ton locomotives. The results of the test were quite satisfactory, testimony showing that the locomotives ran very smoothly over the track. The system, as will be remembered, is a compound one and consists of a steel rail resting on a split wooden stringer. Ties are placed seven feet between centres. The wooden stringer employed before being diagonally split has a size of 6×6 ins, the weight of rail being twenty-four pounds per yard. The stringers and rails break joints alternately so that a practically continuous rail is presented to wear.

H. Ward Leonard & Co. are licensing various manufacturing and construction concerns under Mr. Leonard's recently patented system of motor regulation. The basis of the license is a charge of $2.50 per kilo-watt (roughly per horse power) in the motor. The royalty charge is not an annual charge, but is paid once for all in each case. Wm. Sellers & Co. have taken license under Mr. Leonard's patent on this basis, they agreeing to use the method upon all electric cranes they build in the future, during the life of the patent. The royalty is so small that the method will, no doubt, be rapidly introduced wherever it is applicable. H. Ward Leonard & Co. have secured the contract for wiring the *Mail & Express* building for 3,500 incandescent lamps, acting as sub-contractors under the Waddell-Entz Electric Co. They have also received an order from Wm. Sellers & Co., of Philadelphia, for two forty H. P. motors for use upon traveling cranes. The motors are to be supplied under rigid specifications, as to dimensions and performance.

The Ball Engine Co. of Erie, Pa., include the following in a list of their late shipments: Lawrence Gas & Electric Light Co., New Castle, Pa., one 150 H. P. single cylinder; Attica Electric Light Co., Attica, N. Y., one eighty H. P. single cylinder and one fifty H. P.; Citizens' Electric Light Co., Braddock, Pa., one 150 H. P. single cylinder; Youngstown Electric Light Co., Youngstown, O., one 350 H. P. cross compound, Pittsburgh & Birmingham Traction Co., Pittsburgh, Pa., one fifty H. P. single cylinder; Calif. Electric Light Co., San Francisco,

Cal., one 300 H. P. Cross compound ; Claremont Electric Light Co., Claremont, N. H., one eighty H. P. single cylinder ; Johnstown Electric Light Co., Johnstown, Pa., one 200 H. P. single cylinder ; Abington & Rockland Electric Light Co., North Abington, Mass., one 100 H. P. tandem compound ; Edison General Electric Co., New York, two fifty H. P. single cylinder ; Union City Electric Light Co., Union City, Tenn., one eighty H. P. single cylinder ; Brush Electric Light Co., Cleveland, O., one thirty-five H. P. single cylinder ; Loraine Electric Light Co., Loraine, O., one 100 H. P. single cylinder.

W. R. Fleming & Co., of New York City, representing the Harrisburg Foundry & Machine Works, are installing the "Harrisburg" Ide and Ideal engines as well as complete plants in many localities. The following are a few of the recent orders they have taken: For the H. W. Johns Manufacturing Co.'s new factory, South Brooklyn, two 125 H. P. horizontal,steel,single return-tubular boilers; Phillip Daly's Fennsylvania Club House, West End, N. J., a complete plant of sixty H. P.; Dunellin Electric Light Co., Bound Brook, N. J., complete plant of thirty-five H. P., Mr. Luther C. White, Waterbury,Conn., one 25 H. P. Ideal engine; Hotel "Marlborough," New York, one 100 H. P. "Ideal" engine; Mr. Jacob Rothchild, New York, one 35 H. P. Ideal; Hotel "Endicott," New York, two 100 H. P. Ideal engines. All of these contracts for engines were made with most rigid guarantees that the engines would run noiselessly and without vibrations. These people are making a specialty of this class of work, appreciating how important it is that there should be no noise or vibration whatever in plants for hotel and apartment house service.

The Page Belting Co. of Concord, N. H., with stores in New York, Boston, Chicago and San Francisco, are moving on with their business in the usual manner, increasing in all departments and report that among the large belts which they have recently shipped is one to Richmond, one to Madison, Me., and one to the Natick Electric Lignt Natick, Mass. Of their Acme link belts, among the street railway companies to which they have shipped during the past month, have been the following ; the Chattanooga Electric Railway Co., Chattanooga, Tenn ; Shamokin Electric Street Railway Co., Shamokin, Pa.; People's Street Railway Co., Scranton, Pa. In the export business they have shipped to Havana, Russia, Brazil and Carraccas. Of their Eureka dynamo belts, which is a double leather belt, slotted, they have shipped among others to the following electric companies: Austin Water, Light & Power Co., Austin, Tex.; Xenia Electric Light Co., Xenia, O.; Danbury & Bethel Gas & Electric Light Co., Danbury,Conn.; West End Street Car Co., San Antonio, Tex.; Home Electric Light & Steam Heating Co., Tyrone, Pa.; Shamokin Street Railway Co., Shamokin, Pa.; Johnstown Electric Light Co., Johnstown, Pa.

The Thomson-Houston Electric Co. of Boston, have a business which never seems to grow less, but is constantly increasing. Their railway supply department is now thoroughly established and meeting with great favor, and is prepared to furnish supplies of every description for electric railways, for line construction, car equipment and power stations. A number of railway companies have already manifested their appreciation of this new department, and express themselves as highly gratified at being able to obtain any particular device promptly forwarded upon receipt of order. The company have ample facilities for manufacturing the supplies they furnish, and many of the devices are the outgrowth of long experience in railway work and represent the latest inventions and improvements in their particular line. The large stock room which was secured for the supply department a few months ago is now filled with a very complete stock of railway supplies. Among the latest additions to the line of supplies is a steel gong or bell for cars, which the company guarantee to replace whenever one is broken, Mr. E. P. Morris, who is well known in connection with electrical work, and whose experience in street railway construction and operation renders him eminently fitted for the position, is in charge of this department, and is surrounded by a force of energetic and competent assistants.

The Berlin Iron Bridge Co., of East Berlin, Conn., have recently closed a contract with the Dry Dock Engine Co., of Detroit, Mich., for a new fire-proof modern machine shop to enable them to build the largest engines with the least expense and the quickest possible time. The machine shop when complete will be one of the finest on the great lakes and will compare favorably with any in the country. The plant will have modern appliances, such as electric cranes, two of twenty tons capacity running the whole length of the building, new machinery, electric lights, etc. The shop will be 201 ft. long × 66 ft. in width overlapping the present quarters which will be torn down. The main portion of the building will be 200 ft. long, thirty-seven feet wide and fifty feet high in the clear, the two electric cranes running the whole length with thirty-eight feet of clear space above the floor. Large windows will be placed along the sides giving abundance of light, and skylight with twelve feet of clear glass will run along the whole roof. Three galleries twenty-eight feet wide will open out of the main shop, extending its entire length. The first two will be occupied by light machinery benches, and the top gallery will be arranged for the storage of patterns. Work on the new building will be begun immediately. Two-thirds of it will be erected in eight weeks and completed in ten. The remainder will be completed as soon thereafter as the old shop can be cleared away.

The Engineering Equipment Co., of New York, report some recent sales of Habirshaw wire aggregating 59,000 ft. showing that they are now considered in a position to handle this well-known wire at manufacturer's prices. In the line of span and guard wire they had sold up to December 18, the enormous quantity of 310,320 ft. to important railways now being constructed. They have also recently shipped nearly 60,000 ft. of hard fibre pipe, the sale of which they control, to points in New York, Pennsylvania and Tennessee. There are over 300,000 ft. of this pipe laid in Philadelphia, Buffalo and Detroit. Among their customers in this line they number the New York Central & Hudson River Railroad Co. who use it to carry their signal wires. Reports received recently by the Engineering Equipment Co. show conclusively that every foot of the pipe now laid is giving full satisfaction. Some of this pipe has been down three years. Recent shipments by them of Anderson's electric railway specialties number 2,987 "Ætna" insulators ; 150 "Boston" trolleys, complete ; of Anderson pull-offs, 536 ; terminals, 405 ; tree insulators, 925 ; hangers, 1,595; also miscellaneous shipments in considerable quantities of other Anderson specialties. All of the above were additional to direct factory orders. Besides these shipments the Engineering Equipment Co. report the following : 310 clips, 1,500 eye bolts, 7,500 rail bonds, 400 turnbuckles 500 bond clamps, 625 trolley ears, 150 curve insulators, 430 trolley bells, etc. The electric railway specialties of this company are peculiarly reliable and they will not knowingly commend nor sell cheap materials.

WESTERN NOTES.

The Knapp Electrical Works of Chicago, are receiving substantial orders from railway companies for feeder wire and general supplies.

Chas. Munson & Co., of Chicago, have recently furnished three sixty inch belts, each 127 ft. long, for the Louisville Electric Light Co., to take the place of belts of another manufacture.

The Illinois Steel Co., at their South Chicago works, produced during November 34,338 tons of steel rails, which is stated to be the largest output for a month in the history of the plant.

The Electrical Supply Co., of Chicago, are now making their own rawhide pinions. The company announce that a decided reduction has been made in the price of the Boston trolley and its parts, so that it does not now cost materially more than other trolleys.

The Patton Motor Car is operating successfully at Pullman, Ill. Thomas Saunders, general manager of the Patton company, says that three new cars will soon be built. They will be different in design from that of the present car, but no changes in mechanism will be made.

The Western Electric Co. of Chicago, have furnished for the Toledo Consolidated Street Railway Co. an electrical equipment for two cars now being operated upon the lines in Toledo. The motor is gearless and of the Eickemeyer type. The armature is a drum with seventy-four coils. The cars will be thoroughly tested on the Toledo system before additional motors are made by the Western Electric Co.

A. G. Hathaway, of Cleveland, O., manufacturer of the Hathaway patent transfer table, turn-table, etc., sends us word that among his latest contracts is one with the Riverside Worsted Mills, of Olneyville, R. I., which is the largest plant of its kind in the United States. His wheel press, described in another column of this issue is also meeting with a wide demand. The Hathaway appliances are now generally recognized as standard and essential parts of most street railway equipments.

The Shultz Belting Co., of St. Louis, number among their recent sales two woven leather link belts to the Citizens' Electric Railway Co., of Decatur, Ill.; one flat, forty-eight inch, double belt to the Municipal Electric Light & Power Co., of St. Louis, who installed a similar belt nineteen months ago, and two double belts, one thirty inches wide and 175 ft. long, and the other thirty-six inches wide and 210 ft. long, at Clinton, Mass. They have also supplied a number of other prominent manufacturing companies with belting recently.

The Columbia Incandescent Lamp Co., of St. Louis seem certainly to manufacture an electric lamp which is satisfactory for street railway use, if the many orders which they have on hand is any indication of the satisfaction which it gives in practice. This company write us that their factory has been running day and night for the last thirty days in order to supply the large demand for the lamp,although they have not a single traveling agent engaged in soliciting ordres. The special claims made by this lamp company for their lamp are long life, combined with high efficiency and full candle power.

The Detroit Electrical Works of Detroit, Mich., have closed a contract for five additional thirty H. P. equipments with the People's Electric Railway Co., of Springfield, Ill. This road was equipped by them in the spring of 1891 with ten 30 H. P. motors, two additional equipments being purchased later. The present order makes a total of seventeen complete equipments for this road. Another recent contract by the Detroit Electrical Works is with the Kokomo Electric Railway Co., and is for five cars and one 80 kilo-watt generator of the type "B," the same which has done such good service at Nashville, Tenn., Gloucester, Mass., and South Chicago, Ill.

The American Car Co., of St. Louis, only recently established, is already making rapid progress. Their works, which are very large and complete, are thoroughly equipped with the most improved machinery and all modern appliances for handling a large business. This American company is at present busy on an order of 180 cable cars for the Washington & Georgetown Railway Co., of Washington, D. C., and their second order of thirty cars for the West Division Street Railway, of Chicago. This company report the outlook for the new year very promising, and they are receiving every encourgement from their railway friends. Mr. Wm. Sutton is president and Mr. Emil Alexander secretary. We wish them every success.

The Electric Merchandise Co., of Chicago, are, as usual, busy with their many orders. Good words spoken for a number of their specialties are coming in from many roads. Brand's steel wire track broom holders, Wardwell's track broom holders, Pratt's portable fare registers, and Burton electric heaters, are meeting with large sales. The latter have been placed upon electric roads in the following places the past month: Ottumwa, Iowa ; Reading, Pa.; McKeesport,

Pa.; Cleveland, O.; Lincoln, Neb.; Martinsburg, W. Va.; Salt Lake City, Utah; Sioux City, Iowa; Marquette, Mich.; Wheeling, W. Va.; Quincy, Ill.; Williamsport, Pa.; St. Louis, Mo.; Ottawa, Can.; Wilkes-Barre, Pa.; Shamokin, Pa.; Bloomington, Ills,

The Pond Engineering Co., through their Chicago offices have recently closed a contract with the American Express Co. to install a 120 H. P. engine of their make in the building of that company. They have also closed a contract with the Laclede Gas Light Co., of St. Louis, for two 250 H. P. compound, condensing, Armington & Sims engines, with Blake pumps, and independent condensing apparatus. This work was awarded, after strong competition from all the leading high speed engines, to the Pond Engineering Co., who will put in the foundations and superintend the installation and starting of the plant. It is expected that one of these engines will be in operation by January 1, 1892, and the other shortly thereafter. The first engine will be belted direct to a 2,500 light alternater. The foundations will be carried to solid rock.

The Thomson-Houston Electric Co., through their Chicago office,have just closed a contract with the Benton-Bellefontaine Railway Co., St. Louis, for the equipment of thirty cars with two motors each, of the latest improved type, known as the W. P., or water proof. The contract also includes the furnishing of three 333 H. P. compound wound generators of the Thomson-Houston manufacture, and it is understood that the railway company will do everything that is required to make this installation model, complete and perfect in every respect. The Thomson-Houston Co. have their electric railway equipment in exclusive use in St. Louis on the following roads: St. Louis & Suburban, Union Depot, Mound City, Missouri Railroad, Suspension Bridge & East St. Louis, and it is now generally conceded that St. Louis has more Thomson-Houston electric railway apparatus in use than any other city in the United States, with the exception of Boston.

The Laclede Car Co., St. Louis, find themselves with plenty of orders at the beginning of the new year. At a recent visit of our representative he found them busy on the order of 375 cars for the Third Avenue (N. Y.) Railway Co. Two specimen cars of this order have already been delivered and are reported to be highly satisfactory to the Third Avenue company. These are models in every way of the latest improved street cars. They are thoroughly fitted and finely finished inside. There are to be 200 closed and 175 open cars. The closed cars are finished inside with mahogany and bird's eye maple, and are to be equipped with Baltimore trucks and running gear. The open cars will be equipped with the McGuire truck. The Pintsch system of gas lighting is used, which will add greatly to the appearance of the car when lighted, as well as to the comfort of the passengers. The Laclede company are improving their works and adding to their facilities, anticipating an unusually large amount of work during 1892, which they are in thoroughly good shape to handle.

The Electric Merchandise Co., of Chicago, have nearly completed the arrangements of their new offices at 11 Adams Street, which are pleasanter in every respect than the old quarters, having more room, light and better ventilation. The old location is still advantageously utilized for the storage and shipping of the lighter stock. A full line also of all their well known electric railway supplies is exhibited upon the ground floor. This company have received a letter from the Allentown & Bethlehem Rapid Transit Co., of Allentown, Pa., requesting the shipment of eight more heaters with switches, and stating that the heaters at present owned by the company are giving excellent satisfaction and are liked by the patrons of the road much better than the stoves. Orders have also been received from the Benson & Halcyon Heights Railroad Co., Omaha, Neb.; Edison General Electric Co., Portland, Ore.; Maschinenfabrik Oerlikon, Oerlikon bei Zurich, Switzerland; Newburyport & Amesbury Horse Railroad Co., Newburyport Mass.; Warrensburg Electric Light Co., Warrensburg, Mo. It is interesting to note that the Aspen Mining Co., Aspen Colo., have ordered four sets of electric heaters for use in the company's motor stations.

The Pullman Palace Car Co. are turning out an immense number of cars at their shops at Pullman, Ill. One of their street railway orders is for twenty cars for the City & Suburban Railway Co. of Portland, Ore. These cars will be delivered in sixty or seventy days. The Pullman company are now finishing one of their new double deck, centre vestibule cars for the City Traction Co. of Philadelphia. This style of car with its novel features promises to become very popular with street car companies. The one tried on the West End Railway of Boston has proved so extremely satisfactory that the railway company are thinking of purchasing a considerable number of these cars. In fact, they have requested figures from the Pullman company for the supply of 100 of these cars. The Pullman company will also furnish six motor car bodies for the Jacksonville (Ia.) Electric Railway. The cars will be finished in mahogany. The car which was built for the Judson Pneumatic Co. is now in operation at Pullman. The works are turning out large numbers of cars for steam railroads. One of the recent orders was for 4,000 freight cars and 100 passenger coaches for the Philadelphia & Reading road. When these are completed the Pullman company will have built 14,000 freight cars for the company. Twenty chair cars are to be built for the C., B. & Q., and the same number for the Rock Island road. For the Chicago & Eastern Iilinois twenty-five ordinary passenger coaches are building.

The Central Electric Co., of Chicago, have just taken the agency for Illinois, Missouri, Nebraska and Indiana for the Interior Conduit & Insulation Co., and will carry in stock at Chicago, St. Louis, Kansas City and Omaha, a sufficient supply to meet the demands of the business. This is a very important agency, and the Central Electric Co. can be congratulated in securing it. Since taking the agency the company have secured an order for 50,000 ft. of one size of tube. It has started in well. Since undertaking the handling of electrical supplies, the Central Electric Co. report a very considerable increase in this department of their very large general electrical supply business. Electric railroad men are coming to understand that they can get their goods promptly from this company, who carry a large stock, enabling them to make shipments promptly. The Central Electric Co. are headquarters for a number of first-class specialties, among which might be noted the porcelain break insulator, glass, high resistance insulator, special Candee feed wire, trolley hangers, etc., etc. Occupying a building of some 20,000 sq. ft. area, not one foot of which can be spared on account of the large stock constantly carried, this company assure their customers promptness in filling orders, and courteous treatment. This company have taken the agency for the Washington carbon and will carry a large stock, These carbons are designed for both high and low tension systems. They give long life and are perfectly straight and uniform. Shipments will be made from the Central Electric Co.'s stock and at factory rates.

A New Company.

The Wheeler Condenser & Engineering Co. have recently filed articles of incorporation with the Secretary of State, at Trenton, N. J. The company have bought out the entire plant and business of the Colwell Iron Works, at Cateret, N. J., which is one of the largest concerns in this country manufacturing vacuum pans, and special machinery for sugar refineries, salt works, condensed milk factories, etc.

Annual Meeting of The Burton Electric Co.

At a meeting of the Board of Directors of the Burton Electric Co. held December 15, at Richmond, Va., it was stated that since W. R. Mason of Chicago had become president of the company over 1,000 Burton heaters had been shipped. Eighty-five roads, it was also mentioned, were at that time using the heater, though at present the number is over 100.

A resolution was unanimously adopted expressing their entire appreciation and satisfaction of the zeal manifested by Mr. W. R. Mason, president of the company, in the management of its affairs.

A Company Goes Into Liquidation.

The Equitable Engineering & Construction Co., Philadelphia, announce that on the 1st of January they will go into liquidation. Their business for the past year has been a profitable one, but the active members of the concern wish to get out of the construction business. Mr. Ashton Hand has accepted a position as superintendent of the Detroit Electrical Works, and Mr. W. A. Stadelman wishes to devote his time for the present to his interests in Bristol, Tenn., which consist of the Bristol Belt Line Railway, and the Bristol & East Tennessee Railroad, in both of which he owns a controlling interest. The company advise us that they retire from business with every debt paid and a good balance to be distributed as a dividend to the stockholders.

The Astoria Electrical Manufacturing Co.

The Astoria Electrical Manufacturing Co., has been organized with a capital of $500,000 for the manufacture of electrical machinery and apparatus, especially stationary and railway motors. The company have secured the ownership of the various patents upon improvements in electric railway motors which have been granted to Mr. W. M. McDougall and Mr. John Boothby. These patents cover a wide range. Offices have been taken at 14 Dey Street, New York. The officers of the company are as follows: President, Conrad N. Jordan; vice-president, William Steinway; treasurer, Herman Ridder: secretary, Chas. W. Spear; general manager, W. M. McDougall. Directors: William Steinway, Edward Uhl, Egerton R. Burpee, Herman Ridder, Conrad N. Jordan, W. M. McDougall, Chas. W. Spear.

A Chapter on Raw Hide.

It is a fair presumption that since gearing was first employed a desire has existed and efforts have been made to secure for it the important combination of noiselessness and durability. That this has at last been accomplished by the raw hide gearing is shown by the testimonials published by the New Process Raw Hide Co. from a cloud of witnesses, including eminent engineers, machinists and many street railway companies.

The din, rattle and racket of metal gearing used on many electric motor cars is accountable for a great part of the hostility to the extension of old and the building of new lines, and was one of the points recently most vigorously urged in opposition to electric cars for Brooklyn. Yet this noise is not a necessary adjunct to the conveniences and comforts which electric street cars alone provide, since the problem of how to "stop that noise" was solved when a way was discovered by which raw hide, without injury to its life or fibre, could be compressed, hardened and so treated that in the form of a gear or pinion it will do the work of steel. Such a process the New Process Raw Hide Co. claim to have, and that their gears and pinions have been doing active service on motor cars and in machine shops for the past three years.

The charge cannot be made that "these roads have no grades," and that "the conditions are all favorable." On the Federal Street & Pleasant Valley Passenger Railway, Allegheny, Pa., on the People's Railway of Scranton, the grades are remarkably heavy and frequent, the curves sharp, traffic heavy. Yet on these lines the gears in question

have been doing efficient service for the past two years and more; and on many others where the conditions are the opposite of favorable.

The following claims are made for them: They have the strength and endurance of steel; they are noiseless; they do not require lubricating, hence a saving of oil and labor; cleanliness is an accompaniment, no oil being used; they greatly reduce vibration, prolonging the life of the armature wires; they do not wear the gears with which they mesh—cannot possibly strip or otherwise injure them; are free from flaws.

New Publications.

New Stories Boiled Down for Busy Men. This is the title of a small circular issued by the Eureka Tempered Copper Co. of North East Pa., which contains, besides a few remarks about the tempered copper manufactured by this company, a number of very flattering testimonials from former and present customers.

A Few Testimonials; issued by the Burton Electric Co., and their selling agents, the Electric Merchandise Co. This circular gives a few of the many testimonials received by those two concerns from street railway companies, recommending the well known Burton electric heaters. The names of many prominent street railway companies appear as users of this appliance.

Combined Snow Sweeper issued by the Thomson-Houston Co.; This handsome publication which forms No. 1,001 of the bulletins of information issued by the Thomson-Houston Electric Co., is descriptive of the Thomson-Houston electric snow sweeper, shown at the Pittsburgh Convention and already illustrated in these columns. Three handsome engravings besides small cuts are given in the pamphlet, as well as a statement of the different types manufactured and the net prices to the customer.

Catalogue of Street Railway Cars issued by the St. Louis Car Co., of St. Louis, Mo This very handsome and carefully edited catalogue presents types of the many cars for cable, electric, horse and steam roads, manufactured by the St. Louis Car Co. The principal dimensions of each style of car are given with the illustration. The catalogue also includes a view of the St. Louis Car Co.'s electric snow plow, of their many types of trucks, car appliances, etc. The productions of this company are widely recognized as models of careful construction and intelligent workmanship.

Eighth Annual Report of the Bureau of Statistics of Labor in New York for the Year 1890. Submitted in 1891 by the commissioner, Charles F. Peck. In this volume of nearly 1,200 pages a great deal of space is occupied with the discussion of many "labor questions." Among these the eight hour day question takes up many pages and a variety of opinions, more or less logical; are quoted in favor of it by the commissioner. But four pages are devoted to the condition of street railway employes. The wages of drivers and conductors for a day of twelve hours seems to vary from $1.50 to $2.00. A more complete statement on the question of wages was given in the Sixth Annual Report.

The Monthly Record of Facts and Figures about Electric Railway Work; published by the Edison General Electric Co., Edison Building, New York. This publication, issued by the railway department of the Edison General Electric Co, is a new departure, and will contain information concerning the improvements which are from time to time made in the Edison system for electric railways, as well as important facts relating to the numerous electric railways which are being operated throughout the country. The first two numbers which have been issued present much interesting matter, and show that the railway department of that company is enterprising, pushing and bound to get its share of the business.

Report of the Board of Railroad Commissioners of the State of New York on Strains on Railroad Bridges of the State for 1891. Issued by the commissioners. Within a year from the establishment of the Board of Railroad Commissioners of the State of New York in 1883, it became evident that some measures should be taken to secure a more accurate report on the strains brought to bear on the members of the different railroad bridge trusses. For this reason a special department was organized and details are now obtainable of each railroad bridge in the state. The total number thus examined is about 25,000 not including the structures of the New York elevated railroad, the strains of which have also been calculated. 669 bridges have been criticised by the board, of which 535 have been repaired by the various companies and 134 entirely rebuilt.

Annual Report of the Postmaster General of the United States for the Fiscal Year Ending June 30, 1891. This exhaustive report sent to the President under date of November 30, 1891, covers 181 pages and contains much interesting information as well as a number of valuable suggestions and recommendations for the improvement of the service. Under the title Utilizing Street Cars in Cities, Mr. Wanamaker describes briefly the plan proposed in St. Louis, which we give more fully in another column. He also makes mention of the use of the inter-urban electric line at St. Paul and Minneapolis for carrying the mails, and recommends the use of electric cars in other towns for this service. As an example of a point where, he thinks, the electric cars could be utilized to advantage, the city of Wheeling, W. Va., is cited, from which place the towns of Benwood, Bellaire, Martin's Ferry and Bridgeport, O., could be easily served. The postal authorities are also proposing to install electric postal cars between the cities of Davenport, Ia., and Rock Island, Milan, and Moline, Ill. Among other recommendations made by the Postmaster General is one for a postal telegraph.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, DECEMBER 1, 1891, TO DECEMBER 22, 1891, INCLUSIVE.

DECEMBER 1.

Bed Support for Railway Tracks, Edward R. Edwards, Mineral Ridge, O. 464,173
Car Axle, William S. Kisinger, Bellevue, Ky. 464,028
Car Starter and Brake, Frank J. Stafford, Cleveland, O. 464,111
Car Truck, James T. Robinson, Altoona, Pa. 464,041
Car Truck, Edgar Peckham, Kingston, N. Y. 464,253
Crossing for Trolley Wires, Robert M. Jones, Salt Lake City, Utah. 464,129
Electric Wire Support, Richard Ellison, Cincinnati, O. 464,298
Hanger for Trolley Wires, Thomas E. Adams, Cleveland, O. 464,411
Railroad Rail Fastener, James S. Peirce, Portsmouth, N. H. 464,180
Railway, Henry Day, Fairview, N. J. 464,455
Street Car, Geo. T. Chapman, White Plains, N. Y. 464,450
Trolley Wheel for Electric Railways, Smith W. Kimble, Denver, Colo. 464,370
Trolley Wire Hanger, Smith W. Kimble, Denver, Colo. 464,371

DECEMBER 8.

Cable Grip, Louis Kannenstine, St. Louis, Mo. 464,878
Car Brake, Henry F. Braun, Denison, Tex. 464,847
Car Brake, John Trendley, St. Louis, Mo. 464,596
Conduit Conductor for Electric Railways, Walter H. Knight, New York. 464,505
Drill for Electric Railways, Harrry P. Bradford, Little Rock, Ark. 464,673
Electric Fare Recording System, Barton S. Molyneux, Minneapolis, Minn. 464,513
Electric Railway System, Leon O. Dion, Natick, Mass. 464,557
Rail Joint, Edward Samuel, Philadelphia, Pa. 464,793
Rail Joint, Milton C. Niles, Chicago, Ill. 464,702
Rail Joint, Milton C, Niles, Chicago, Ill. 464,696
Railway Rail Joint, Algernon G. Edmondson, San Buenaventura, Cal. 464,699
Removable Shoe for Cable Car Grips, Charles Fitzgerald, Pittsburgh, Pa. 464,924
Street Railway, Whitcomb L. Judson, New York, N. Y. 464,614
Street Railway, Whitcomb L. Judson, New York, N. Y. 464,615
Street Railway, Whitcomb L. Judson, New York, N. Y. 464,616
Transmitting Mechanism, for motor cars, Charles W. Thomas, Jersey City, N. J. 464,640
Trolley for Electric Railways, John W. Schlosser, Washington, D. C. 464,780

DECEMBER 15.

Bracket for Supporting Electric Conductors, John A. Duggan, Quincy, Mass. 465,365
Car Brake, James T. Robinson, Altoona, Pa. 465,389
Converter System for Electric Railways, Mark W. Dewey, Syracuse, N. Y. 465,359
Electric Car Brake, Edmond Verstraete, St. Louis, Mo. 465,034
Electric Railway, George F. Green, Kalamazoo, Mich. 465,407
Electric Railway, George F. Green, Kalamazoo, Mich. 465,432
Fender for Street Railway Cars, Robert H. Marsh, Boston, Mass. 465,383
Momentum Reservoir Motor, Marion M. Bailey, Denver, Colo. 465,122
Pick-up and Throw-off Mechanism for Cables, George Muller, Hoboken, N. J. 465,191
Rail Chair, George E. Walls, Philadelphia, Pa. 465,223
Sliding Railway, Charles A. Barre, Paris, France. 465,151

DECEMBER 22.

Cable Grip Car Truck. Ernest R. Esmond, New York, N. Y. 465, 659
Car Truck. Ernest R. Esmond, New York, N. Y. 465, 658
Car Truck. Ernest R. Esmond, New York, N. Y. 465, 660
Electric Railway. William H. Applegate, Atlantic, Ia. 465, 613
Electric Railway Trolley. Charles S. Foster, Whitesborough, N. Y. 465, 469
Electric Railway Trolley. Frank J. Sprague and Patrick F. O'Shaughnessy, New York, N. Y. 465, 806
Gearing for Electric Motor Cars. Owen F. Evans, Columbus, O. 465, 592
Guard for Trolley Wire Insulators. Francis O. Blackwell, Lynn, Mass. 465, 447
System of Street Car Propulsion. Frederick G. Wheeler, New York, N. Y. (reissue) 11, 211
Steam Generator for Street Cars. Frederick G. Wheeler, New York, N. Y. (reissue) 11, 212

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

Caution.

To all whom it may concern:

We beg leave to call your attention to U. S. Patent No. 287,861, dated November 6th, 1883, under which we manufacture "our noiseless" rawhide gears of steer hide and cured by our patented process.

As the owners of this Patent, we claim the sole right to manufacture and sell rawhide gears "composed of several layers of rawhide, each having the flesh side removed, and all suitably and securely joined together;" and in order that all may be aware of our rights and not feel aggrieved if sued for infringement upon our rights, we hereby notify all interested parties that we shall prosecute all infringers whether they be makers, dealers or users.

"The owner of a valid patent secures by virtue thereof three substantive rights, *the right to make, the right to sell, and the right to use* the patented article. He who invades *any* of these rights *is an infringer.*"

Birdsell *v.* Shaloil, 112 U. S., 485.
Tuttle *v.* Mathews, 28 F. R., 98.

THE NEW PROCESS RAWHIDE CO.,
October 28th, 1891. Syracuse, N. Y., U. S. A.

QUOTATIONS OF STREET RAILWAY STOCKS.

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 7 Exchange Place, Members of Boston Stock Exchange. Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	86⅛	86¾
West End Com'n	50	$7,150,000	J. & J.	5	1890–1891	74	74⅛

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co	100	$270,000	New.	...	Oct., 1887	94	95
Union R. R. Co., Prov.	100	2,000,000	Q.—J.	2	1862–1863	185	190
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co	100	$300,000	J. & J.	4	.....	200	225
Holyoke Street R. R.	100	150,000	J. & J.	3	.....	150	155
Northampton Street R. R.	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	3	.....	.....	65
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	7

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE-SASSIER, 174 Common Street, New Orleans, La., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co	100	800,000	Quart.	1½	1867	117	120
Crescent City R. Co	100	1,150,000	"	1¾	1866	86½	88½
Canal & Claiborne R. R. Co.	40	240,000	.....	...	1888	22½	25
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	125½	129
Orleans R. R. Co	50	185,000	"	2	1868	69	70
St. Charles Street R. R. Co.	50	600,000	"	1½	1866	82	85

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	100½	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93–'99	.....	.....
do do new	1886	40,000	M & N	6	1896	.....	.....
N. O. City R. R. Co	1879	495,200	J & D	6	1903	119½	121½
N. O. & Carrollton R. R. Co.	1882	300,000	F & A	6	'92–'06	113½	.....
St. Charles Street R. R. Co.	1881	165,000	J & D	6	'89–'01	.....	.....

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	140	.....
State Street Horse R. R. Co.	25	23,000	J. & J.	3	.....	100	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	20	.....
New Haven & Centville H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co.	1874	22,000	J. & J.	7	Jan., 1894	105	.....
New Haven & W. Haven R. R. Co	1889	50,000	J. & J.	5	July, 1899	100	.....
Bridgeport Horse R. R. Co.	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B.	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued)	.....	100,000	M. & N.	5	May, 1910	.....	.....

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co	50	1,000,000	Q.—J.	1½	.....	105	108
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	185	.....
Brooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	169	.....
Coney Island & Brooklyn R. R. Co	100	500,000	.....	...	.....	121	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	106
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	107	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	103	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	105	106

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Aug.	1½	1890	107	110
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	10	15

BONDS.*	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	103	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	102	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	105	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	105	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	105	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103	104
" " " Debenture	1891	200,000	M. & N.	6	1901	108	110¼
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	95	98
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	.....	70

*In bonds buyer pays accrued interest.

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾	.....	25	28
Broadway & Seventh Avenue	100	2,100,000	Q.—J.	2	.....	205	205
Brooklyn City	10	2,000,000	Q.—F.	2	.....	165	170
Brooklyn Crosstown	100	500,000	A. & O.	4	.....	108	110
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	104	108
Christopher & Tenth	100	650,000	F. & A.	1¾	.....	115	116
Central Crosstown	100	600,000	Q.—F.	1¾	.....	125	130
Dry Dock, E. B'way & Battery	100	1,200,000	Q.—F.	2	.....	125	135
42d & Grand St. Ferry	100	748,000	Q.—F.	3	.....	230	240
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	37	40
Eighth Avenue	100	1,600,000	Q.—J.	2	.....	.....	.....
Houston, W. St. & Pav. Ferry. Leased to B'way & 7 ave	100	1,000,000	Q—F.	2	.....	160	.....
Second Avenue	100	1,862,000	J. & J.	5	.....	102	103
Sixth Avenue	100	1,500,000	M. & S.	3	.....	130	150
Third Avenue	100	2,000,000	M. & N.	4	.....	290	305
23d St	100	600,000	Q.—F.	2½	.....	220	220
Ninth Avenue	100	800,000	.....	3	.....	90	95

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry	.....	700,000	J. & J.	7	July, 1900	110	.....
B'way & 7th Ave., 1st mort	.....	1,500,000	J. & D.	5	June, 1904	105	107
2d mort	.....	500,000	J. & J.	5	July, 1914	105	106
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	106	107
Additional	.....	1,000,000	J. & J.	5	July, 1905	93	95
Brooklyn City	.....	200,000	J. & J.	5	Jan., 1902	105½	107½
Brooklyn Crosstown	.....	200,000	... .	5	1902	107	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	114	116
Christopher & Tenth	.....	250,000	A. & O.	7	Oct., 1898	112	114
Central Crosstown	.....	250,000	M. & N.	6	Nov., 1922	118	120
Dry Dock, E. B'way & Battery. 1st mort	.....	840,000	J. & D.	7	June, 1893	104	106
Scrip	.....	1,200,000	F. & A.	6	Aug. 1914	98	100
42d & Grand St. Ferry	.....	236,000	A. & O.	7	April, 1893	110	112
42d St. Manhat. & St. Nich. Av 1st mort	.....	1,200,000	M & S.	6	Sept., 1910	112	114
2d mort	.....	1,200,000	J. & J.	6	1915	38	39
Eighth Ave., Scrip	.....	1,000,000	F. & A.	6	Aug., 1914	105	110
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	109	111
Second Avenue	.....	1,600,000	M. & N.	5	Nov., 1909	102	103
Third Avenue	.....	5,000,000	J. & J.	5	Jan., 1937	108	112
23d St	.....	250,000	M. & N.	7	May, 1893	108	110

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$600,000	M. & N.	4	May, '91.	185	187½
Ditto new shares (90% paid.	50	300,000	.....	...	.....	184½	187½
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1965	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	67½	68
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	18	18½
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	90½	91
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	111½	112
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	111½	112
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City.....	100	$7,000,000	Q.—J.	3	.....	280	285
Chicago Passenger.....	100	1,000,000	A. & O.	2½	.....	....	96
North Chicago City.....	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street.....	100	5,000,000	J. & J.	4	.....	175¼	176
West Division City.....	100	1,250,000	Q.—J.	8¾	.....	630	.....
West Chicago Street.....	100	10,000,000	Q.—F.	1½	.....	126¼	127
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City.....	.....	4,000,000	J. & J.	4½	.....	96½	97½
Chicago Pas-senger.....	1883	400,000	F. & A.	6	1903	105	109
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,640,000	M. & N.	4½	1927	92¾	93¼
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	.....	99
West Division Railway.....	.....	3,790,000	J. & J.	5	.....	100⅛	100⅝
" " " Ext....	.....	250,000	J. & D.	6	.....	100	100¾
West Chicago Street.....	.....	4,160,000	M. & N.	5	.....	99⅞	100¼
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	98

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co....	50	1,500,000	.....	..	.....	20⅝	20⅞
Citizens' Traction R. R. Co ..	50	3,000,000	J. & J.	3	.....	60	61
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	18⅜	18½
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	....	48
Federal St. & Pleasant Valley	50	1,300,000	J. & J.	3	.....	22¼	23
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	36	37
West End R. R. Co.....	50	200,000	J. & J.	...	.....	70	.....
Second Avenue R R. Co.....	50	300,000	J. & J.	3	.....	....	60
Penn Incline Plane Co.....	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	.....	20
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	40	.....
Pittsburgh Incline Co.....	100	150,000	.....	...	.....	100	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co ..	1887	1,250,000	A. & O	5	1927	106¾	107½
Pitts. & Birmingham Traction Co.....	1889	1,500,000	M. & N.	5	1929	95	95½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	103½	....
Pleasant Valley Ry.....	1891	300,000	J. & J.	5	1919	.....	.....
P., A. & M. R. R. Co.....	1891	1,500,000	J. & J.	5	1931	102	109½
Duquesne Traction Co.....	1890	1,500,000	J. & J.	5	1930	.....	98
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.....	1889	375,000	J. & J.	5	1919	.....	.....
Pleasant Valley R. R. Co.....	1873	75,000	J. & J.	6	1908	.....	.....
Union R. R. Co.....	1881	100,000	A. & O.	5	1901	.	.....
West End R. R. Co.....	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.....	1883	125,000	.....	6	1903	.....	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.....	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.....	100	1,000,000	Monthly	5	....	115	119
Central R R. Co.....	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	.....	100
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	....	52½
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	39	44
Omnibus Cable Co.....	100	2,000,000	Monthly	4	.....	66	68
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	22¾	30
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House.....	.....	650,000	M. & S.	6	1914	....	102½
Market Street R. R.....	.....	3,000,000	J. & J.	6	1913	122	124
Omnibus R. R.....	.....	2,000,000	A. & O.	6	1918	113¾	116
Powell Street R. R.....	.....	700,000	M. & S.	6	1912	.....	116
Park & Ocean R. R.....	.....	250,000	J. & J.	6	1914	.....	115
Park & Cliff House R. R.....	.....	350,000	J. & J.	6	.....	....	97½

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Dec. 18.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.....	100	$324,000	Q.—J.	3	1864	100	.....
Cass Ave. & Fair Grounds.....	50	300,000	.....	...	1876	44	50
Citizens'	100	1,500,000	A. & O.	1¼	1887	100	105
Jefferson Avenue.....	100	112,000	.....	..	1885	200	300
Lindell	100	2,500,000	Q.—J.	...	1890	56	60
Missouri.....	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central.....	100	200,000	.....	...	1884	100	105
People's.....	50	1,000,000	M. & S.	6	1889	40	45
St. Louis.....	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal.....	50	150,000	Jan.	.50	1872	15	25
Union.....	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1790	200	250
St. Louis & Suburban.....	100	1,000,000	... .	...	1891	10	15
BONDS.	Date of Issue	Amount Out-stand ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine.....	1880	$500,000	F. & A.	6	1900	102	102½
Cass Avenue.....	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable.....	1887	1,500,000	J. & J.	6	1907	106	107
Lindell	1890	1,500,000	J. & J.	5	1895-1910	99	100
Mound City.....	1890	525,000	A. & O.	6	1900-1910	104	105
Missouri Cable.....	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort.....	1882	125,000	J. & D.	6	1902	102	105
" 2d mort.....	1885	75,000	M. & N.	7	1902	104	105
People's Cable.....	1889	800,000	J. & J.	6	1889-1914	95	97½
Northern Central.....	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable.....	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union.....	1885	150,000	M. & N.	6	1895-1915	102	103
Union Depot.....	1890	1,600,000	A. & O.	6	1900-1910	104	105

PHILADELPHIA STOCKS AND BONDS.—Corrected by ROBERT GLENDINNING & Co., 143 So. Fourth st. (Bullitt Building), Philadelphia, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'.....	50	$500,000	Q.—J.	4	1858	250	.....
Continental.....	50	1,000,000	J.—J.	6	1873	118	125
Frankford & Southwark.....	50	1,250,000	Q.—J.	6	1854	196	200
Germantown.....	50	1,500,000	Q.—J.	...	1858	97½	98
Green & Coates...	50	500,000	Q.—J.	3	1858	118	125
Hestonville...	50	2,050,000	.....	...	1859	30	31
Lombard & South.....	25	500,000	A.—O.	8	1861	62	63
People's Common.....	25	1,500,000	M.—S.	2½	1873	42	43
" Preferred.....	25	750,000	M.—S.	2½	.....	43	.....
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	145	146
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	65	66½
Philadelphia Traction.....	50	5,000,000	M.—N.	3	1883	56	58
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	200	205
Second & Third.....	50	1,060,200	Q.—J.	4½	1853	145	150
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	180	.....
Union.....	50	1,250,000	J.—J.	9½	1864	170	171
West Philadelphia.....	50	750,000	J.—J.	10	1857	175	176
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	79	80
Baltimore Traction.....	25	5,000,000	.....	...	1889	16¾	17
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	25	30
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	15	20
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	101	101½
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Outstanding.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,500,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co. Bankers and Brokers, 26 West Third Street, Cincinnati, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	109¼	109¾
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	109	109½
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	120	123½
Mt. Auburn Cable	100	300,000	.....	...	.....	47½	50
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	52	55
" " " Pref.	100	100,000	.....	6	.....	90	95

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	102	.....
" "	.....	50,000	J. & J.	7	July, 1894	104	.....
" "	.....	50,000	J. & J.	7	July, 1895	.....	110
" "	.....	50,000	J. & J.	7	July, 1896	108	112
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	103½	.....
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	.....
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	107½	115
" " "	.....	300,000	J. & J.	6	Jan. 1914	102½	104
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	96	98
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	100	103
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co, Bankers, 9 South Street, Baltimore, Md., Dec. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.. ..	.....	65
Union Pass. Ry. Co	50	750,000	.....	...	.....	.....	.....
Highlandtown & Point Breeze Ry. Co	50	180,000	.....	...	.....	.....	.....
Balto. Traction Cable Co	25	5,000,000	Quart.	1	.....	17	18
North Balto. Pass. Ry	25	600,000	Sem an	3	.....	31	32

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	110	.....
" " cons. mort	.....	1,500,000	.....	5	.....	93	.....
Balto. Traction Cable Co.	1889	1,500,000	M. & N.	5	1929	102½	103
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	105¾	106

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	220	230
Metropolitan R. R.	50	750,000	Q. J.	...	1864	93	99
Columbia R. R.	50	400,000	Q. M.	...	1870	60	72½
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	36	40
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	31	40
Georgetown & Tenallytown	50	200,000	.....	...	.....	52	59
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	104	105
do. do. convert.	'83–'91	2,000,000	J. & J.	6	1899-1929	139	145
Eckington & Soldiers' Home.	.....	100,000	J. & D.	6	1896-1911	95	97
Capitol & North O St. R. R.	1891	250,000	J. & J.	5	1921	108½	114
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	117	125

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	....	.....	120	125
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	80	84
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	149	150

Financial.

THE Altoona (Pa.) City Passenger Railway Co. will issue $50,000 of bonds.

$ $ $

THE Cincinnati (O.) Street Railway Co. have voted to increase their capital stock from $6,000,000 to $6,750,000.

$ $ $

THE Denver (Col.), Lakewood & Golden Railway Co. have decided to increase the capital of the road from $600,000 to $1,000,000.

$ $ $

THE earnings of the Atlanta Consolidated Street Railway Co. for October were reported to be $37,302, against $35,136 last year.

$ $ $

The net earnings of the West End railway, of Boston, in October, are reported as $173,000, an increase, it is said, of $36,000 over 1890.

$ $ $

THE Oshkosh (Wis.) Street Railroad Co. have filed an amendment to their articles of incorporation increasing their capital from $60,000 to $100,000.

$ $ $

THE stockholders of the Columbus (O.) Consolidated Railway Co. have decided to increase the capital stock of the company from $250,000 to $1,250,000.

$ $ $

THE Rutland (Vt.) Street Railway Co. on December 1 retired bonds numbering 11 to 20 inclusive. There still remain unpaid bonds to the amount of $26,000

$ $ $

THE new managers of the Rome (Ga.) Street Railway Co. have decided to make a new issue of bonds. The amount is $100,000 bearing interest at six per cent.

$ $ $

THE report to the State Commission of the Cottage City (Mass.) Street Railway Co.: Total earnings, $2,666.15; running expenses, $2,261.68; net earnings, $404.47.

$ $ $

AT a meeting of the Board of Directors of the Lebanon (Pa.) & Annville Street Railway Co. the capital stock of the company was increased from $60,000 to $100,000.

$ $ $

THE International Trust Co. of Boston have made application in the Superior Court for the appointment of a receiver for the Keokuk Electric Street Railway & Power Co.

$ $ $

THE stockholders of the Redlands (Cal.), Street Railway Co. will vote January 23, 1892, on the question of increasing the capital stock of the company from $50,000 to $75,000.

$ $ $

THE St. Louis (Mo.), Collinsville & Carondelet Railway Co. have filed for record a resolution of the bondholders authorizing the directors to issue 1,500 bonds of $1,000 each, payable July 1, 1931.

$ $ $

THE Laramie City (Wyo.) Tramway Co., of which F. M. McHale, of Denver, is president, has just issued $60,000 in bonds, secured by a first mortgage upon their property. The Title Guarantee & Loan Co. are named as the trustee.

$ $ $

THE Dubuque (Ia.) Electric Railway, Light & Power Co. have given a second mortgage for $50,000 on their plant to cover the floating indebtedness caused by the building of the South Dodge Street and other branch lines. The first mortgage is for $200,000.

$ $ $

The $100,000 deposited by the Lake Street L Co., of Chicago, with the city treasurer as a guaranty that the road would be built, is to be returned to the company, and the city gets a bond in the penal sum of $200,000 on condition that the road is completed according to the ordinance.

$ $ $

THE total receipts for 1891 of the Citizens' Traction Co., of Pittsburgh, including $300,000 from new stock were $962,223.31. The total expenditures, including Sharpsburg electric construction and equipment and dividends, were $905,741.74. Cash balance November 1, 1891, $56,481.57.

AT the last annual meeting of the Philadelphia Traction Co. it was voted to increase the capital stock, now $500,000,000 to $800,000,000 by authorizing the issue of 60,000 additional shares from time to time as the directors may determine. It is understood that $1,000,000 of stock, or 20,000 shares, will be issued during the coming year. The par value of Traction shares is $50, with $40 per share paid on the existing stock. During the past year the Traction company carried 68,675,451 passengers, and had $3,552,364 earnings and $3,246,050 expenses, leaving $396,314 net earnings.

$ $ $

THE applications to the bankers for the $2,000,000 issue of bonds of the Baltimore City Passenger Railway Co., offered at 102½ and interest, was largely in excess of the amount for sale. The bonds were dated November 2, 1891, bear interest at five per cent., payable May and November 1 in gold, and run twenty years. The average net earnings of the company for the past ten years, as stated in the bond circular, have been $133,775 51 a year, or $1.337,775.10 for the whole period, being $337,775.10 in excess of the amount required to pay the interest on the bonds for a corresponding period. The company during the last ten years, besides spending large amounts for betterments, property and extensions, have paid dividends of from ten to thirteen per cent per annum.

$ $ $

THE directors of the West End Street Railway Co., Boston, last month declared dividends of four per cent. upon the preferred stock and five per cent. upon the common stock, payable January 1, 1892, to stockholders of record December 19, 1891. The full board of directors elected at the last annual meeting was as follows: G. T. W. Braman, Isaac T. Barr, T. Jefferson Coolidge, Joseph S. Fay, Jr., Eustace C. Fitz, Henry D. Hyde, Walter Hunnewell, E. D. Jordan, Samuel Little, William Powell Mason, Theophilus Parsons, Dexter N. Richards, Nathaniel Thayer, Walter S. Swan, Henry M. Whitney. The new members are Messrs. Mason, Coolidge, Parsons, Hunnewell and Thayer. From figures based upon past records the surplus of this company for the six months ending December 31, 1891, after paying all fixed charges and dividends upon both preferred and common stocks, it has been estimated, will be fully $150,000.

The Westinghouse Reorganization.

The plan of reorganization adopted by the Board of Directors April 14, 1891, and by the stockholders July 15, 1891, has been completed for some time. The stockholders have responded with substantial unanimity to the call for the surrender of forty per cent. of their holdings for the use of the company. Of the stock at the disposal of the company, $4,000,000 has been converted into seven per cent. preferential, cumulative stock and the balance into "assenting stock," entitled after the preferred stock, to a seven per cent. annual preference. Provision has been made for the company's debt and working capital by the sale at par of $3,000,000 of the preferred stock, for which payment in full has been received.

The company have acquired almost all of the stock of the United States Electric Lighting Co. and the Consolidated Electric Light Co. (commonly referred to as the "leased companies"), so that the fixed charges formerly incident to the lessee of those companies are now substantially obliterated, and the consolidation of interests thus effected has rendered possible a great reduction in general expenses. The saving in interest upon debt, rentals and other fixed charges, thus effected by the reorganization, amounts to more than $400,000 per year. All this has been accomplished without increasing the company's capital stock ($10,000,000), of which over $1,000,000, common and preferred, still remains in the treasury for future use. The reorganization has been effected without litigation and without interruption to the business, the three factories having been kept in continuous operation. The company have never been so favorably situated for work as now, and they have every prospect for a large and profitable business.

A Large Ammeter.

The Weston Electrical Instrument Co., of Newark, N. J., have taken a contract to build a 5,000 ampere ammeter for the Wilson Aluminum Co., of Leaksville, N. C. This instrument is to be a very large form of the well known Western type of ammeter, with some important modifications to meet the peculiar requirements of the case. It will have a scale about fourteen inches long, which will be divided into 250 parts. Each division will equal twenty amperes and the divisions will be large enough to be easily read to tenths or two amperes, and with care to one ampere. The scale will be laid by actual calibration to the full current to be measured by the instrument in practical work, namely 5,000 amperes.

This may seem a somewhat astonishing thing for the Weston company to do, especially when we consider the work which is commonly done by the use of a current of 5,000 amperes. Nevertheless, it is not beyond the facilities of the Weston Electrical Instrument Co. to construct such an instrument in the regular course of their work, without a single change in their appliances or any special preparation. The appliances of the Weston company for standardizing work are generally known to be excellent, and some idea of the perfection of the company's plant can be formed when we state that the copper conductors in the laboratory for handling ammeter work, weigh about four tons, and that some of the mains have a sectional area of five square inches, and that they are capable of carrying a current of 10,000 amperes without inconvenient heating.

A New Engineering Firm.

A corporation known as Sprague, Duncan & Hutchinson (Limited) has been formed in New York, with offices at 15 Wall Street, to carry on the work of consulting electrical engineers. The gentlemen composing this company are well known in both the street railway and electrical fields.

The senior member is Mr. Frank J. Sprague, inventor of the Sprague motor, and one of the foremost pioneers of the electrical street railroad and a well-known authority on rapid transit by electricty. Dr. Louis Duncan has for a long time been head of the electrical department of the Johns Hopkins University of Baltimore, and his authority as an expert on electrical matters has been widely recognized. Dr. C. T. Hutchinson was Mr. Sprague's assistant in the Sprague Electric Railway Motor Co., and thereafter assistant to the chief engineer of the Edison General Electric Co.

We wish the new corporation all the success in their line of work which they deserve.

What the Papers Say About It.

This road has long been noted for the beauty of its scenery, the elegance and comfort of its equipment, and as the greatest through car line on the American continent.

The main line is 450 miles in length and connects the cities of Chicago and Buffalo, with branch lines to the oil regions of Pennsylvania, Fort Wayne, Ind., and to the flourishing cities of Detroit, Jackson, Lansing, Kalamazoo, and Grand Rapids in Michigan. The main line passes through such important cities as Dunkirk, N. Y., Erie, Pa., Cleveland, Sandusky and Toledo, O., Adrian, Hillsdale, Mich.; and Goshen, Elkhart, South Bend and La Porte, Ind.

The roadbed is unsurpassed by any line in the country, and under the great improvements made during the past two years in the way of reducing curves and grades, the Lake Shore is to-day a line practically without a grade or a curve, a thoroughly constructed double-track railway, facts which give increased popularity and which have made it the favorite passenger line between the East and West, standing in the front rank among the great transportation companies of the world, a shining example of the careful, considerate, and progressive policy of its management, the double tracks permitting of a high rate of speed with entire safety, the perfect roadway giving ease and comfort to its patrons.

The equipment of its trains is, indeed, of a very high order of excellence. The sleeping, drawing-room and dining cars are of Wagner build, and nothing which the ingenuity of man could suggest for the comfort and welfare of passengers is omitted in their make-up.

The Lake Shore enjoys the distinction of being the line selected by the United States Government as the route of the fast mail trains—three daily trains being devoted almost exclusively to this branch of business—and forms in connection with the New York Central & Hudson River Railroad the greatest through mail line in the world, the line between New York and Chicago. No higher compliment could be paid to its management, and the road certainly merits the trademark it has adopted—the mail pouch.

The country traversed by it represents the richest portion of the Middle States. Its connections with other railways being made in almost every case in Union passenger stations of necessity calls to its line the people from a large territory tributary to its own immediate neighborhood. Its universally recognized excellent through train service between the cities of New York, Boston and Chicago, which has recently been increased by the addition of two new trains making thirteen through trains between the cities mentioned, ten of which are daily, has attracted the attention of people throughout the Eastern country and in Europe.

The magnificent passenger station on Van Buren Street, occupies a central position in the city of Chicago, convenient to all hotels, banks, postoffice and street railway lines, and secures to travelers immunity from the annoyance of of a long transfer across the city.

Another cause of the Lake Shore's popularity is the fact that it is the only line conveying passengers over the four track New York Central into the City of New York without a ferry transfer.

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FOR SALE.—Street Railway, (4 miles), operated with horses, in a growing manufacturing city of 20,000, East of the Alleghenies. For particulars write to "BUELING," care STREET RAILWAY JOURNAL.

FOR SALE—STREET CARS.—On account of increase of business calling for larger cars, we have for sale 9 twelve-foot double-end, box cars, with fare box in each end. Gauge 4 feet 8½ inches. Apply to UNION STREET RAILWAY Co., New Bedford, Mass.

FOR SALE.—11 standard gauge, very light, ten-foot Double End Street Cars-Built by Stephenson. Seat 12. Repaired and repainted in excellent manner. Price $300 each. Cash or part cash; balance on installments. HUMPHREYS & SAYCE, 10 Wall St., New York.

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WANTED.—By an electrical engineer familiar with all branches of the profession and expert in experimental work, particularly telegraphic and telephonic. Is desirous of engaging with parties who have new invention or system to develop and introduce. Has had extensive practice in Europe, both with apparatus and with patents. Practical operator, long experience, best references, modest expectations. Address "MULTIPLEX," care STREET RAILWAY JOURNAL.

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1 Hazelton Tripod Boiler, 150 H. P.,
1 " " 300 "

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Electric Cars in Albany.

Under the heading "Notes from the Field," in the January issue of the STREET RAILWAY JOURNAL, we gave a detailed account of the operation of the electric lines of the Albany Railway Co. In the same connection we take pleasure in presenting the accompanying illustrations, Fig. 1 illustrates, in a striking manner, the old and the new in the evolution of rapid transit. The car shown to the left of the figure is one of the original horse cars with which the lines were equipped. The centre figure is of a horse car that was employed on State Street before the advent of electric traction, and which ordinarily required four horses to haul up the steep grade, and frequently in snowy weather six horses. An electric car with which the lines were first equipped, manufactured by J. M. Jones' Sons, of Troy, N. Y., is shown at the right of the figure, and as we stated in the previous "Notes," makes the ascent of State Street with apparent ease and fair speed. Fig. 2, given on the next page, shows a view of State Street with three electric cars ascending the eight per cent. grade, and the New York State Capitol in the background. Since our last "Notes" some of the new cars, with Thomson-Houston S. R. G. motors, have been put in service.

Rapid Transit in Omaha.

THE OMAHA STREET RAILWAY.

The present company who control all lines running in Omaha with the exception of that to Council Bluffs, and the Benson & Halcyon Heights Railway, a suburban line, are composed of three originally distinct companies, the Omaha Cable Tramway, the Omaha Horse Railway and the Omaha Motor Co. The result of the simultaneous existence of these three roads, until their consolidation, was great competition which damaged all three, by building unnecessary lines, and by running some in the wrong direction. The three companies, appreciating their imprudence, very sensibly joined hands and formed the Omaha Street Railway Co. The result of this amalgamation has been the abandonment of unprofitable lines and the substitution of electricity on the horse roads and on the Harney Street cable line, the result of which has been a great saving of expenses. Notwithstanding this good management a troublesome obstacle has constantly to be contended against, and that is the natural disadvantages of the city. Above Twentieth Street the city is very sparsely settled. Just west of the new City Hall on Eighteenth and Farnam Streets—the latter the principal business thoroughfare of the city—a great deal of open



FIG. 1.—THE OLD AND THE NEW IN RAPID TRANSIT—ALBANY, N. Y., STREET RAILWAY.

country is encountered, the houses are scattered over a great deal of territory, and there are deep ravines on each side of the street. This is the situation out as far as the western city limits. Besides, the grades are extremely heavy and there are a great number of them. There is one on Farnam Street of nine and a half per cent. and they range in general from four per cent. to nine per cent. The result is that on some lines trailers cannot be run, but it is necessary to run a more frequent service of motor cars which, in passing, is much more convenient for the public. Notwithstanding these disadvantages the public are well pleased with the rapid transit afforded by the company's cars. When the question was asked whether the traveling public would consent to returning to the horse cars, the answer was a most emphatic "No," and that whether the company would be willing to make the change met with the same reply.

There are at present in operation about fifty-three miles of electric road and six and a half of cable. The standard rail used on the former weighs fifty-eight and a half pounds to the yard, of the Johnson girder type with a very small flange. On the cable road and the Harney Street electric line there is used a forty-five pound to the yard, section D, centre bearing, Johnson girder rail. Oak ties are employed to a greater extent than any other. On the down-town portion of the city they are laid sixteen inches from centre to centre, as in railroad practice, while at the outskirts they are laid five feet apart. All joints are suspended between two ties laid sixteen inches from centre to centre. The curve rails are of the same type as the straight rails, but are provided with guards. The joints are standing up very well where the ties are laid close together, but not otherwise. There is a good deal of pounding to be observed on the western portion of the Farnam Street line.

The general manager of the company, Mr. W. A. Smith, stated that the joints stood up better on single track lines where the cars ran in both directions, than on double track roads where they ran in one direction only. He said that he had noticed in stringer construction that the stringer joint plates were worn at one end only on double track lines, and the head of the rail beaten down where the car jumped from one rail to the other, and on single track lines the joint plates were worn at both ends and the rail heads were smooth. He also stated that he would advise the use of a girder rail by all means in the city streets, but a T rail in the outlying districts where the authorities would allow it. The steepest grades on the various lines are very abrupt, and, in consequence, it has been necessary several times to bend the rails vertically. There are not many short curves, the radius of the shortest being about thirty-eight feet; the rest range all the way up to sixty feet. The poles to support the trolley wires are of pine, with the exception of those on the viaducts, which are of steel. On the Edison lines No. 00 trolley wire is used, and on the Thomson-Houston lines No. 0. No guard wires are used to prevent interference with the telephone service.

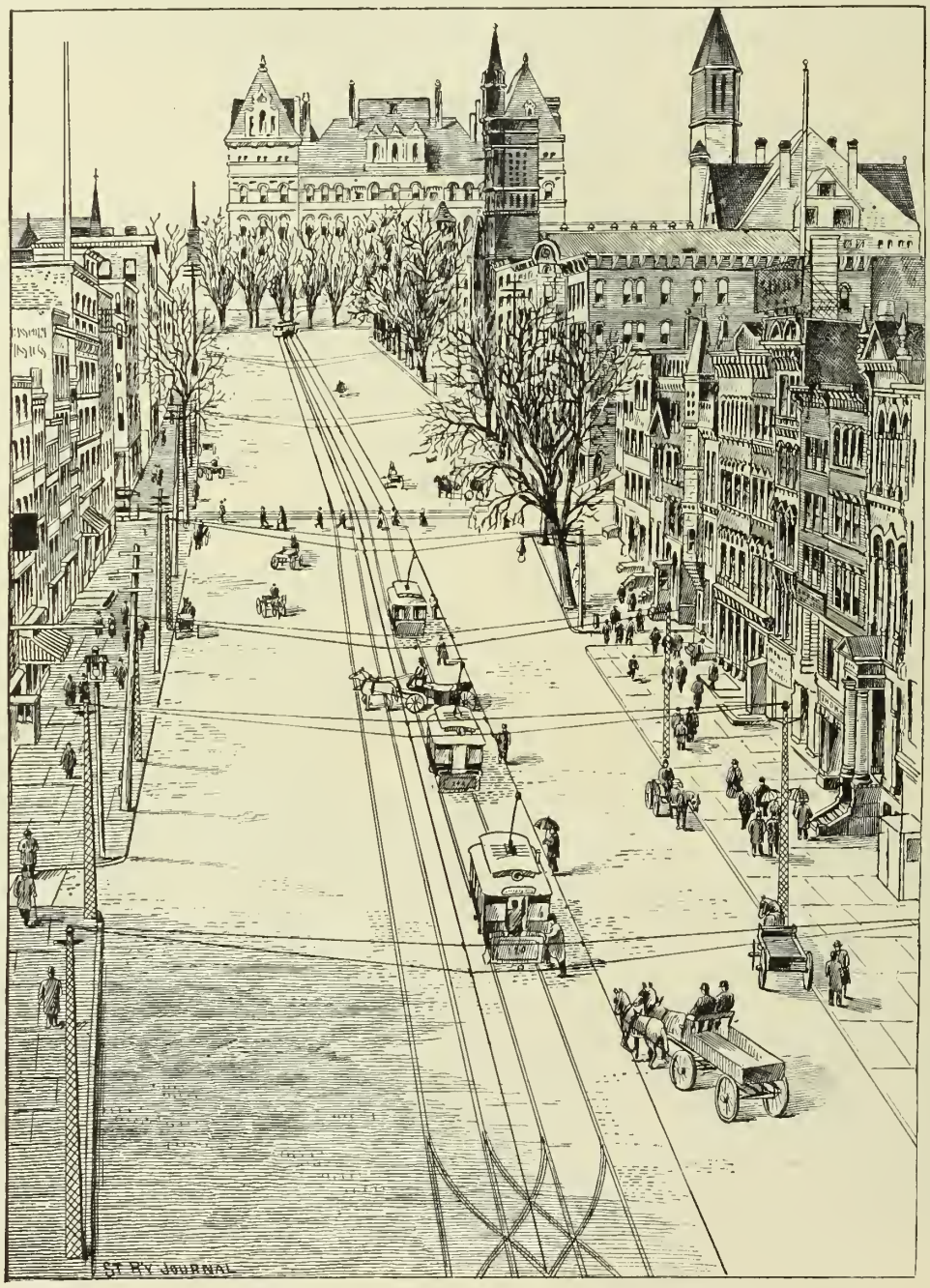


FIG. 2.—VIEW ON STATE STREET—ALBANY STREET RAILWAY.

There are two electric systems employed by the company, the Edison and the Thomson-Houston. There are at present in operation forty-five Edison and thirty-one Thomson-Houston motor cars, each equipped with two fifteen H. P. motors. This number has been distributed over seven routes, namely, the Walnut Hill line, eleven and three-quarters miles long, and operating one-half Edison and one-half Thomson-Houston motor cars; the South Omaha line, eighteen miles long, operating Thomson-Houston cars; the Farnam Street line, six and a third miles long, operating Edison cars; the Park Avenue & North Twenty-fourth Street line, thirteen and a half miles long, operating Edison cars; the Harney Street line, four and three-fifths miles long, operating Edison cars; the Thirteenth Street line, six miles long, operating Edison cars. The above mileage represents single track. The Walnut Hill line was the first in the city to be operated by electricity, and has been running almost three years. About two-thirds of the motor cars haul trail cars. The cable equipment consists of twenty-two grip cars and twenty-two trailers; the latter are duplicated in summer by open cars. About two-thirds of the car equipment was supplied by the John Stephenson Co. Ltd., and one-third by the Pullman car company.

There is but one cable road in operation at present, the Dodge and Twentieth Streets line. This has been operating about four years, and is the only line in the city that uses track brakes. There was another cable line running on Harney and West Dodge Streets where five trains were in operation. It proved very unprofitable, and was replaced by four Edison electric cars. It has been rumored that the Dodge Street line is also unprofitable, but as it is next to impossible for an electric car to climb the grades along its route the cable cars have been retained. When the Harney Street line discontinued operating as a cable line the reserve power was utilized for running two 135 H. P. Edison generators. The engine doing this work is of 600 H. P., and operates the generators by an extension of the flywheel shaft, and on to which was coupled a large flywheel connecting by a belt to Hill clutch pulleys which in turn operate the two generators by means of belt connection with the latter. The generators in this power plant are of the latest Edison type.

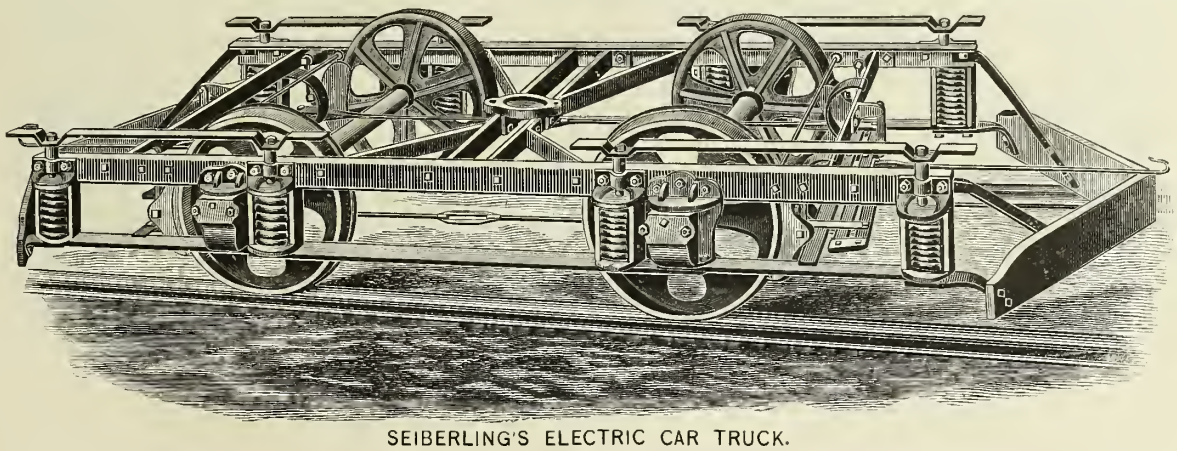
Since the publication of the last article in the STREET RAILWAY JOURNAL on the Omaha street railways there has been but one addition to the power, an increase in the Edison plant. At that time there were two Westinghouse compound engines of 250 H. P. each in the latter plant. There has since been added a 600 H. P. E. P. Allis tandem Corliss engine. This machine does the greatest credit to the manufacturers, standing up splendidly under the varying loads attendant upon the roads. The cut-off mechanism is a fine piece of workmanship, and represents the latest designs in the Allis company's machines. The cylinder dimensions of this engine are 24 ins. × 36 ins. × 48 ins. The switch board is not elaborate, but is very neatly fitted up. We noticed that the indicators showed very little variation in the amperage. There are at present ten Edison generators in the plant of 100 H. P. each, one-half of which number is kept in reserve. The Allis engine operates one force, while the two Westinghouse engines operate the other. In connection with the Allis engine and its generators is used the Hill clutch, and with the Westinghouse engines and their generators the Eclipse clutch. The boiler equipment was increased when the Allis engine was put in by the addition of five boilers of 100 H. P. each, made by the Milwaukee Boiler Co. of Milwaukee, Wis. The entire boiler equipment has at present a capacity of 1,000 H. P. The steam piping outfit is overhead. The smokestack is of brick, and is 125 ft. in height. The trolley wires are so connected with the power station that one or more stations or parts of stations can operate one or all lines, or, in other words, the power at command is perfectly interchangeable.

The company wind their own armatures and have a fully equipped machine shop for the purpose. The cores have to be b ught, but the winding is an easy matter if put into the hands of a few intelligent and experienced men, such as the Omaha management certainly have in their employ.

The number of passengers carried within the last two years is as follows: In 1890, 11,900,000; in 1891, 12,500,000. There are but eight horse cars in operation at present; they are chiefly employed in traversing lines not in full operation, and run upon them to hold the franchises. Most of the old horse cars are now used as trailers.

THE BENSON & HALCYON HEIGHTS RAILWAY.

This road is owned by Mr. William Crary, of Omaha, is suburban in character, and was built to build up Benson and Halcyon Heights, two suburbs of Omaha. It is two miles in length, single track, with one turnout, and at its eastern terminus connects with the Walnut Hill line. Its trolley wires connect with those of the latter, and thus it derives its current from the Thomson-Houston power station of the Omaha Street Railway. The roadbed is laid with a twenty pound to the yard T rail which is bending between ties laid about three feet apart. Two cars constitute the present equipment of the line. They were made by the J. G. Brill Co., of Philadelphia, are painted white and are neatly fitted up. They are equipped with fifteen H. P. single reduction Westinghouse motors, resting on two spiral springs and mounted on a McGuire standard truck. Each car is provided with a Burton electric heater, which gives great satisfaction. The car shed only accommodates the two cars and a small bench for tools and repairing purposes. The car equipment will undoubtedly be increased in the spring, as business will certainly demand it. One Sunday afternoon last fall both cars carried 1,200 passengers, and one car has carried the extraordinary number of 120 on one trip. Both cars are of the standard length, sixteen feet, and each makes 112 miles per day. The Westinghouse single reduction motor is practically noiseless and brings the car up a heavy grade with a celerity and an ease that are admirable.



SEIBERLING'S ELECTRIC CAR TRUCK.

THE OMAHA & COUNCIL BLUFFS RAILWAY & BRIDGE CO.

Practically no changes have taken place on this road since it was last described in the STREET RAILWAY JOURNAL. The car equipment has been increased by a few cars. The management is at present trying a new rail joint on the portion of the road laid with T rails, and which is about the same as the one adopted by the Broadway (N. Y.) cable road.

A New Electric Car Truck.

A new type of truck for electric cars designed by J. F. Seiberling, president of the Akron Street Railway Co., of Akron, O., has been in use for some time on the line of that road with satisfactory results. The principal features of this truck, which is illustrated in the accompanying engraving, are simplicity, durability and strength. It has, as shown, two sills which are the main support of the car body; these are mounted on the car axle in the usual way and on them are suspended four brackets with the coil springs which support the car by carrying plates. Ample space is allowed for the motor.

The brake operates on the four wheels simultaneously and, as will be seen, the leverage being large, its application is quite simple. Five of these trucks have been in use since the spring of 1891 on the Akron railway, above mentioned, carrying heavy Pullman cars with perfect suc-

cess. During the summer the loads on these cars have been as high as 150 passengers at one time. The line has heavy grades, so that the car brakes have been tested severely, but no difficulty has been experienced in controlling the cars. The parts are all substantially constructed and put together and no renewals have been required except for brake shoes during the nine months of service. A number of these trucks will soon be installed on the electric line at Zanesville, O., and the inventors propose to manufacture them for the general market during the coming season



FIG. 1.—BOWLING GREEN LOOP—BROADWAY CABLE RAILWAY.

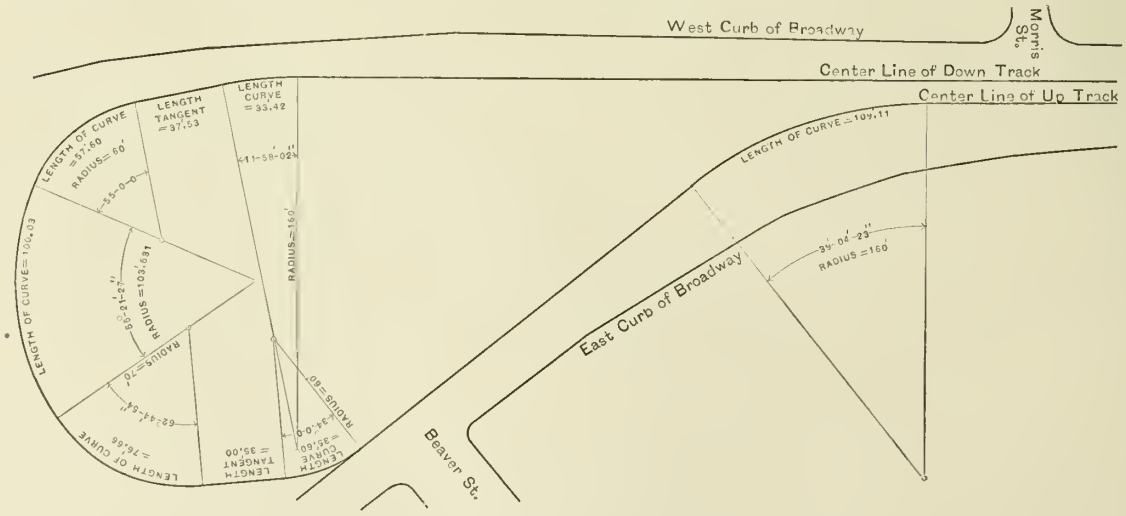


FIG 2.—PLAN OF BOWLING GREEN LOOP—BROADWAY CABLE RAILWAY.

IN THE STREET CAR.—"Paul, sit still or you'll get a thrashing!" "Mamma, if you punish me I shall tell the conductor that I was four years old yesterday, then you'll have to pay."—*Fliegende Blatter.*

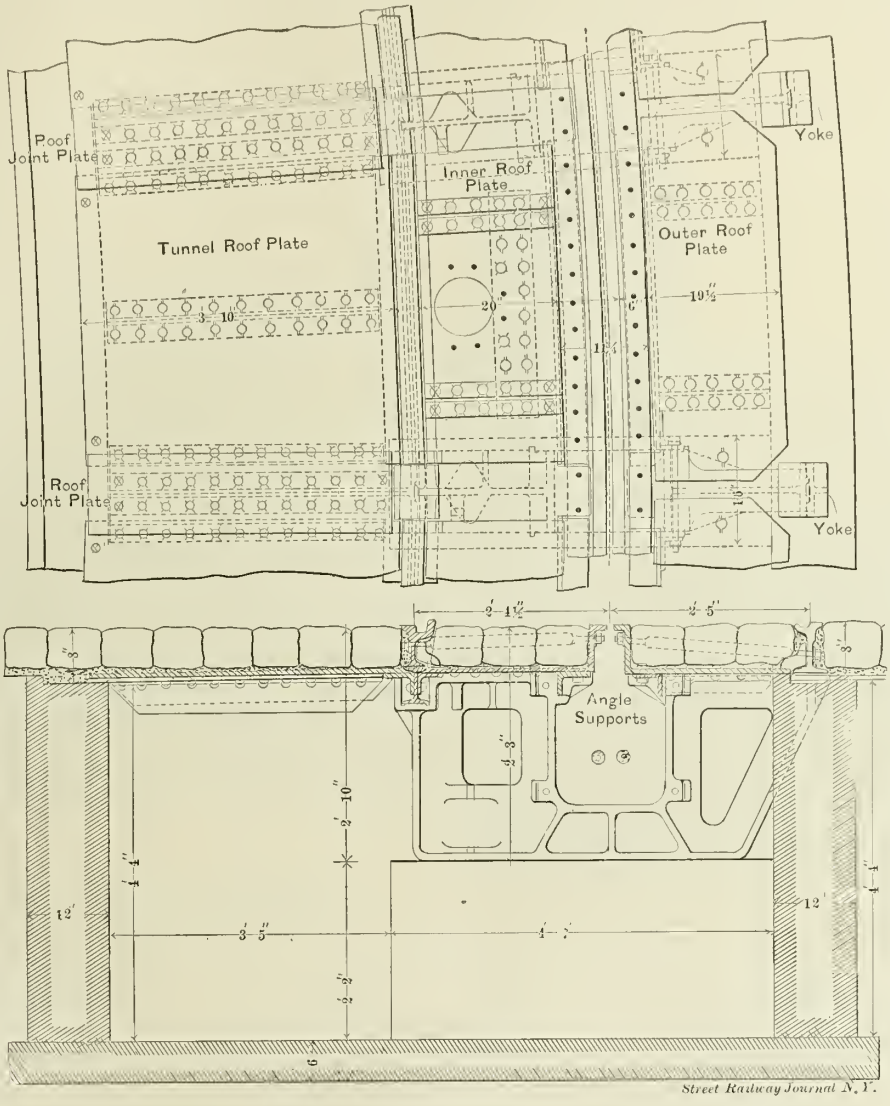
The Broadway (N. Y.) Cable Railway.

The work of laying the conduit and rails for the extensive cable line on Broadway has been almost completed, the only portion remaining to be done being a short section at the lower terminus of the road at South Ferry. Broadway is again open for uninterrupted traffic, and the street cars will continue to be operated by horse power over the cable tracks until the summer or fall, when it is hoped the cable will be in operation. The engineers in charge of the work are now busily engaged in perfecting the working drawings of the power stations and other details in regard to the road. As has already been stated, there will be two main stations, one of which will be at Fifty-first Street and Sixth Avenue and the second in a large building to be erected by the company at the corner of Broadway and Houston Street. There

will also be a third smaller station, to operate the loop between South Ferry and Bowling Green, the location of which has not been decided upon.

The present Broadway car stables cover nearly the entire block bounded by Seventh Avenue, Fiftieth Street, Sixth Avenue and Fifty-first Street. Work has already been commenced at the Sixth Avenue end for the power station which will occupy this portion of the building from Fiftieth to Fifty-first, the horses formerly stabled at that end being transferred to another part of the building. The architect of this power station and car house is W. B. Powell, of Philadelphia. The architects of the Houston Street station are McKim, Mead & White.

The road is divided into four sections. The first of these will extend from Fifty-ninth Street and Seventh Avenue to Thirty-sixth Street and Broadway, and will be operated from the upper station. The second section will extend on Broadway from Thirty-sixth Street to Houston Street and the third from Houston Street to Bowling Green, these two being operated from the Houston Street station. The fourth section, that between Bowling Green and South Ferry, has already been referred to. The duplex system of cables will be used throughout, except for the South Ferry loop, which will have a single rope. The last portion of the street construction on the main line to be finished was that at Bowling Green, of which we present an illustration in Fig. 1. The problem presented here compelled the adoption of a three centre curve in making the circuit of Bowling Green. The radii of the several curves are 60 ft., 103½ ft. and 70 ft. The curve pulleys will be placed here, as elsewhere, four and a half feet apart. Fig. 2, shows a plan of the loop. Figs. 3 and 4 are reductions from the working drawings of the curve construction used.



FIGS. 3 AND 4.—CURVE CONSTRUCTION—BROADWAY CABLE RAILWAY.

As will be seen from these drawings, a tunnel is provided on the concave side of each track of the curve by which access to the carrying sheaves may be had. The yokes are supported upon a brick foundation fifty-five and a half inches wide and twenty-six inches high which in turn rests on a concrete floor six inches deep, as shown. The retaining walls are twelve inches thick. The tram rails are, for clearness, not shown in Fig. 3. A method of arrangement for the carrying sheaves at curves which has been proposed, but has not been finally determined upon, is shown in Fig. 5.

On tangents the two cables in the conduit run at a distance of threee and a half inches apart, and on the same level, except at the approach to curves when one is carried above the normal level, and the other is lowered below that level. A special device will be used at the beginning of each curve by which the grip can be carried a constant height irrespective of which cable is being used, with a certainty of the cable returning to its proper sheave when released.

The present proposition is that every other car at Bowling Green will pass around the loop, and that the alternate cars will release the main cable and connect with the cable on the lower loop to carry them to South Ferry. The cars on the main line during the busy portions of the day will run on forty seconds headway. The length of the car decided upon is thirty feet, to be mounted on four wheels with a nine foot wheel base. The contract for these cars, at the date of publication, had not been awarded.

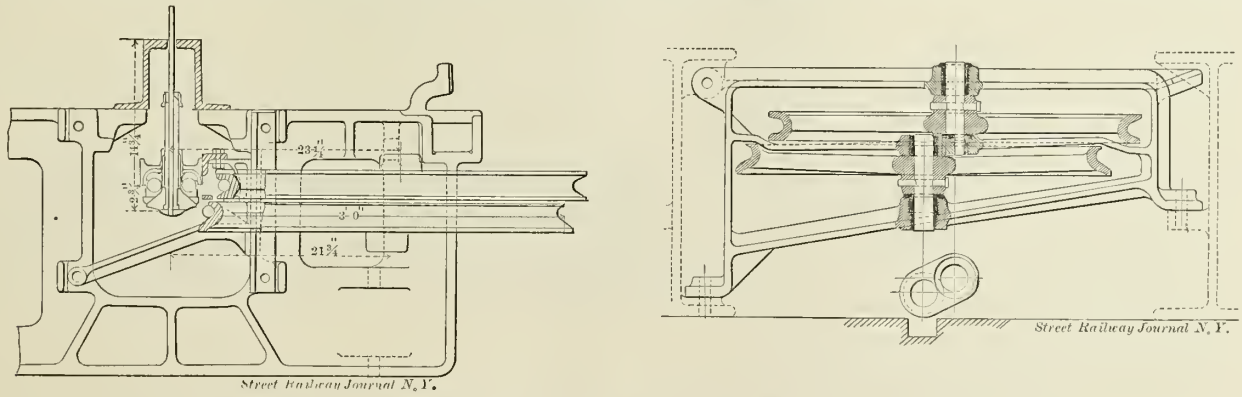


FIG. 5.—PROPOSED ARRANGEMENT OF CURVE PULLEYS—BROADWAY CABLE RAILWAY.

THE Philadelphia & Reading Railroad have ordered two electric switch engines built by the Thomson-Houston Electric Co. These will operate on the overhead system, wires for that purpose being strung through the company's yards.

Automatic Electric Car Lighting in a Chicago Tunnel.

The cars of the North Chicago Railway Co. pass through the La Salle Street tunnel which connects the north and south divisions of the city. This passage under



FIG. 1.—CARS ENTERING AND LEAVING CHICAGO TUNNEL.

the Chicago River is brilliantly lighted by arc lamps which, for the most part, are suspended from the roof of the tunnel. While the illumination is brilliant outside the car so that the gripman can see as well as in the daylight, the car roof shuts out the light from the interior and the passenger is unable comfortably to continue the perusal of his paper. To enhance the comfort of the passengers the company have introduced a system for lighting the cars by electricity while they are passing through the tunnel.

To the electric railway man the plan which was followed will be obvious; it is simply an overhead trolley system with a few peculiar details. Fig. 1 shows cars entering and leaving the tunnel. The general arrangement of the trolley can be seen in Fig. 2. It is a little over three feet in length and is ordinarily held horizontal, as shown in the engraving, by a hook resembling in form an inverted L (⅂). When the cars reach the mouth of the tunnel the contact wheel strikes against a copper guide or inverted trough to which a peculiar bend has been given. As a result the trolley arm is pressed down, and out from under the ⅂-shaped hook. The wheel is guided through the chute to the trolley wire; good contact with the latter is insured by a strong spring as in the case of an electric railway trolley. When the car emerges from the tunnel the same operation takes place but in a reverse order, and the trolley is left in a horizontal position, held down by the hook. In the diagram, the chute or guide, the guide rail and the trolley spring are shown.

Three or four lamps are used in each car. In the cars which are now being wired the latter number is used.

The cable cars on the system are run to a great extent in trains of three. In these cases the trolley is located on the grip car, and the others are connected by an ordinary form of connector attached to a flexible insulated conductor.

Current for supplying the lamps is generated in the power house at the corner of La Salle Avenue and Illinois Street, a block north of the northern entrance of the tunnel. Three dynamos are located here, all of the Thomson-Houston type. Two machines furnish the current for the arc lights in the tunnel. The third, a 100 light, 110 volt dynamo, is used entirely for the car lighting system. This dynamo always carries a light load, for during the rush trips not over eight or ten cars are in the tunnel at one time. The ground is used as a return. Connection is made with it through the grip mechanism. This plan was adopted instead of employing the rails for a return, because the latter are dry and sandy and a good contact could not be made.

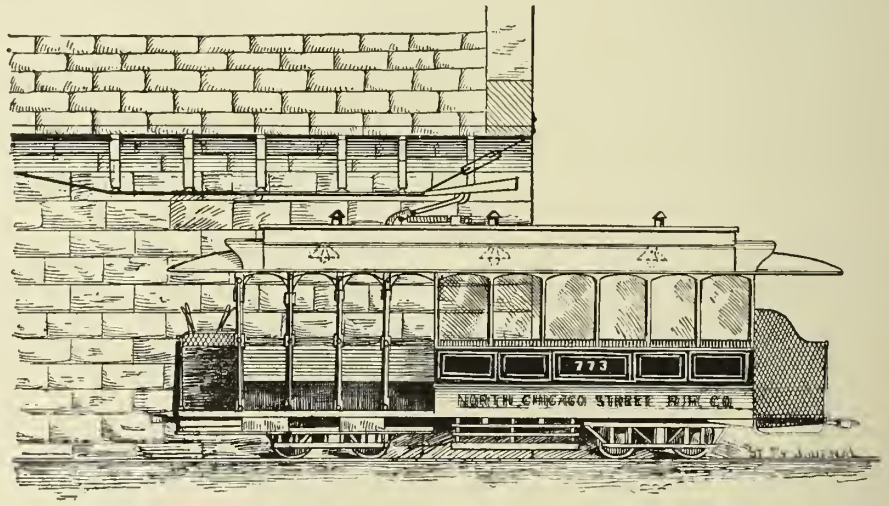


FIG. 2.—DETAILS OF THE ELECTRIC LIGHT SYSTEM IN CHICAGO TUNNEL.

Cleanliness and Godliness.

One of the Chicago papers has been waging war on the street car passengers who, regardless of the rights of others, insist upon indulging in the habit of tobacco chewing while riding on the cars. The results of this practice are sufficiently well known the country over. Efforts have been made to prevent passengers from making nuisances of themselves, but the contract was a large one, and it was difficult for conductors to enforce the regulations without continually getting into trouble. Unfortunately, little if any attention was paid to the prohibition printed on a placard within the car. It had become too familiar; it was rather mandatory in expression. A new sign, which it is hoped will work a reform, has been hung up in the North Side cars. It is worded so as to catch the eye of the most wary, and reads as follows:

> Cleanliness is next to godliness, they say! We can't be gods, but we can be clean. Do not spit on the floor!

Street Railway Convention at Cleveland.

A large number of companies have already engaged quarters at the Cleveland hotels for the convention of the American Street Railway Association. Provision has been made so that ample accommodations will be available for all who attend the meeting. A building has been secured near the Hollenden which will be the headquarters of the Association, for exhibition purposes. It is large and convenient, so that all exhibitors will be provided for.

J. B. Hanna of the local committee of arrangements says the delegates will have a thoroughly enjoyable time, and that they may be perfectly confident they will not be victimized by hotels.

The Healy Steam Motor.

The Healy steam motor is now in operation on two lines running out to a Detroit suburb. The illustration shows the latest type of motor which was recently adopted as a standard. It has recently been stated in the daily papers that C. E. Healy, the inventor of the engine, would leave Detroit and make his headquarters in Chicago, where a plant for the manufacture of the motors would be erected. This report, Mr. Healy says, is incorrect, although he does not deny that he has received overtures from Chicago capitalists.



HEALY STEAM MOTOR CAR IN DETROIT.

The problem which Healy undertook to solve was the construction of a steam motor for street car service, which would be practically noiseless. What has condemned the steam engine for this work has been the puffing of steam. This, it is claimed, has been accomplished and the plan followed is explained in the inventor's own words as follows: "I went at the problem in exactly the opposite way from other workers in this field and enlarged instead of cramping the exhaust. No puffing of steam can now be heard, and, consequently, there is nothing objectionable about the motor. It can be run through crowded streets and no one finds fault with it."

The motor does not create a smoke nuisance; in fact, no more smoke issues from the flue than from the chimney of an ordinary car stove. Hard coal, and gas coke are used as fuel.

The standard motor shown in the illustration weighs five tons. As to the capacity in horse power Mr. Healy makes no statement, for the reason that he has made no tests to ascertain it. He states, however, that the motor has drawn five loaded freight cars "without slack." He uses a steam brake of his own design.

In regard to the economy Mr. Healy states that eighteen cents' worth of fuel runs the motor one hour. He asserts with great confidence that the operating expenses are much less than any tram locomotive in the market; indeed, he goes so far as to say that they will be found greatly below those of an electric railway even when compound engines drive the generators.

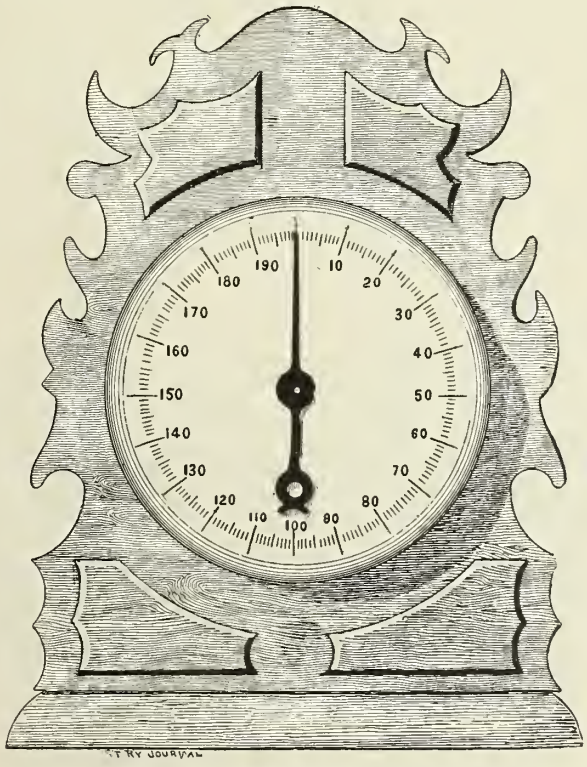
Seven motors are now in use on the two lines mentioned. An order has recently been received for motors to be operated on the line connecting Owosso and Corunna.

THE Augusta (Ga.) Railway Co. have recently installed a number of arc lights operated by the railway circuit. The Ward lamp is used.

An Electrical Fare Register.

A fare register for electric cars and operated by electricity derived from the same source as that for operating the car has been devised by A. O. Mackin, of Johnstown Pa. The general appearance is shown below.

The face of the register is formed on the flat surface of the bell and registers up to 200 fares. In addition there is a secret record kept within the register where consecutive fares can be registered.



AN ELECTRIC FARE REGISTER

The interior mechanism of the register consists of a small brass cog wheel having a lever and ratchet movement, the lever being operated by an electric magnet; the circuit through the core of this magnet is made by the conductor by pressing suitable switches situated at different points in the car. The secret record is made upon a roll of paper drawn from one spindle to another.

Toledo Line Wagons.

The wagons used by the Toledo Electric Railway were made in accordance with designs made by officers of the company. They have served their purpose well, and are



FIG. 1.—TOLEDO "HURRY UP" WAGON CLOSED.

now considered essential parts of the equipment. The two wagons for line work are illustrated in the accompanying engravings. Figs. 1 and 2 show the "hurry up" wagon. The framework, ordinarily, is folded in the vehicle, as shown in Fig. 1; but on reaching the point where the hurried job of repairing is to be performed, the superstructure may be raised, as shown in Fig. 2, in half a minute. This is accomplished by means of a crank at the end of the wagon, which turns the reel on which the cable running to the top of the upright or stake is wound. The

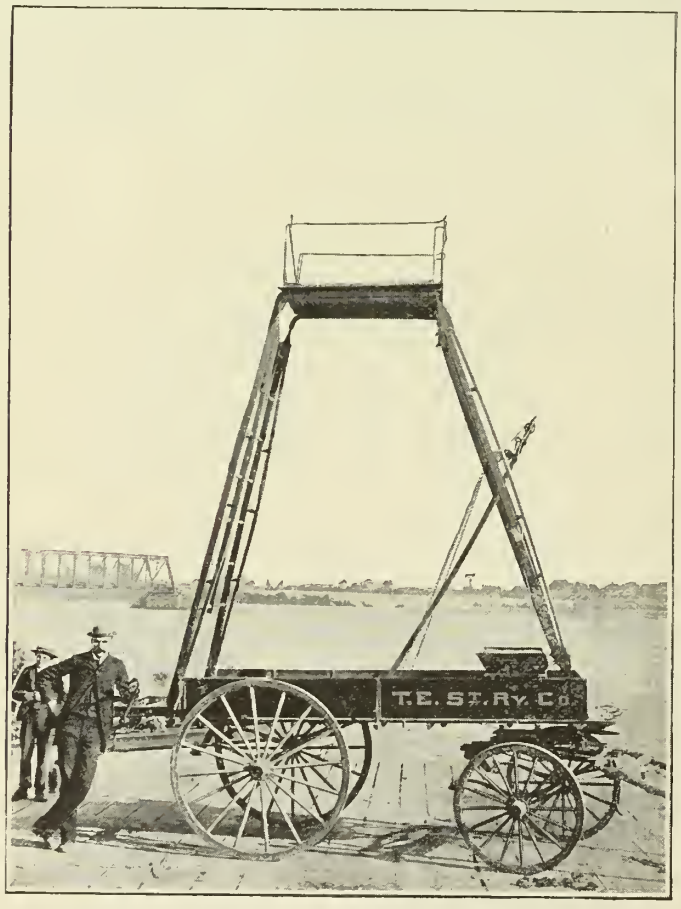


FIG. 2.—TOLEDO "HURRY UP" WAGON OPEN.

platform is thrown into position by the workman as soon as he mounts one of the two ladders on the framework. The platform is protected by an iron guard rail which folds down when desired. The arrangement is such that the framework can be raised to any desired height; whatever this may be the platform is always level. The wagon is provided with a gong, so that an alarm may be sounded when a hurried run is made to a point where repairs are needed.

The regular line wagon is illustrated in Fig. 3. The distance between the wheels is four feet eight inches, and the platform has the same width. The latter can be widened four feet on each side by raising folding extensions, which are supported by two iron rods fastened in the main upright. The advantage of this arrangement is obvious. Work can be carried on at the same time on both wires on a double track or at a switch. The framework on which the platform is supported may be raised or lowered when necessary, as for example, in working under a bridge. On the body of the wagon tools and supplies are carried.

Switch and Signal Tower, Chicago.

Since the introduction of the cable system on the West Side in Chicago the operating company have adopted



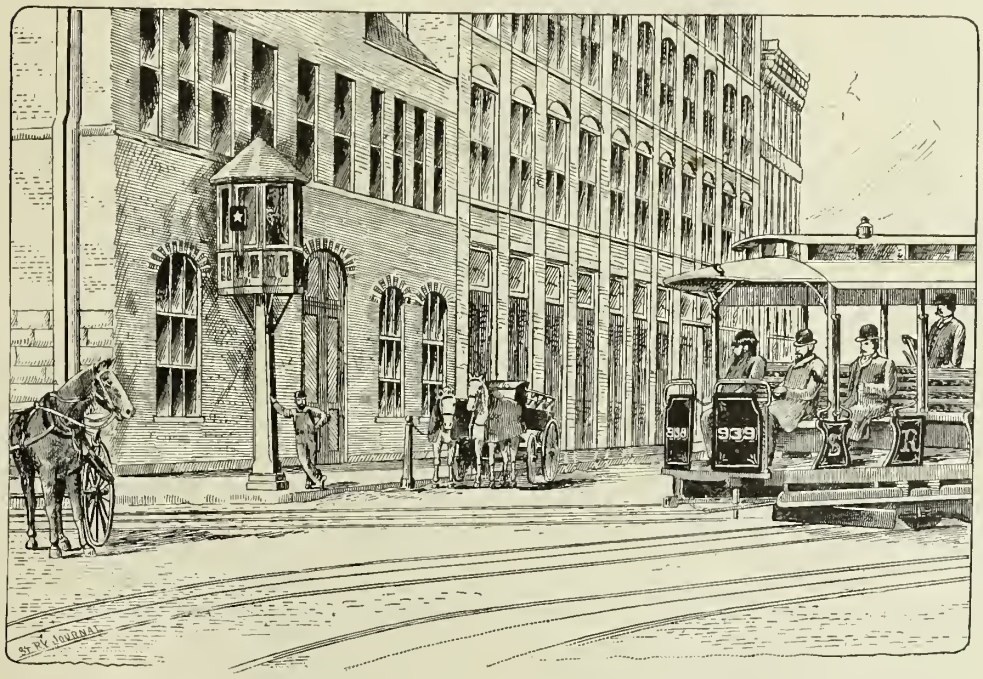
FIG. 3.—TOLEDO STANDARD LINE WAGON.

a number of improvements in details, which have increased the reliability and safety of the service. One of the most interesting and important of the auxiliary devices is the switch and signal tower at the corner of Washington and Jefferson Streets. The Madison Street and Milwaukee Avenue cars which use the same tracks up to this point diverge at this corner. The former turn to the south; the latter continue westward for a block.

The switch is located 200 ft. east of the corner, and it was formerly operated with a lever by an employe stationed between the track and the curbing. This method was found to be objectionable. The traffic at this point is quite considerable, so much so that it formerly caused delays in one of two ways: Either the switchman was driven from his post by wagons, and the cars remained at a standstill till he was able to return, or the drivers, to avoid the switchman, would turn their vehicles on the tracks and a blockade would follow. The annoyance was so great that it led to the present system in which the switch is moved by compressed air.

The tower, which is located on the northwest corner of Washington and Jefferson Streets, is fifteen feet in height. The little windowed station is supported by a hollow iron column. The operator reaches his post by steps on the column. The little apartment is just large enough for the switchman to turn about when sitting down. This tiny room is extremely comfortable even on the coldest day, for steam is carried in a pipe from the power house, a few feet distant, up through the centre of the supporting column to the switch station where it can be regulated by a valve.

The switch, 200 ft. east, can always be seen by the operator, so that he can tell whether the compressed air has done its work. At night the switch can be seen by the light of a city arc lamp; as an additional precaution the rays of a 100 C. P. incandescent lamp are thrown on the switch by a reflector attached to the lamp post.



SWITCH AND SIGNAL TOWER—WEST SIDE RAILWAY, CHICAGO.

The air is compressed in a small reservoir in the power station. The pressure ranges from twenty-five to thirty pounds; if it increases materially the reservoir is relieved by a device practically identical to the safety valve of a steam engine. The compressed air passes up through the hollow supporting column to the signal station and thence to the cylinder which operates the switch. The operation of the cylinder is not different from that of an engine. The admission of compressed air through the pipe connected to one end of the cylinder throws the switch in one direction; the opposite movement is effected by the admission of air through the second pipe leading to the other end.

The duties of the switchman are simple. With his left hand he controls the cock which admits and releases the compressed air from the pipes; with his right hand he turns the signal which guides the gripmen.

While the switchman is always supposed to be able to see the switch, he has in front of him an indicator which shows how the switch stands. This device is extremely simple; it is merely an arm actuated by the exhaust, which points to the words "Madison" and "Milwaukee," This indicator, while almost superfluous ordinarily, is useful, of course, in a fog. One other device completes the equipment of the station; this is an alarm box by means of which a signal may be sent to the engineer to stop the power. In case of an accident of any kind the ropes can be stopped within a minute or two.

The signal is four-sided; three sides are red and the fourth green with a white star. The gripman must see the green before he can start. It was at first intended to operate the signals by the exhaust, but it was subsequently decided that the operator could manipulate it to better advantage. Experience has demonstrated that this decision was wise. At night an ordinary railway switch lantern was used, with three red windows and the fourth green.

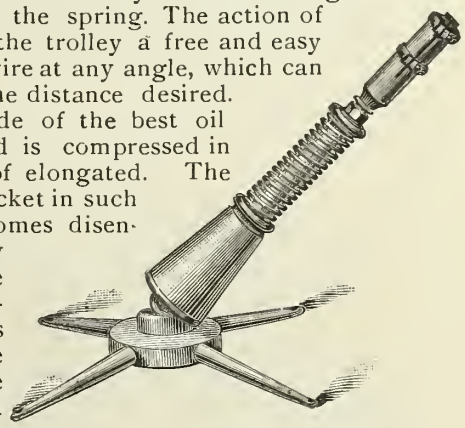
Practice has demonstrated that the signal tower is successful in all respects. The location of a man there where his vision is not cut off by carts, and where he is not in momentary danger of being run over, makes his work far superior to that of his predecessor the flagman. The arrangement of the signal is such that the gripman cannot make a mistake except through gross carelessness. The operator has complete control of the switch so that no time is lost. The result of the operation of the new system has been the almost complete avoidance of accidents and collisions at, perhaps, the worst corner on the West Side.

The illustration is reproduced from a photograph taken while a Madison Street train from the east is turning from Washington Street into Jefferson Street. The view is taken on Jefferson Street looking north. It will be noticed that a star is shown on the signal which permits the gripman coming in the opposite direction on Jefferson Street to advance.

The company's power house is at the building on the left. The horses at the right of the power house are attached to the wrecking wagon which is always kept in readiness. The driver stands leaning against the signal tower.

Bill Trolley Base.

The Bill trolley base shown in the illustration has but one spring, which gives a steady pressure on the wire. It is so made that the pole may come to the roof of the car without injury to the spring. The pole can be swung from front to the rear of the car at an almost horizontal position without injury to the base, and it can also be left in a horizontal position for any reasonable length of time without injury to the spring. The action of the base gives to the trolley a free and easy movement on the wire at any angle, which can be regulated to the distance desired. The spring is made of the best oil tempered steel, and is compressed in its action instead of elongated. The pole is held in a socket in such a way that it becomes disengaged if the trolley should catch in the wire, so that breaking of the latter is prevented. The castings are of the best grey iron, and are neat in design, without angles to cause easy breaking. The base weighs fifty-five pounds complete, and has been commended by all those using it. Alfred G. Hathaway, of Cleveland, is the sole agent for the trolley base.



BILL TROLLEY BASE.

New Grip Cars for a Chicago Company.

The North Chicago Railway Co. have started the construction of ten new grip cars in their new car shops at the corner of Fullerton Avenue and Sheffield Street. The cars will be exceedingly strong and well built, and will embody some new features. The interesting fact about this construction lies in the probability that, hereafter, the North Side company will engage in car building.

Steam Tramway Locomotive for Chicago.

The North Chicago Railway Co. will make the experiment of running a tramway locomotive on certain sections of their line. When the president of the company, Charles T. Yerkes, was in Europe last summer he came to the conclusion that a steam motor such as he had seen in operation in several places could be used to advantage by the company. He found a type in Paris which seemed to be noiseless and to give satisfaction. Mr. Yerkes determined to order an engine of similar design, and he gave the order to Carels Bros., of Ghent, Belgium. It has recently reached Chicago, and has since then been in charge of Superintendent Miller at the car shops, Sheffield Avenue, where the photograph for the accompanying was taken.



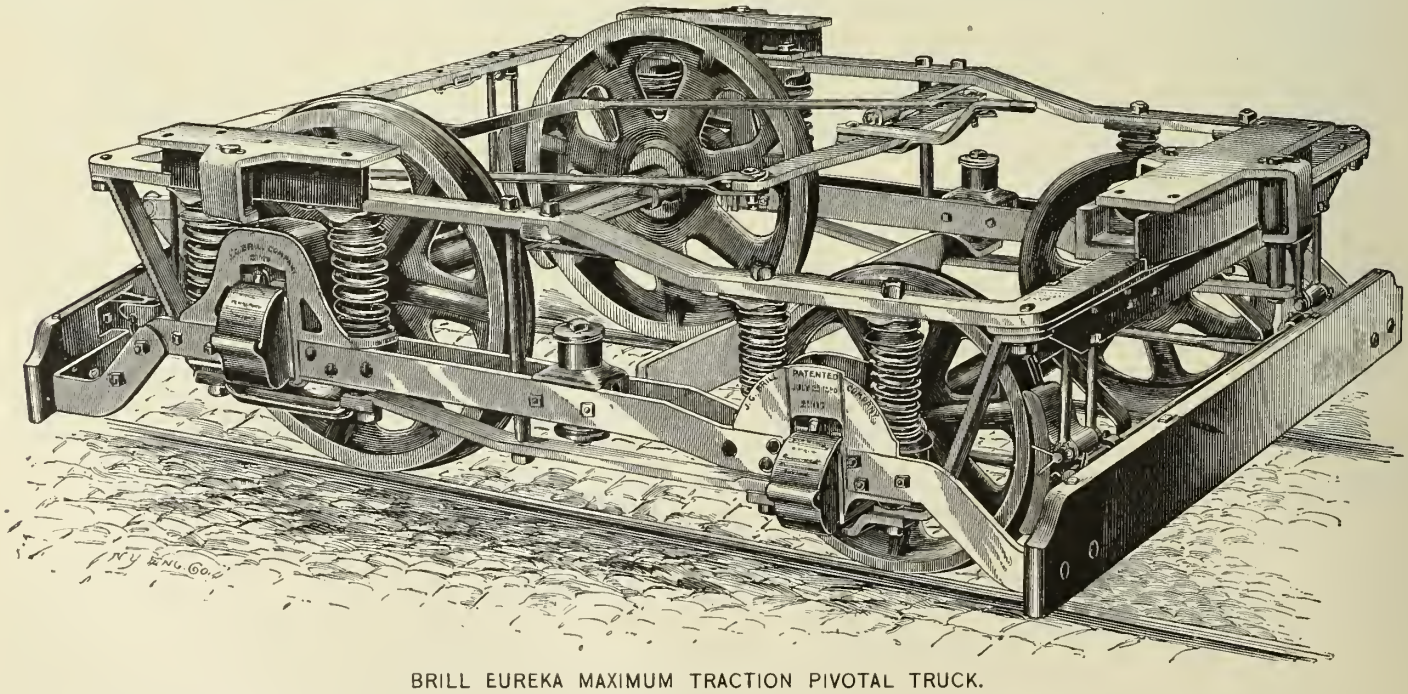
STEAM TRAMWAY LOCOMOTIVE FOR CHICAGO

The locomotive is built entirely of steel, and the construction is of the most substantial character. Its weight is about seven tons. It is twelve feet in length, seven feet eight inches in width and nine feet high. The engines, which are below the floor, drive directly the four driving wheels. The engines are of the double cylinder pattern. The exhaust steam passes into the series of condenser pipes which are shown on the roof of the locomotive.

Eureka Maximum Traction Pivotal Truck.

When John A. Brill's maximum traction truck was invented many of the disadvantages of pivotal trucks were overcome. The height of the car body was reduced ten inches, and the necessity of double steps was thereby obviated. The wheel base was shortened, and the amount of power required was materially reduced. A gain in traction of forty-two and one-half per cent. was secured, it was also claimed. The only objectionable feature—although this was not by any means serious—resulted from the fact that the pivotal centre or drawing point, which came over the axle, was in the way in dismounting the motor and had to be removed, though this trouble was overcome by using a movable spider. In the truck which is illustrated herewith the objection has been entirely overcome.

This truck has been styled the Eureka maximum traction truck. It has no mechanical pivot, and is specially adapted for the "waterproof" and, 'ironclad" types of motors which have their upper portion hinged so that they can be raised when it is necessary to get at the armature or other parts of the motor. The space above that occupied by the motor is free and clear, so that when the trap doors



BRILL EUREKA MAXIMUM TRACTION PIVOTAL TRUCK.

in the cars are raised every part of the motor can be reached and the armature taken out without removing or disturbing any part of the truck. A reduction in the height of the car to the extent of one and a half inches is obtained, and the weight of the truck is reduced by 150 lbs.

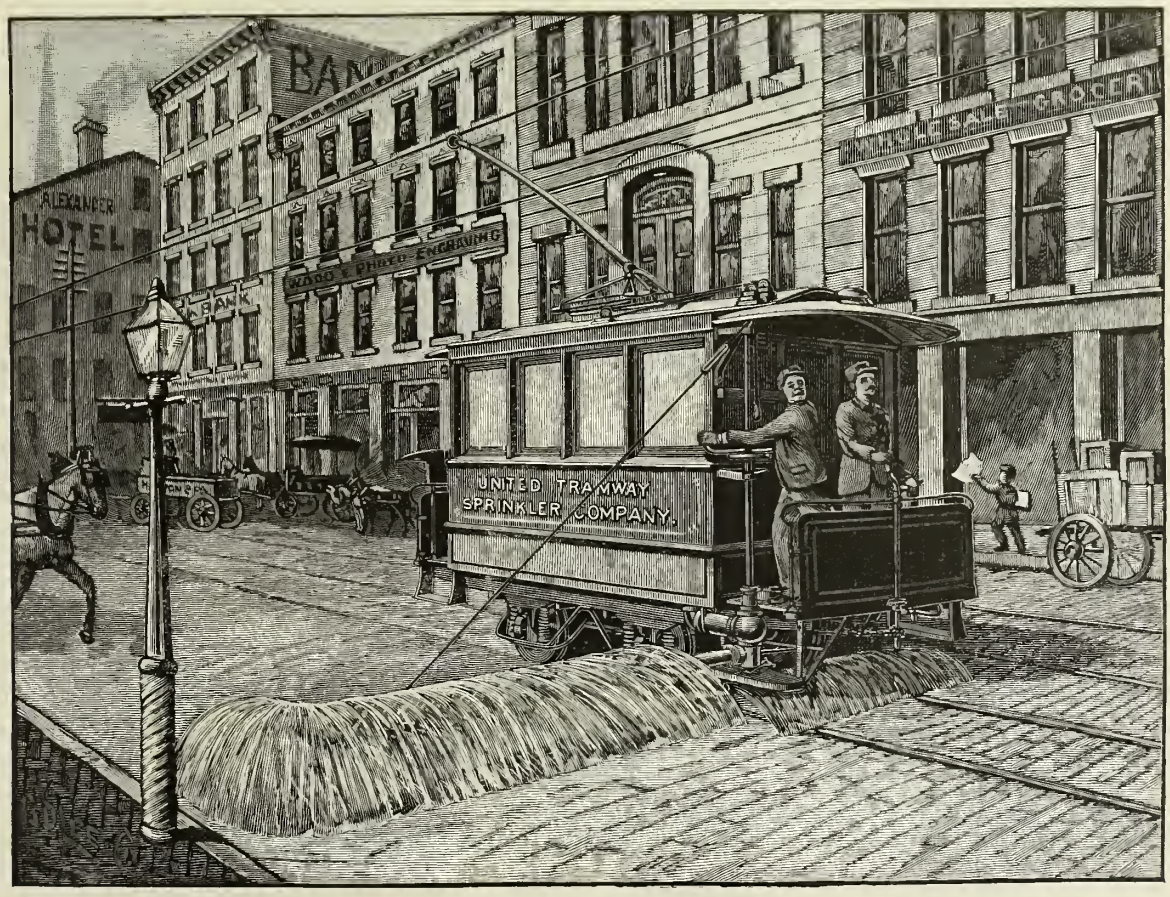
The pivoting in this truck is accomplished by the combination of rollers on the side of the rub plates on the upper part of the truck. The drawing (draught) of the truck and car body is done from the small end of the truck, and this feature affords additional means of keeping the small wheels from climbing the rails. Since their introduction by the J. G. Brill Co. several hundreds of them have been sold and are in operation.

An Electric Street-Sprinkling Car.

The accompanying illustration represents a street-sprinkling car as it appeared while making a regular run on Market street, Louisville, Ky. The device is a tank car not unlike in appearance to an ordinary car, there being blind windows in the sides which may be utilized for advertising purposes. The car is equipped with a cross pipe beneath the floor, which sprinkles the track and a short distance on either side, and a swinging or derrick perforated pipe, which is attached by means of a slip joint to the standpipe and is controlled by means of a lever operated from the front platform. When in operation this pipe is thrown out at right angles to the track and is of sufficient length to sprinkle a very wide street. When not in use, or when it is necessary to pass vehicles or other obstructions, it is swung back to any angle or beneath the projecting sides of the car body alongside the truck. Valves are provided which control the supply of water to the pipe, and there is a mechanism which regulates the discharge orifices. A flush valve at the end provides for discharging any mud or other obstruction that may enter the pipe.

The tank, which holds about 2,000 gals., is charged by means of a hose which is carried on the car, one end being attached to the bottom of the tank by an inlet valve and the other end provided with a coupling which admits of its being attached quickly to a flush hydrant. Hydrants, if not already properly located, should be provided at the terminals and at intervals of about three-quarters of a mile along the route. With proper arrangements the car can be stopped, the tank filled, and the car started in less than two minutes, so that it can be operated between passenger cars running on schedule time, provided it has two or three minutes the start, and the passenger car is required to stop to take on or let off passengers. One of these cars, it is claimed, will distribute daily between 600 and 700 tons of water.

This car street sprinkler, then operated by horses, was described in our field notes from Louisville in January, 1891, but we understand that during the last season, when operated by electricity it was even more successful than when drawn by horses. Even on Market Street, which is sixty feet wide and often crowded, it is said to have done its work satisfactorily to the people and to the street railway management, as it did not interfere with the passenger traffic.



AN ELECTRIC SPRINKLING CAR.

Other advantages besides the laying of dust to prevent annoyance to passengers and the public are claimed for this system of sprinkling on electric lines. Among these are an improved return circuit by reason of wet rails, and less wear on the motor and running gear owing to the absence of dust. The advantage of wet rails in the saving of power was quite fully explained in a paper by Geo. K. Wheeler, printed in our January issue. As this car not only sprinkles the track but also the remainder of the street, the sprinkling company could doubtless sprinkle the tracks of the railroad in return for the right of way and motive power, and derive its revenue from abutting property owners.

We have seen a number of letters from local railway men and others, fully supporting the claims made for this method of street sprinkling.

Mr. H. H. Littell, while superintendent of the Louisville lines, in a letter endorsing the system, says: "The car has no difficulty in keeping the street sprinkled down from curb to curb and without delaying the cars."

Thos. J. Minary, superintendent of the Louisville Consolidated Street Railway Co., says: "I am very glad to say that we find the system to work successfully, and

would take pleasure in recommending it to the street railroads throughout the country."

Mr. A. V. DuPont, chief stockholder and president of the old Central Passenger Railroad Co., says: "I was at first doubtful whether these cars could be operated on our line without interference with our passenger traffic. I am now convinced of the entire practicability of the system, and it appears to work here even more satisfactorily upon the electric lines than upon the horse car lines. I now regard the system as a valuable accessory in the operation of street railways, and especially to those using electric motor power."

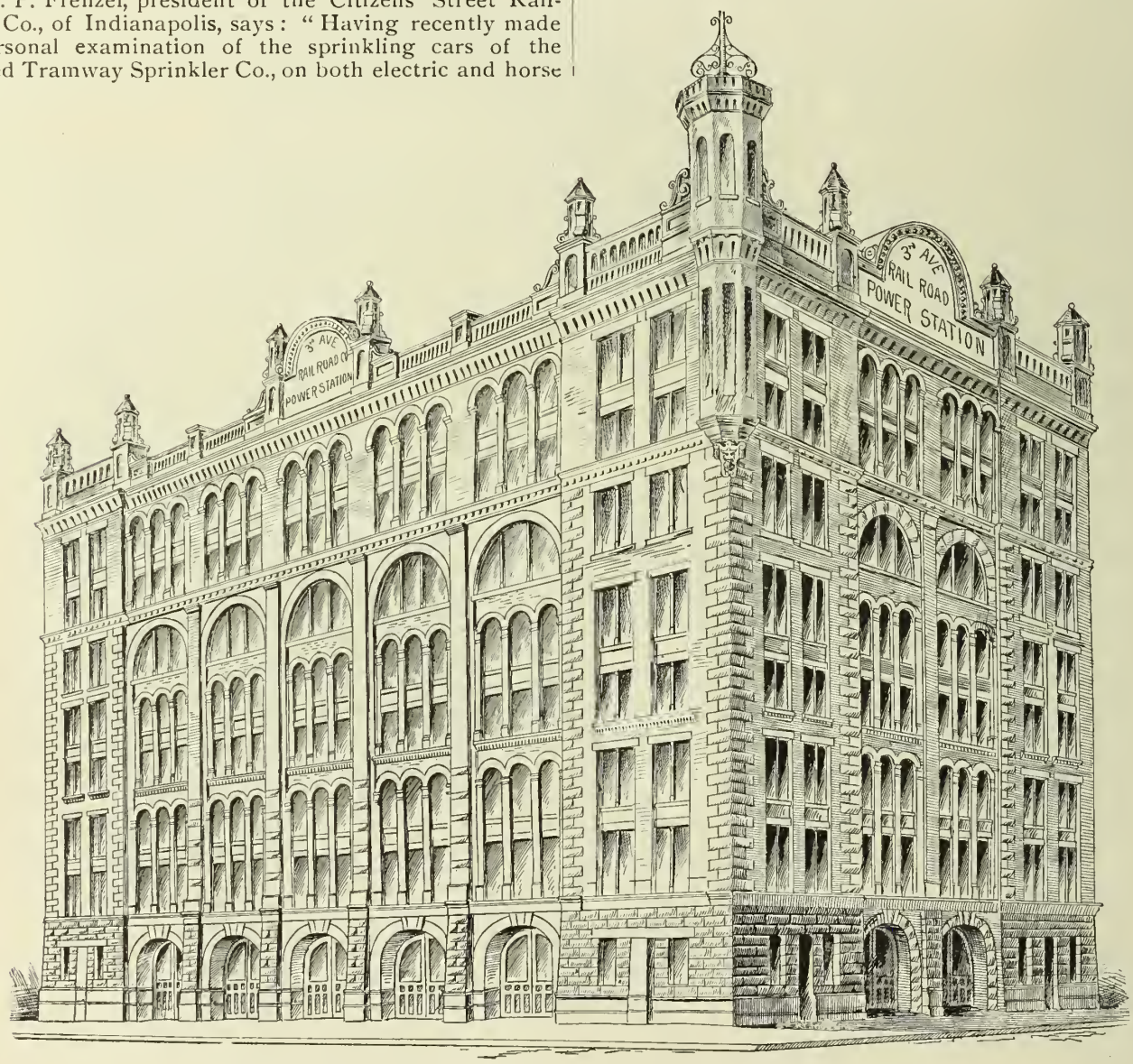
J. P. Frenzel, president of the Citizens' Street Railroad Co., of Indianapolis, says: "Having recently made a personal examination of the sprinkling cars of the United Tramway Sprinkler Co., on both electric and horse car lines in Louisville, Ky., it gives me pleasure to testify to the practicability of the system and its advantage to a railroad company. As a result this company has made a contract for the operation of these cars on all of its lines."

For further particulars interested parties should address the United Tramway Sprinkler Co., Louisville, Ky.

Downtown Power Station of the Third Avenue Road, New York.

The downtown power station of the Third Avenue Railway Co., illustrated herewith, will be located on the Bowery, corner of Bayard Street. Several buildings have been torn down to afford a site for the new structure, and workmen are now engaged in excavations for the foundations. The structure, as designed, will be of brick and granite, nine stories in height, and the upper stories will be rented for business purposes. The basement is thirty-six feet below the street, will be occupied by the cable winding machinery which was fully illustrated in our September issue. The engines, shafting and winding drums will occupy the west section. On the east side of the basement will be located the vaults for the coal storage and the tension runs.

The street floor will be utilized on the Elizabeth Street side for the sixteen boilers necessary to run the plant, the Bowery side of the floor being turned into a storeroom and repair shop. The building will have six elevators and be fitted throughout with electric lights. It will be completed in July and will cost $650,000. The architect of the building is Albert Wagner, of 67 University Place, New York, who states that the building, in arrangement and in point of equipment, will be the most complete power station in the country.



DOWNTOWN POWER STATION—THIRD AVENUE CABLE RAILWAY, NEW YORK.

Car House of the Toledo Electric Street Railway Co. Burned.

The car house of the Toledo Electric Street Railway Co. on Canton Avenue was destroyed by fire on the morning of January 19. The illustration on the next page shows the ruin accomplished. The building was a one story brick structure 100 ft. front and 150 ft. in depth. It had been carefully planned by the management so that every facility was afforded the workmen in inspecting the motor cars. The pits extended back 100 ft. from the front of the building. Three rooms in the rear were used as paint shop, carpenter shop and blacksmith shop. In the centre of the building, in what was known as the monitor or turret, was located the winding room. This was conveniently

arranged and well equipped. All materials from the ground floor were raised by a windlass.

Twenty-seven motor cars were destroyed by the fire,



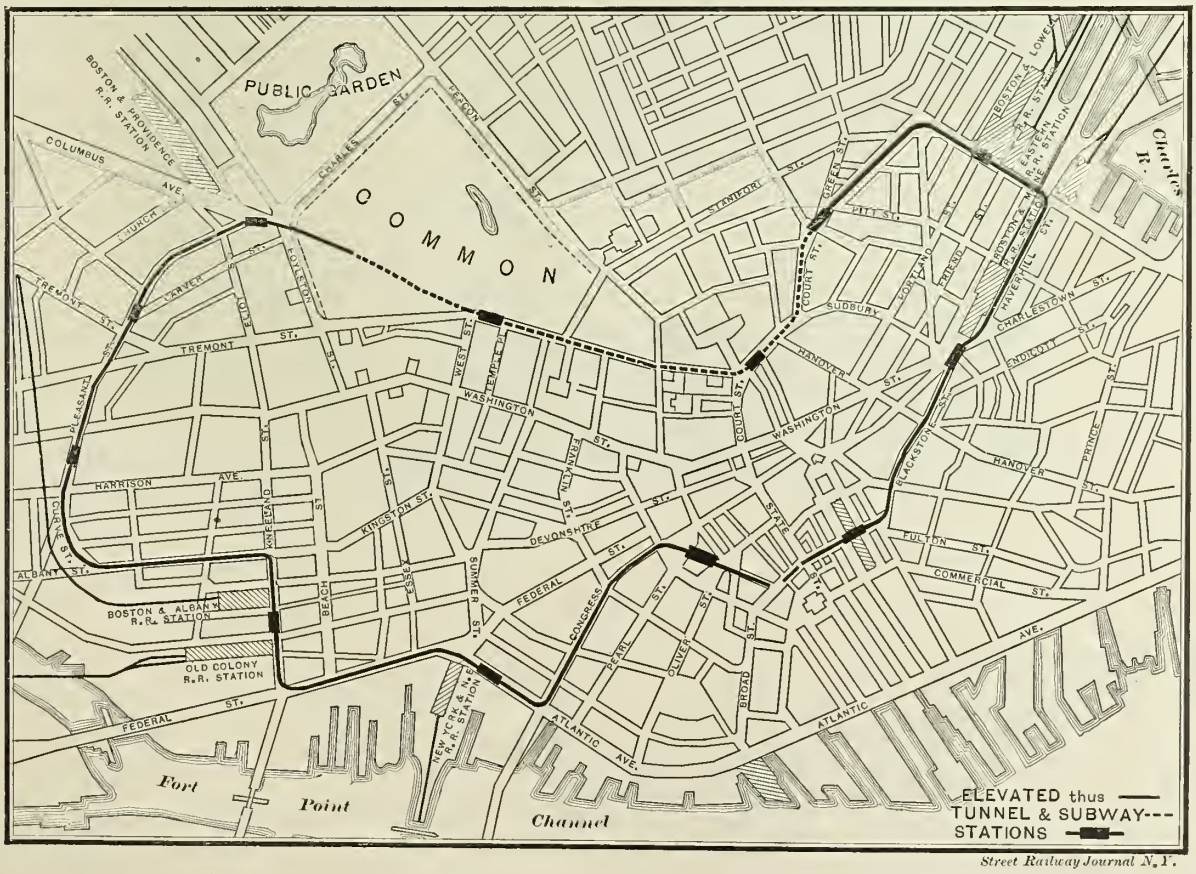
RUINS OF TOLEDO ELECTRIC STREET RAILWAY CO.'S CAR HOUSE.

and the total loss is estimated at considerably over $100,000. The insurance was $60,000.

The company was fortunate in having just completed a new car house at the corner of Ontario and Galena Streets. This building has a frontage of 125 ft. and a depth of 175 ft., and has sufficient accommodations to meet the temporary needs of the company.

Rapid Transit in Boston.

The Rapid Transit Commission, of Boston, have agreed upon a provisional route and structure for the relief of the more crowded part of the city proper. The plan contemplates a double tracked elevated and subterranean structure covering a circuit route shown in the accompanying map. As will be seen, the circuit includes the heart of the downtown portion of Boston. The portion of the railway which will be overhead is indicated in full



Street Railway Journal N.Y.

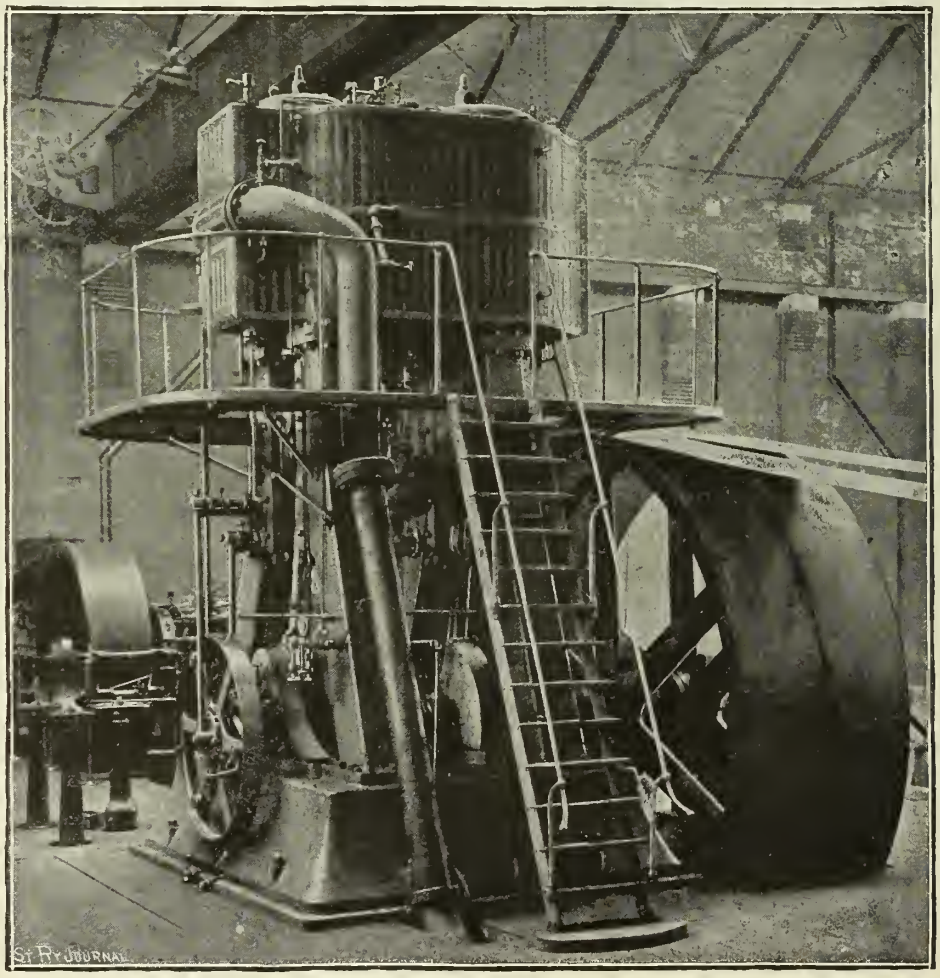
MAP SHOWING PROPOSED ROUTE OF BOSTON'S RAPID TRANSIT SYSTEM.

lines, that underground in broken lines. Twelve passenger stations for this road are proposed. These will be located at determined points most convenient for the accommodation of traffic and indicated on the map of the proposed route.

The commissioners especially state in their report that they wish it understood that this circuit route must not be taken to comprehend their entire plan and that the route for further roads may be submitted later. They have notified all persons owning property along the proposed route, and the public generally, that they are prepared to give a public hearing at their rooms, 306 Exchange Building, State Street, Boston, upon the subject of the plan as outlined. This hearing commenced on January 21 and was to be continued until all persons interested should have had an opportunity to be heard.

Electric Railway Engine of the Buffalo Railway Co.

The engine which is shown in the illustration was designed for the Buffalo Railway Co., Buffalo, N. Y., to drive their electric generators. The view was taken when the engine was in position in the power house. The general type of the engine is that of a vertical compound with two cranks at ninety degrees. The high pressure cylinder is seventeen inches in diameter; the low pressure, thirty-three and one-half inch in diameter, and the common stroke twenty-eight inches. The engine is designed for 140 revolutions per minute. This speed is midway between the Corliss and the modern high speed engines usually used for this kind of work, but the piston speed is kept at 600 ft. per minute.



VERTICAL ENGINE FOR THE BUFFALO RAILWAY CO.'S POWER PLANT.

The engine is rated at 450 H. P., with 125 lbs. initial steam pressure. It will run equally well, condensing or non-condensing. At the present time it is operated non-condensing, as the condenser house is not yet finished.

There are several new points in the design of the engine. One of the most important is the double ported steam and exhaust valves used for steam distribution. There are two steam and two exhaust valves for each cylinder, which are operated independently as in a Corliss, thus allowing different degrees of compression and cut-off. The valves, which are extremely light, are perfectly balanced, and give a large port opening with a small valve which is a noticeable feature. In most marine engines using piston valves in the high pressure cylinder, the diameter of the valve chest is often as large, if not larger than that of the high pressure cylinder itself in a triple expansion engine, and with the same style of valve used on the low pressure it becomes necessary to use two and sometimes three different valves, locating the centres on a circle whose centre is coincident with that of the low pressure cylinder. On the low pressure cylinder the admission valves have a peculiar motion, effected by means of rocker arms, which give a quick movement at the point of cut-off. The movement of the high pressure admission valve is controlled by a centrifugal shaft governor, by which the speed of the revolution of the engine is regulated. The matter of speed is, of course, very important in this class of work and the governor, which has only one weight, one spring and four pivoted joints, is extremely sensitive. The variation, it is stated, does not exceed one per cent. under extreme changes of load. Some objections have been raised as to the advisability of governing an engine of this size by means of a shaft governor, but with the type of valves employed no difficulty, it is stated, has been experienced and the engine is to-day operating very successfully.

Much care has been given to the details of construction. For instance, the piston rod and crosshead are forged in one piece and babbitted slippers are fastened to the head of the rod and set out, not by wedges but by liners only. The crosshead end of the connecting rod is forked, while the crankpin end is of the standard marine type. All bearings of the engine are babbitted. The main bearings have cast iron shells lined with babbit, in which water is caused to circulate in order that the temperature may be kept down in case of trouble. Water also circulates through the back of the guides. The engine is lubricated entirely by means of grease. This lubrication is effected automatically, the lubricant being forced through pipes running from the central reservoir to the different parts or bearings of the engine. This system is similar to that of an accumulator in a hydraulic plant, weights being placed on the piston of the accumulator, which force the grease to the respective parts of the engine, the flow of grease being controlled by stopcocks at the various bearings.

The engine has been running for some time non-condensing, as already stated, although really designed to be worked condensing. It has given perfect satisfaction, doing its work smoothly and with entire ease. There has been a notable absence of hot bearings, so common with new engines on this class of work. The engine is one of two which have been built by the Lake Erie Engineering Works of Buffalo for the Buffalo Railway Co., by direction of their engineers, the Field Engineering Co., of New York, who designed and equipped the entire railway system in Buffalo.

Liverpool (Eng.) Electric Elevated Railway.

Perhaps the most interesting engineering work in progress in Liverpool at the present time is the overhead railway which is being built along the line of the docks. The illustrations show very clearly the general design of the railway. The entire structure is carried on columns with the exception of a few hundred feet where the road runs on built-up ground enclosed by masonry walls. The total length of the line is five and three-quarters miles. The length of the standard span is fifty feet. The columns, are delivered by the manufacturers completed. They are of simple construction, being formed of two channel iron sections and plates riveted together.

One of the peculiar features of the railway will be the tilting bridges, the device of Ferdinand Huddleston who has secured a patent on the design. For all ordinary street traffic beneath the railway, the height of the structure is sufficient to permit clearance, but as marine boilers, and other large machinery have to be taken to the docks, provision was made to give all the clear headway necessary by building bridges which could be tilted. One of these is shown in Fig. 1 as closed and Fig. 2 as open.

The main principle will be apparent from the illustrations. It will be seen that two spans are opened simultaneously, the girders across being continuous. They are hinged to their intermediate pier in a manner plainly shown by the view of the open bridge. When the bridge



FIG. 1.—LIVERPOOL ELECTRIC ELEVATED RAILWAY.

is opened one end acts as a counterweight to the other, but the height of the viaduct not being great, only fourteen feet in the clear, and the opening of considerable width, one part is necessarily shorter than the other and kentledge has to be used to bring the weights more nearly to an equality. In order to increase the length of the short arm, over that which would be given simply by the height of the viaduct, a pit has been sunk as shown. The movement is affected by hydraulic power. Fig. 1 also shows a curve and a reverse curve on the line and gives a good idea of the appearance of the flooring. The rails are here laid for the bogie to run over and are not permanently in position.

It has been decided that the road will be operated by electricity. Trains will not be run out, but separate motors will be provided for each car. The road is at present nearing completion rapidly. The engineers in

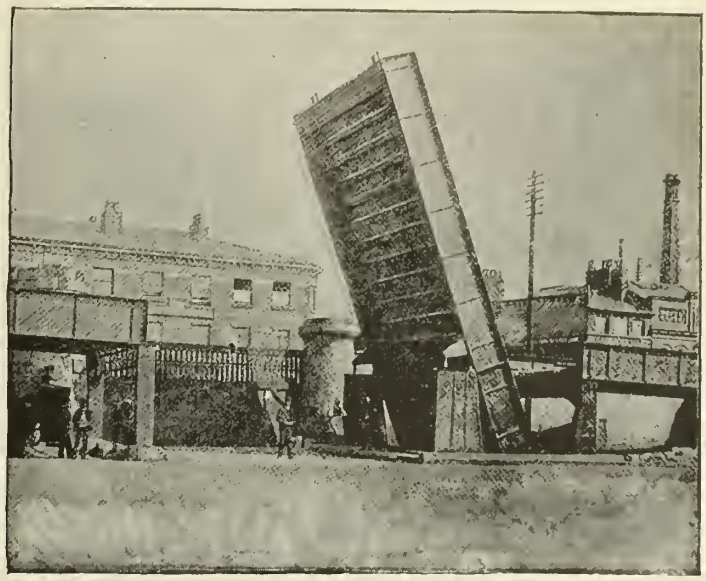


FIG. 2.—LIVERPOOL ELECTRIC ELEVATED RAILWAY.

charge of the work are Sir Douglas Fox and Mr. J. H. Greathead.

The cuts are reproduced from *Engineering*.

New Grip Cars for the Third Avenue (N. Y.) Cable Railway.

Two grip cars, one open, the other closed, samples of the large order which is being filled by the Laclede Car Co., of St. Louis, for the Third Avenue (N. Y.) cable railway, have been delivered during the last month to the railway company and are very handsome specimens of the car builder's art. The open car, No. 201, is thirty-eight feet eight inches over all, with four-foot platforms at each end, and has a seating capacity for forty-eight people and is mounted on two McGuire four wheel trucks. The car has a centre aisle, twenty-four reversible seats covered with rattan, and furnished by Hale & Kilburn, of Philadelphia, Pa., with a seating capacity of two each. The ceiling is of birdseye maple and the ventilator windows of stained glass. The interior of the car is supplied with bronze fittings and mountings; and the whole is lighted by three five burner chandeliers, burning Pintsch gas and supplied by the Safety Car Heating & Lighting Co., of New York. Four auxiliary oil lamps for emergencies are also carried, besides a headlight. The exterior of the car is very handsome, the centre panel of the body being painted a bright red with silver ornamentation and gold lettering. The lower part of the body is painted white. The dashboards are the same shade of red as the upper part of the body and bear the number of the car painted in silver. Handsome awnings, in addition to the regular storm curtains, extend the entire length of the car, and are arranged so as to shield the eyes of the passengers from the sun in summer, thus completing the car equipment.

The closed car, No. 1, has a twenty-two foot body, is thirty feet over all, and is equally handsome, the interior being fitted up in mahogany and having a birdseye maple ceiling like the open car. The four-wheel truck is the Baltimore with Third Avenue standard axle boxes, oil and dust tight, designed by W. S. G. Baker, of Baltimore. The doors have birdseye maple panels. The car is lighted with three chandeliers, burning Pintsch gas and supplied by the Safety Car Heating & Lighting Co. Dark red plush seats, four oil lamps for emergencies and bronze trimmings complete the interior equipment of the car. There are seven windows on each side of French plate. The shutters are of mahogany with bass wood blinds. The exterior of the car is painted in a way similar to the open car.

Each car is also supplied with safety extension gates manufactured by the Pitt Iron Works, 53 Reade St., New York.

An Interesting Suit at Salem, Mass.

At the Superior Court in Salem, before Judge Hammond, a case of considerable interest was decided, last month, in favor of the plaintiffs which involved quite a number of new points. The facts of the case, as accepted by both parties concerned, are that a serious accident occurred in the electric lighting station, at Lynn, at 1 : 45 A. M., October 26, 1890, by which the flywheel of a 500 H. P., compound Corliss engine burst, partially wrecking the building and also crushing in the sides of two other and adjoining buildings. A number of pulleys in the station were broken, a massive masonry pedestal of great strength, forming one of the supports of the main shaft was raised from its foundation and a fire occurred in the tower. These events followed each other with great rapidity during a very short space of time.

The point at issue in the matter was a certain question of cause and effect which involved the liability of insurance companies. In the case the Lynn Gas & Electric Light Co. was the plaintiff, and some twenty-three insurance companies, holding policies on the building and contents, were the defendants. The actual defendant was the Meriden Insurance Co., whose case was accepted as a test case.

The theory of the plaintiff was that a fire occurred among the wires in the tower of the station, probably caused by short circuits between different wires. The claim was that this produced a certain shock upon the dynamos, which, breaking their pulleys, released the load and caused the breaking of pulleys on the main shaft, a piece of which struck the governor on the engine in such a way as to knock off one of the balls and disable it so as to prevent its controlling the engine. It was also considered by the plaintiff that a large piece was driven under the flywheel in such a manner as to break it.

It was therefore claimed that the insurance companies were liable for the whole damage as resulting directly from the fire.

The insurance companies claimed that the engine escaped the control of the governor, probably because of a broken governor belt, or that it slipped on account of the failure of the lacings to hold, or the stretching of the belt. From this cause the speed of the engine was accelerated until the flywheel burst.

But it was further claimed that before this rupture of the wheel, the speed was such that the electrical machines were revolving at about four times their normal rate, on which account the regulators of the electrical apparatus failed to control the current and caused short circuits. A fire resulted, causing a damage of about $1,100, which the companies were ready to settle.

The plaintiff, however, claimed a damage of nearly $9,000, due to the wrecking of the engine, the station and other machinery.

The testimony was largely that of experts, the principal ones summoned by the Electric Light Co. being Prof. E. Wilbur Rice, Jr., Albert L. Rohrer and Isaac F. Baker of the Thomson-Houston company and Charles F. Pritchard, superintendent of the Lynn Gas & Electric Light Co. The experts summoned by the insurance companies were Charles E. Emery, of New York, C. J. H. Woodbury and Edward Winchester, of Boston.

Early in the trial of the case Judge Hammond suggested, in view of the electric and technical points involved, that the case be taken from the jury and tried before referees, but the suggestion was not agreed to.

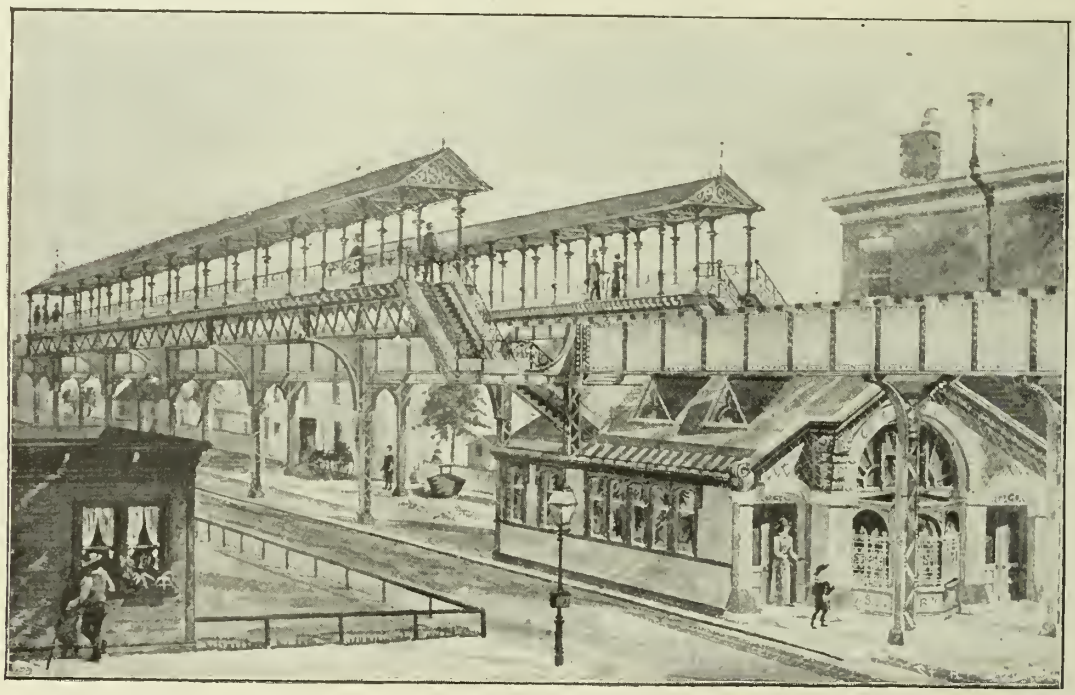


FIG 1.—STATION AT TWENTY NINTH STREET—SOUTH SIDE ELEVATED RAILROAD, CHICAGO.

Chicago Elevated Railways.

Of the multiplicity of elevated railroad projects in Chicago two have assumed tangible form. One of these is designed to give rapid transit to the south division of the city; the other was planned to perform a similar office on the West Side. Work was begun on the roads about two years ago, but for several months nothing has been done.

It is a dangerous thing to attempt to write anything in regard to these projects. It would be a marked week if a score of contradictory rumors were not published regarding them; if alleged sales of the two properties were not announced. In this brief article an attempt is made to sift the chaff from the wheat, the statements presented being based on interviews with the controlling officials of the two companies.

The failure of the two companies to meet the expectations of the public has been due to financial difficulties. It now appears, however, that there is an extreme likelihood of a resumption of work in the near future on the south side or Alley L railway. This company have already built an elevated structure from Peck Court to Thirty-seventh Street, although in this distance there are two short breaks, at points where the company failed to secure the property. The necessary agreements have,

however, been reached and but little work will be required to make the line continuous. It is proposed to extend the road to Jackson Park to carry passengers to the World's Fair grounds.

It was an occasion for considerable satisfaction when the announcement was made a few weeks ago that the line was to be extended to Thirty-ninth Street at once, and that the road would be operated from Congress Street to that street as soon as possible. When the writer called at the office of the company, the report was verified. It was stated that operations would commence by April 1. It is probably safe, however, to set a somewhat later date.

Colonel Goddard, the general manager, stated that he would order the equipment at once. The first installment will be twenty locomotives and fifty cars. They will probably be built by the Pullman Car Co., and will seat forty-eight persons, but will contain space for at least 100 passengers. When the road is put into operation trains will be run every two minutes during rush hours over the three miles and a half of completed road.

About $3,000,000 has been spent on the construction of the road up to the present time. The general character of the construction is shown in the accompanying cuts.

Col. M. H. Alberger, the principal owner of the Lake Street elevated road, is kept busy denying reports that the line has been sold, or that it will be used as an entrance of a trunk line into the city. The road has not at this time excited the interest of capitalists, and there is no immediate prospect that work will be resumed.

The road is built at the present time from Canal Street to Ada Street, about a mile and a quarter, and about $1,000,000 has been invested in the project. The ultimate terminus of the road is a point about five miles west.

The structure, is considerably wider than that of the South Side road. Provision is made for the laying of four tracks so that express trains can be operated.

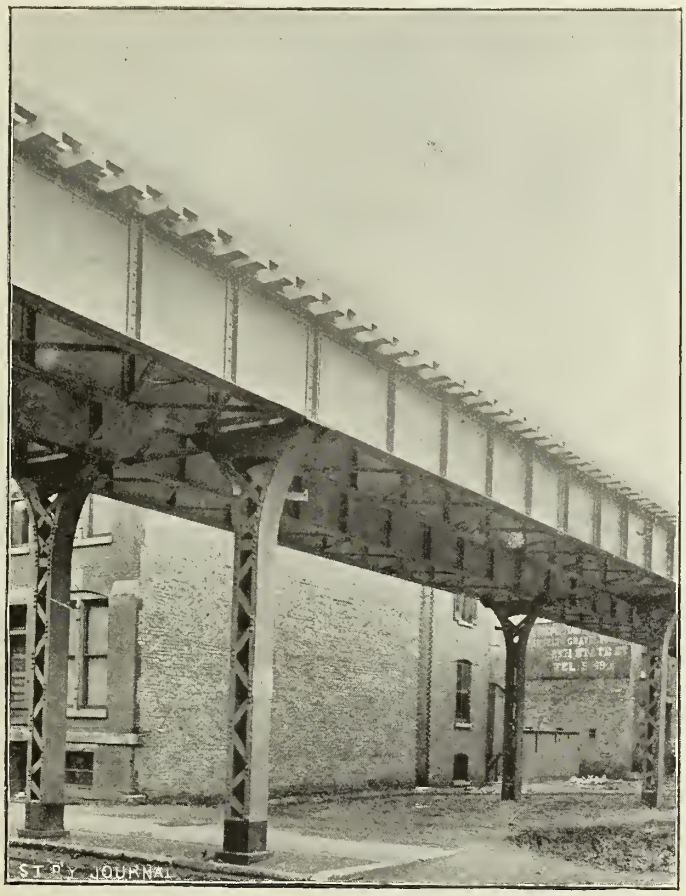


FIG. 2.—SOUTH SIDE ELEVATED ROAD, CHICAGO, AT THIRTIETH STREET.

The trains will cross the river from the West Side to the South Side by a bridge. The projectors realize that the public may live in constant dread of trains running into the river. It has already been arranged, therefore, that a system of electric signals will indicate when the bridge is open, even a mile and a half west of the bridge.

No Sunday Cars for Toronto.

The citizens of Toronto have always been opposed to the operation of the street cars in that city on Sunday, and consequently on that day the street railway system has always suspended operations. There has recently been quite a movement in favor of the establishment of a limited service on Sunday, though the innovation was advocated by only one morning newspaper, the *World*, and the question was put to popular vote. The result of the ballot was 9,952 for the running of cars on Sunday and 14,066 opposed.

Notes from the Field.

Newark N. J.

While the municipalities of New York and Brooklyn have been debating and hesitating over the adoption of some system of rapid transit the neighboring city of Newark has installed and perfected an electric railway, which, judging from results and opinions expressed to our representative upon a recent visit by him to that city, gives satisfaction to both management and public.

The Newark Passenger Railway Co., who own ninety per cent. of the street railway mileage in the city of Newark, were chartered January 23, 1890, on which date the Essex Passenger Railway Co. and the Hudson & Bergen Railway Co., were consolidated with this company. The Elizabeth Passenger Railway Co., and the Newark & Irvington Street Railway Co. were purchased July 1, 1890, by the new railway company and the property of the Rapid Transit Street Railway, of Newark, has been acquired by the same company during the last six months. The electrical equipment has been adopted at present upon about one-third of the entire railway system, though it is intended later to extend the use of electric motors over all the main lines. All of that at present equipped, amounting to seventeen and a half miles, is double track, upon about one-half of which centre poles with double brackets are employed for supporting the overhead system. All the poles upon the road are of an exceedingly tasteful design and were supplied partly by Milliken Bros., and partly by the Walworth Manufacturing Co. Every other pole carries a cluster of five incandescent lamps operated from the railway circuit for street illumination. At present sixty electric cars, all vestibuled, are in use, twenty of these being long cars.

The Irvington Division

was put in operation Oct. 4, 1890, and was constructed under the supervision of the Field Engineering Co. The electric motors upon this division are of the well known S. R. G. type, from the works of the Thomson-Houston Electric Co., the dynamos being supplied by the same company. The cars, painted wine color and yellow, with silver lettering, are handsome and very comfortable. They were supplied by the Gilbert Car Manufacturing Co. and A. L. Rogers & Co. of New York. All the long cars in use upon this road are employed on this division, and all use the Brill No. 11 maximum traction truck. Lewis & Fowler stoves and registers of the same make, complete the car equipment.

The station supplying current to this portion of the line is situated at the corner of Bedford Street and Springfield Avenue, and occupies a brick building originally intended for a projected cable railway which was to operate over very nearly the same route upon which the electric cars now run. The winding drum intended for the cable road, and used for a few months before the project was abandoned, lies buried within a few yards of the station. The boilers, of which there are four, were built by the Iowa Iron Works of Dubuque, Ia., are twenty feet long, of

the double deck pattern, with water legs on each side of the fire box. They have proved quite efficient, though of a construction which makes them rather difficult to clean, the sediment lodging and hardening in the portions of the boiler surrounding the furnace. Each boiler has a capacity of 150 H. P.

The engine equipment consists of two Ball engines of 240 H. P., each of which is belted direct to four Thomson-Houston multipolar dynamos of 100 H. P. capacity each. The belting was supplied by the Underwood Manufacing Co. and is of cotton leather. The switchboard is contained in the engine room, and is completely equipped with the necessary appliances. The station is quite small for its capacity, and is interesting to visit for that reason, showing, as it does, the small space in which a generating plant of this size can be placed. As is stated later, the management of the company is increasing the capacity of the station at Boyd Street so as to accommodate the call for increased current with an increase in the number of cars operated. The average load carried by the station just described is from 400 to 450 amperes.

The car house of the Irvington division, which is about a mile beyond the power station, at present contains the first installment of an order of twenty cars which has recently been placed with the J. G. Brill Co. of Philadelphia, for use on a new line between Newark and South Orange. These cars are very tastefully fitted up, equipped with S. R. G. motors, and mounted on the No. 13 patent, independent, rigid motor truck of the J. G. Brill Co.

The Rapid Transit Division

crosses the Irvington division at the corner of Springfield Avenue and Washington Street. The cars on this line are equipped with the Edison No. 6 motors, the car bodies being from the works of the Pullman Car Co. and A. L. Rogers & Co. They present a very handsome appearance, being painted a dark green, picked with gold. Each car is equipped with the usual number of incandescent lamps and Meaker fare registers.

Some of the grades on this line are quite severe, on West Kinney Street the ascent for a distance of one-quarter of a mile being divided in two parts, covering about half the distance, each grade being over ten per cent. But one car is allowed upon this section at a time, and the motor cars have no difficulty in making the ascent, even with a slippery track.

The power station on Boyd Street is of brick, 100 × 150 ft. and most complete in all its appointments. It was designed and built by G. E. Talcott. Work has recently been finished upon an extension of the building which has more than doubled its capacity. The boilers at present in position are seven in number, of a rated capacity of 200 H. P. each, were manufactured by the Erie City Iron Works, and were installed by Cyrus Currier & Sons, of Newark. The steam gauges were manufactured by James Beggs & Co., New York. The portion of the building devoted to the engines and dynamos adjoins the boiler room, from which it is separated by a brick wall. This wall is represented in the engraving, Fig. 1, as broken away so as to show the arrangement of the driving machinery.

The engines at present installed are two independent, horizontal, Corliss engines, built by Hewes & Phillips of Newark, N. J., and one pair of similar engines operating one flywheel. Each independent engine has a twenty-two inch cylinder and a forty-two inch stroke, and is rated at 250 H. P., though capable of developing at least 300 H. P. The diameter of the flywheel of each is sixteen feet with a face of thirty-two inches. Each of the coupled engines has the same dimensions as the independent engines, the dimensions of the flywheel being, however, eighteen feet diameter, and sixty-two inches face. All the engines are belted to one countershaft, which extends the entire length of the room and is divided into four sections connected by friction clutches. Fast and loose pulleys on the countershaft provide for starting and stopping single dynamos. The pulleys were furnished by the Robert Poole & Son Co., Baltimore, Md. The device in use for shifting the belts was invented by the engineer, G. E. Talcott, and is illustrated in Fig. 2. As will be seen, the shifter is operated by a wheel and screw and is both convenient and compact.

The belts were furnished by the Jewell Belting Co., of Hartford, Conn., and the Page Belting Co., of Concord, N. H., and give excellent satisfaction. The large belt

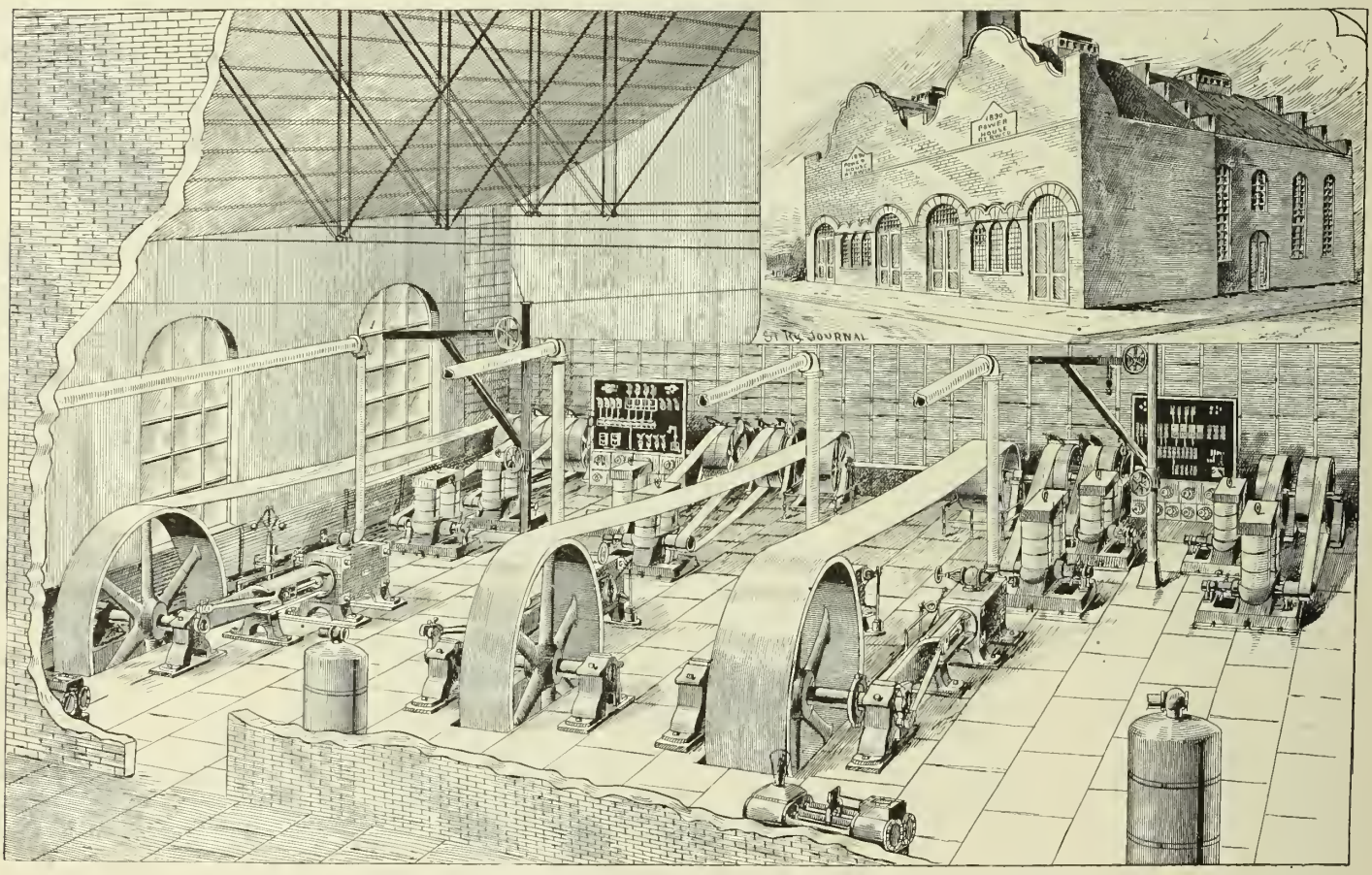


FIG. 1.—NEWARK PASSENGER RAILWAY CO.'S POWER STATION, BOYD STREET.

operated by the coupled engines and manufactured by the Jewell company, is especially noteworthy on account of its size, it being 135 feet long and sixty inches wide.

The generators are eight in number, of the Edison type, with compound winding, five being of 100 kilo-watts, and three of eighty kilo-watts capacity each. There will be two switchboards, as shown in the interior view, of slate, bound in brass. One of these is in process of construction, the other is in position and use, and from it all work done at a switchboard is being carried on. The location of both is very convenient, being near the dynamos, and they will be most completely equipped with the latest appliances. Two Berryman feedwater heaters with Smith,Vail & Co.'s duplex pumps are also located in the engine room. All the pipes in both this and the Irvington station are protected by the covering of the Magnesia Sectional Pipe Covering Co., of Ambler, Pa. Vacuum oil and Phœnix filter are used. The floor of the engine room is of Silo artificial stone.

During a visit to the offices of the company the well

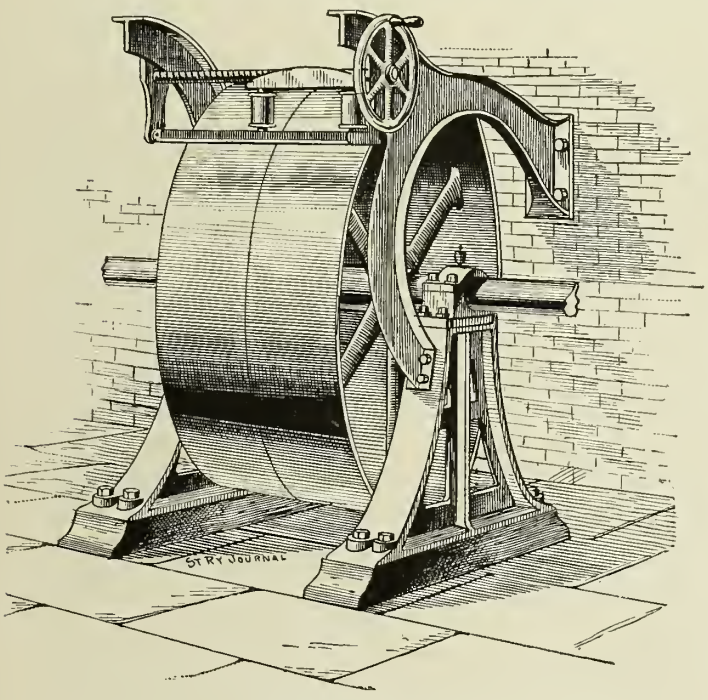


FIG. 2.—BELT SHIFTING DEVICE—NEWARK PASSENGER RAILWAY STATION.

known president of the road, Mr. Thomas C. Barr, under whose able administration the road has achieved its success in the past, expressed himself as very well pleased with the results attained with the long cars for use under the conditions presented on the Springfield Avenue line in Newark. He considers them far superior in point of convenience and safety to short cars with trailers. The long cars on this line run under a headway of from three to five minutes. In regard to rail construction, Mr. Barr stated that the recent practice of his company has been to use a sixty pound girder rail laid with chairs on ties 5×5 ins. ×7 ft. and two and a half feet centres. Upon recent work the Johnson & Tidewater rails have been employed. Experience has proven, however, that even this rail is not heavy enough for the traffic, though in other respects giving satisfaction, and for future work he will favor a girder rail at least ten inches deep and of about ninety or 100 lbs. to the yard, spiked directly to the ties. The return circuit is made by a tinned copper conductor laid in the centre of the track and with cross connections to each rail; rail bonds are also used.

The average car mileage per day on this road for the horse cars is ninety miles and for the electric cars 125 miles. An estimate of the large business done by this road can be had from the statement that the car mileage for 1891 was 4,007,742 miles. During this same time the number of passengers carried was 21,612,167. The advertising space for 154 cars on this line is controlled by Carleton & Kissam.

The Street Railway Situation in Chicago.

In the last number of the STREET RAILWAY JOURNAL appeared an article on the street railway situation in Chicago. It was stated that while the local companies were doing all in their power to meet the enormous demands made upon them, the public still believed that the transit facilities were entirely inadequate. The mayor, as it was stated, had appointed a committee composed of citizens, aldermen and representatives of the railway companies to suggest means for improving the street car service.

Perhaps the most interesting matter to come before this body since the last issue is a letter from Charles T. Yerkes, president of the North Chicago and West Chicago Street Railway companies. The writer said, by way of preface, that the communication was contributed by him not as a member of the committee but merely in his capacity as a citizen. Mr. Yerkes' letter is one of great interest. He is thoroughly conversant with the facts, and he has carefully studied the conditions and the possibilities for improvement. It will be noticed from the synopsis which follows, that in the main Mr. Yerkes' point of view is identical with that of the article contained in the last issue. At the outset he says that enlargement and improvement of present facilities are what must be provided; an immediate and complete revolution is impracticable.

The cause of the existing state of affairs is primarily the contracted business section or, as he terms it, the "heart of the town." This district is bounded by the river, the lake and Van Buren Street. He speaks of the condition as follows: "We find in this three-quarters of a mile square of territory a condition which exists nowhere else in any city of Europe or America. We have within a limited space few buildings which do not contain from fifty to 100 employes and a number in which over 1,000 are regularly employed in the various vocations of life. Besides, there is a large number of persons doing business with these establishments."

As Mr. Yerkes says, all these people desire to return to their homes at very nearly the same hour, and it would be impossible to provide them all with seats unless "every street was so lined with cars that each one touched the other preceding, and the streets were again covered with elevated railroads." If, with the existing facilities, passengers would be content to wait a short time the general comfort would be subserved; but no; the American temperament is impatient of a moment's delay. "If four trains were standing on the same track all ready to start at the same time the first train would be filled to overflowing and the last would be comparatively empty."

Mr. Yerkes next refers to the policemen who might greatly facilitate the handling of crowds but do not do so. He adds: "Any citizen may often see cars right in the heart of the city, with hundreds of anxious passengers in them, blocked for a long distance by an unloading team which might properly be placed in a different position so that the street would be cleared."

Mr. Yerkes next alludes to the possible remedies, and his main suggestion is novel and startling. It is nothing more nor less than the doing away of the Chicago River so as to provide space for the expansion of the business district. The suggestion is made in these terms:

"Here in our great city we have an uncovered culvert, reeking with filth, running through our centre, the sewerage polluting it, and this condition becoming worse and worse. To do away with it would, without doubt, cause a great revolution in present matters; but suppose it did, the change would be beneficial everywhere. The natural rendezvous for our shipping is not in the river, but along the lake front."

Coming to the question of additional facilities needed by the cable roads. Mr. Yerkes says: "I feel there is a positive necessity for extending the loop system on the South Side, as pertains to the South and West Side roads. The South Side company are greatly hampered by being compelled to run their State Street and Wabash Avenue systems into the same loop. With two loops they could

manage at least twenty-five per cent., and I think forty per cent more cars than with the present arrangement and with as much facility. The West Side road should extend their loop to State Street, thereby giving a better opportunity to accumulate cars where the people desire to have them. The space for accumulation is now so small that in case travel is interfered with for any cause during the rush hours congestion takes place immediately."

Mr. Yerkes speaks of the necessity of building cross-town lines on the West Side, and states his belief that companies should seek to provide better motive power than horses; more tunnels also are needed.

The communication concludes with this reference to elevated roads:

"While the river and its branches are open and swing bridges a necessity, elevated railroads for the North and West Sides are a fallacy. They *must end* on the South Side, thereby crossing a bridge, and any interruption to their travel makes rapid transit a delusion. The time lost by open bridges—which is, except in the winter season, about twenty-five per cent. of the whole—would so throw the schedules of the companies out that it would be impossible for them to run with any regularity when the busy hours commenced and the bridges are closed."

TAXPAYERS' RECOMMENDATIONS.

The Taxpayers' Association, of Chicago, has been investigating the street car situation, and at a recent meeting compiled some interesting figures in regard to the intramural railway question. One of the reports relating to the South Division showed that 70,000 persons residing in this section leave for their home each week-day evening between the hours of 5 P. M. and 6:30 P. M. Of this number the suburban trains carry about 13,740 persons Most of the remainder is carried by the cable and horse cars. Two hundred and ten trains running on the state and cable lines, and twenty cars running on Clark Street carry 54,700 persons. About 5,000 persons either ride in carriages or walk.

THE MAYOR'S COMMISSION.

The Commission appointed by Mayor Washburne to consider means for improving the local street railway facilities has held several sessions since the date of the last issue of the STREET RAILWAY JOURNAL. At the meeting, January 6, Mr. Yerkes was asked if the capacity of the North Side and West Side lines could be increased. He replied in the affirmative, and when asked why this was not done he said: "There are several reasons. Our employes will not allow 'trippers' to be run at any but their own prices. This, however, may be arranged hereafter. It will require an ordinance to complete our loop for the Van Buren Street tunnel. We expect to have that line completed by July next. We can then readily increase our carrying capacity sixty per cent., twenty-five per cent. of which will be on Madison Street and Milwaukee Avenue. It would help the cause a great deal if we could extend our loop on Madison Street to State. It would enlarge the loop, and we could handle more people and more cars."

President Wheeler of the South Side company, in response to a question, said the capacity of the system could be doubled if the loops were granted by the Council as desired by the company.

On January 9 the committee made a tour of investigation. At the World's Fair Grounds they inspected the movable sidewalk. Mr. Schmidt, secretary of the Multiple Speed & Traction Co., who control the patents on this means of transportation, explained the system. He claimed that the sidewalk would carry 31,680 passengers an hour past a given point at a rate of six miles an hour, and that the entire line could be operated with no more power than is necessary to propel four street cars holding thirty passengers each.

The committee then went to Pullman, where the Patton motor car is on exhibition. The committee was greatly interested in the car, and it proved extremely satisfactory in operation. The car carried the visitors to the point where the new Pullman double deck car is located. This proved of great interest to the committee. Mr. Pullman said to the committee that such a car, though costing much more than an ordinary horse car, would save any company adopting it fifty per cent., and would, besides, give better accommodation to passengers. An effort is being made to secure its adoption by the South Side company. Mr. Pullman expressed it as his positive opinion that double-decked cars could be made low enough to allow them to pass through the La Salle and Washington Street tunnels, thus making them available for every cable line in Chicago.

Street Railways in Brussels.

BY C. R. KING.

The first street railway in Brussels, Belgium, was built by an English company in 1867, and in 1871 another English firm constructed several lines in the city. It is not surprising, therefore, that the visitor to Brussels sees upon the road there a large number of foreign cars many of which are from the factory of John Stephenson Co., Ltd.

The tracks are well laid, the paving being mostly of granite, and the rails placed flush with the paving as in Paris. The Marsillon system of rail construction is in general use, as in Lille, but is giving way to the solid girder or Broca rail, since it is found that the heavy wagon traffic often crushes the two rails in the former system together, so that considerable power is lost in opening the channel by the car wheel flanges.

The principal lines in Brussels are controlled by a limited company called the Tramways Bruxellois. The value of the track belonging to this company was, in 1890, reckoned at $230,000, and in the same year the gross earnings were twenty-four cents per mile run, or $14.74 per car per day. At present the rolling stock consists of 350 cars, the estimated value of which is $395 each. In addition to these and to their omnibuses, the company have a type of vehicle different from anything in use in the United States and called a tramcar omnibus. This is intended to run on the street railway tracks, but is also adapted to operating on pavements. The wheels are of small diameter for an omnibus, are made of wood, flat tired in the ordinary way, of the regular track gauge and turn on a fixed axle with gun metal caps. The body is that of an ordinary street car, and underneath the front platform a pivoted stay or bracket carries a regular flanged wheel which is lowered when the omnibus turns off the track.

In 1890 the street cars made 2,200,000 miles, or an average of 2,760 miles per car in use.

The following are a few facts regarding the live stock of the company, with cost of maintenance. There are about 800 horses owned by the company, these being of the Flemish breed so much used for street railway service in London. The entire stock is valued at $67,500. The yearly depreciation for last year was figured at $17 each, this being a reduction over that of former years. During a period of sixteen years the average depreciation per day of the horses has been 6.2 per cent.

Taking an average for the entire year the feed allowed for horses per day is as follows:

Oats,	18 lbs	Hay,	7.60 lbs.
Maize,	2.20 "	Straw chaff	0.40 "
Bran,	0.01 "	Bread,	3.50 "
Barley grain,	0.01 "	Various,	3.50 "

The actual total is a little over thirty-two pounds per head per day, costing thirty-one and a half cents each. Under the head "various" is included barley flour, linseed, clover, etc. The cost for forage has materially declined during the past fifteen years except for oats, which, the last two years, has increased in price and now costs 1.1 cents per pound. The total cost for 1890 for forage was $98,700. At present the employes of the company are in a very satisfactory state of mind, their wages having been raised and hours of work reduced.

THE Thomson-Houston Electric Co. are at work on plans for an electric passenger locomotive of 250 H. P. and capable of developing a speed of forty miles per hour.

Transportation of Passengers in and Around the Cities of Europe.

The report of John E. Fitzgerald, a member of the committee appointed by the Boston Rapid Transit Commission to investigate the question of rapid transit in European cities, has recently been issued in pamphlet form. Below will be found some extracts from this interesting publication :

The street railway cars of Great Britain and the continent which I have seen are not brought to that perfection in style which has been attained with us. The cars are heavy and behind the times, if the horse cars of Boston be taken as a standard. There are usually seats on all cars and omnibuses outside. Six companies in Great Britain and Ireland operate over fifteen miles of double track roads. These are in Belfast, Dublin, Edinburgh Glasgow, Liverpool and London; and of these cities the lines in Glasgow and Liverpool are owned by the city and leased to a company, the company equipping and the city taking care of the lines. This double responsibility has, I am informed, been the cause of a great deal of friction between the city and the railroad company running the lines.

Herewith I give a table showing the number of passengers and the average price per passenger, together with the average profit per passenger, on eight of the largest street railways in Great Britain and Ireland for the half year ending June 30, 1891, and compiled for private circulation :

	No. Passengers.	Average Fare.	Net Profit per Passenger.
Belfast	7,754,320	1.14	0.18
Dublin	8,251,440	1.69	0.33
Edinburgh	7,398,160	1.60	0.20
Glasgow	25,746,723	1.92	0.12
Liverpool	16,592,443	1.98	0.11
London	30,527,176	1.18	0.15
London St	12,174,904	1.24	0.18
N. London	35,615,027	1.31	0.25

From this table it will be seen that the average rate of fare for every passenger who rides on the cars of these largest companies in Great Britain and Ireland does not exceed three cents per passenger, though the fares vary from two cents to eight cents, according to the distance run, which is from one to eight miles. The table given above is accurate, for it was prepared and given me by the assistant general manager of the Dublin United Tramway Co. It also shows the enormous amount of penny travel on all these roads as compared with the long distance travel. In connection with this matter I was informed by Mr. Anderson, manager of the Dublin United Tramway Co., that the penny fare system for short distances increased travel very much. He is a man of forty years' experience in the omnibus and tramway systems. He said : "We have steadily decreased fares since the institution of the tramway system in 1881; the result has been a great increase in our short distance travel. Our minimum fare in 1881 was three pence, whereas to-day it is only a penny.

"The number of passengers carried during the half year ending June, 1881, was 4,706,000, whereas the number for the corresponding period of 1891 was 8,251,000. The average fare in 1881 was 2.45 pence; in 1891, 1.69 pence. We have found that our system of low fares and no transfer tickets pays, and we reduce fares wherever we can. Our motto is, 'Cheap fares and no transfer tickets.' To give you an idea how the low fare system has increased, I give the following statistics from our road :

"In the half year ending June 1886, penny passengers carried were	2,173,000
"For the same time in 1891	3,695,000
"In the half year, June, 1886, two-penny passengers were carried	2,926,000
"Two-penny passengers for the same period in 1891	3,089,000
"No. of three-penny passengers, half year, June, 1886	1,623,000
"No. of three-penny passengers, half year, 1891	1,296,000

"It will be seen that this is a large increase in travel, owing to low rates, though our city has not increased in wealth or population during that time, but quite the contrary."

Another excellent feature which I noticed is the parcel system, by which the tramway company collect parcels at offices designated by them and deliver the same at any part of the city, or at any place one mile distant from the end of any route, at prices varying from a penny to eightpence up to fifty-six pounds. This has proved a source of revenue to the company as well as a great convenience to the citizens, especially when one considers that the express company system in vogue with us is not much copied in European countries.

On the great thoroughfares of London no horse cars are allowed, but omnibuses take their place, and as a result the blockades which are so frequent in our cities, especially in Boston, are seldom seen, though on those streets there is a regular up and down travel of omnibuses and hansom cabs as closely packed together as carriages in a public procession. They observe the laws of the road, and the uplifting of a policeman's hand is obeyed as instantaneously as the command of an officer in a well drilled military company. The Strand and Fleet Street are much like our Washington Street in width and general appearance, indeed more so than any other part of London, or any street in any city I visited.

By the Metropolitan Streets Act, which applies to the business thoroughfares of London, no person can, from ten A. M. to six P. M., remove ashes, dirt, etc., drive cattle, load or unload coal, beer, safes or heavy material, or drive through those thoroughfares any vehicle containing timber thirty-five feet in length or projecting eight feet behind. The Strand contains more theatres than any street in London, which are close to each other, and yet their system of regulation is so complete that little inconvenience is experienced.

Great Britain is under a general law known as the Tramways Act of 1870, being "an Act to facilitate the construction and to regulate the working of tramways."

The persons authorized to construct under the act are: (1) The local authorities. (2) Any person, persons, corporation or company, with the consent of the local authorities. The method by which they proceed is as follows : Application to build a horse railroad is first made to the Board of Trade, and when such application is approved the Board of Trade causes a bill to be introduced into Parliament. When such bill passes, the promoters build under the general law and are governed by it. No application shall be considered by the Board of Trade where it is proposed to build a road where, for a distance of thirty feet or upwards, a less space than nine feet six inches intervenes between the outside of the footpath on either side of the road and the nearest rail of the tramway, if one-third of the owners or occupiers of houses along the line dissent. If a city or town builds or acquires possession of a tramway it cannot run cars and charge tolls, but must lease the road to some person or corporation for a period not exceeding twenty-one years, and with the approval of the Board of Trade. Every road built must be of a gauge four feet eight and a half inches, unless otherwise allowed, and the rails must be so laid that the upper surface must be on a level with the street paving. Hence every street railroad in Great Britain does not destroy the smoothness of the road surface, as is the case too often with us. Another good provision also is, that they shall not break up continuously more than 100 yds. at a time, and must have a quarter of a mile between each break.

They are also compelled to keep in thorough repair all space between the rails and eighteen inches on the outside, and where double tracks are laid they must also keep in repair the space between the double tracks. If after a tramway is in operation for three years the city authorities or twenty tax payers complain to the Board of Trade that such road does not give proper accommodations, the Board is authorized to allow another person or corporation to run cars over the road for not less than one year or more than three years.

After any railroad has been in operation twenty-one years the city or town anthorities may buy the same, and if any disagreement as to price exists, the Board of Trade appoints a competent engineer as referee. But, as I have before said, the town authorities must re-lease, and this generally is given to the original company, as in the cases of Liverpool and Glasgow. The County Council of London has given notice to the London Street Railroad that they intend to take posesssion of that road under the Act of 1870 ; but they doubtless will re-lease it back to that company, as under the act they cannot run the cars themselves, though they will take care of the tracks. The town of Birmingham took advantage of the act, and built tramways in that town, but leased them to different companies who run by electricity, steam, cable and horse power, and soon that city will decide which of these is best for Birmingham, and compel the several companies to adopt the system decided upon by the City Council.

In Paris and Berlin the mode of street conveyance is a combination, like London, of the horse railroad and the omnibus, and the system of low fares graded from three cents to six cents prevails. In fact, the systems and the style of coaches in all three cities are very similar. I have seen nothing in any of these cities that a Bostonian might envy, so far as horse car accommodations are concerned, except the penny fares , but our long distance rides are much cheaper than in either of these cities, especially when it must be remembered that the working classes in any one of them do not earn one-half that which a mechanic receives here.

One great advantage, though, which they possess over us is that you are always sure of a seat ; for if a horse car or omnibus has its full complement the conductor admits no more, and you must wait for the next car which has room for "one more." How the system of waiting would please our rapid transit people in Boston and its suburbs is another thing. It may be worth an experiment here. In addition to all this there are the hansom cabs of London and the cabs of Paris and Berlin which seem to be omnipresent, and which transport passengers for very low fares, and are used more generally than with us. But these are not all the convenience and facility for travel which the people of London, Paris and Berlin enjoy, London and Berlin especially. They have a circular system of either underground or surface railroads, affording quick transportation from the suburbs to the city, and from any station on the line of these circular roads to any of the great railroads that go from the city throughout the country. In addition to this, the city of Berlin has a grand elevated railroad structure of four tracks running east and west and halving it, and thus solving effectually the question of rapid transit, not only for suburban but for through travel also.

The electric underground railroad of London, I must confess, though it be treason perhaps to say so, did not impress me favorably as a passenger traveling along it, and that impression was shared by nearly every person to whom I spoke in my desire to get the ordinary passengers' views about it. I went to London to inspect it, and, with a partiality rather in its favor, I rode through it a dozen times or more. By the courtesy of the officers I inspected it from a rear platform by the aid of a lamp, and the oftener I traveled over the road the less favorably it impressed me as a system for Boston. I found that the air is

fresh enough in the tunnel, with a temperature of fifty degrees; that the cars are invariably closely shut to exclude the great draught, and the air in them is not good. This keeping of windows closed is necessitated by the great draught which the single track tunnel has. Then, in addition, there is a noise like the roaring of the ocean mingling with that which electric cars usually give, making the short trip of one-quarter of an hour a very disagreeable one indeed. I asked the engineer if it were possible to do away with the sound. He answered, of course, no; but it could be lessened by lining the tunnel with some substance that absorbs sound. If such a tunnel were built in Boston the temperature in it, I am informed by our engineer would be fifty degrees—not a very inviting place for delicate persons on a summer's day, with the thermometer outside in the nineties.

As a piece of engineering I presume it is perfection, but as a mode of conveying human beings from one part of a great city to another I should much prefer some other method, and some other feeling when traveling than the buried-alive feeling which one experiences in this tunnel. The underground district railroad of London is entirely different. To be sure the odor of gas is sometimes around, but a gleam of light comes in every few minutes. It is double tracked, leaving plenty of space for air. It has open spaces wherever they can be got. It is near the surface, the temperature of the tunnel is about the same as that of the outside air, there is no intense wave sound, and one feels in riding through it much more comfortable than when traveling through the tunnel of the New York & New Haven road in the city of New York. What this underground system does for London the viaduct system of Berlin does more completely for that city By how much light is above darkness for a traveler, in the same measure is the railroad viaduct of Berlin above and beyond any of the other modes of conveyance which I have seen. But its perfection is not alone in its workmanship and its elegant stations and the fact that it is in the sunshine; but it consists also in the facilities it affords for traveling in any direction east and west, and to any part of Europe, without leaving the line of this road, thus not only giving the citizens of Berlin easy, cheap and rapid transit, but forming a direct line of communication between the great railroads of the German Empire.

The German Empire built the road I have described. I am much afraid no private corporation could afford to build such a road here, but if built, no matter by whom, nobody will deny that it would be of inestimable advantage to the people of Boston and its suburbs, and would solve a great part of the rapid transit question with which we have to deal.

Improved Dynamo Construction.

By F. A. SCHEFFLER.

Readers will discover that this short dissertation on the above subject is not a theoretical one. The object is merely to go over the ground roughly and touch upon some particular feature of dynamo construction from a layman's standpoint, which will, perhaps, be more readable to some persons than would an article involving pure theory and mathematics.

The use of dynamos has in the past few years become so general in the street railway business that a discussion involving the improvements made during the past ten years in the design of such machines will not be out of place. As there are no dynamos in use, at the present writing, of the alternating current type, for street railway work, these remarks will be confined to the direct current type. In considering the advance made in dynamo design it will be advisable to recall to mind these machines as they were designed years ago for lighting purposes. The old Edison Department for Isolated Lighting began business by introducing the sixty-light dynamos in 1881, the only practical dynamo built by the Edison company at that time. This machine weighed 2,500 lbs. The wattage output was 4,620 or 1.84 watts per pound. It was a wonderful piece of work considering the small amount of knowledge then at hand for properly designing dynamos for the new method of illumination. Mr. Edison, however, seemed to think that such small machines were of too little consequence for him to perfect, and prepared to turn his personal attention to his "Jumbo" machines, several of which were put in practical operation in the old Pearl Street station, New York City, in 1882. Each dynamo was built originally for 1,200 lights of sixteen candle power each. After they were nearly completed some changes were made, increasing their capacity to 1,600 lights. They were *coupled direct* to high speed engines (Armington & Sims and Porter-Allen were used) running at 350 revolutions per minute. Each one of these machines, without the engine, weighed not less than 30,000 lbs. This was a decided improvement over the sixty light dynamos in the output as compared with weight. The large machine produced four watts per pound, and considering the slow speed at which the armature revolved, the results were remarkable.

One can now look backward and see how completely Mr. Edison was in advance of the times when he proposed coupling dynamos direct to the prime movers.

While there has been an astonishing improvement made in the reduction of material used in the construction of dynamos of equal output in the past ten years, the improvement made in the efficiency of such machines cannot be said to have changed materially. It is surprising to note that claims and generators of ninety-five per cent. efficiency were made by the various electrical manufacturing companies as far back as 1882. These claims were founded on published detailed tests and experiments made by certain college professors who were considered the highest authority in this country on such matters. I am not aware of any higher guarantee, or even claim, being made to-day by any manufacturer for the most improved dynamos. Five per cent. loss in friction and leakage is indeed an exceptionally small amount, and this may *possibly* be reduced by the use of ball or frictionless bearings. We cannot possibly look for much improvement in the increase of efficiency in the electrical construction, for nearly the whole of the loss is in friction.

The improvements in dynamo construction have, therefore, been more in the line of reducing the quantity of, or, so to speak, *increasing the efficiency of*, the material used in manufacture, reducing the labor in such construction and at the same time producing a better machine. As usual with all commodities utilized by the public, competition alone has been the principal cause for the wonderful selling price and cost of manufacture. Of course, the manufacturers' profit has also been materially—yes, extremely—reduced. Some of us can remember when a sixty light sixteen candle power dynamo sold for $1,200. To-day the same machine can be purchased for from $300 to $400 and it will be of a more lasting quality, requiring fewer repairs, and more easily repaired when necessary.

Self-oiling bearings have become almost a necessity with customers, and nearly all of the prominent manufacturers furnish them on their dynamos. Whether the demand for such bearings has been created through positive satisfaction by their use or whether it has grown to such proportions by the mere supposition that it is a "good idea" to have them, will never be told. The truth is that there are two sides to the question. Some persons claim that oil cups, having a sight feed, and an attachment whereby the feed after it is set can be stopped and started at will, without requiring time to reset the same, are the proper devices to use for bearings, for the reason that the dynamo tender is obliged to pay strict attention to the dynamos and bearings, and there is, therefore, no possibility of their being left to take care of themselves, such as might be the case with the self-oiling bearings, because the latter are automatic.

The tendency amongst manufacturers to reduce the speed of armatures is very great, and although the decrease in speed usually means increased shop cost compared with a higher speed for the same output, such machines can be sold at a proportionally higher price, because the user can readily see that slower speed means less wear and tear, and therefore, fewer repairs and less liability of "shut down" on account of hot bearings. Certain manufacturers are building dynamos at present, with very moderate speed of armature, giving an output of seven watts per pound of gross weight (direct current machines—alternating dynamos which usually run at an excessive speed, have a much higher output per pound). Comparing this with dynamos made ten years ago the wonderful advancement can readily be discerned.

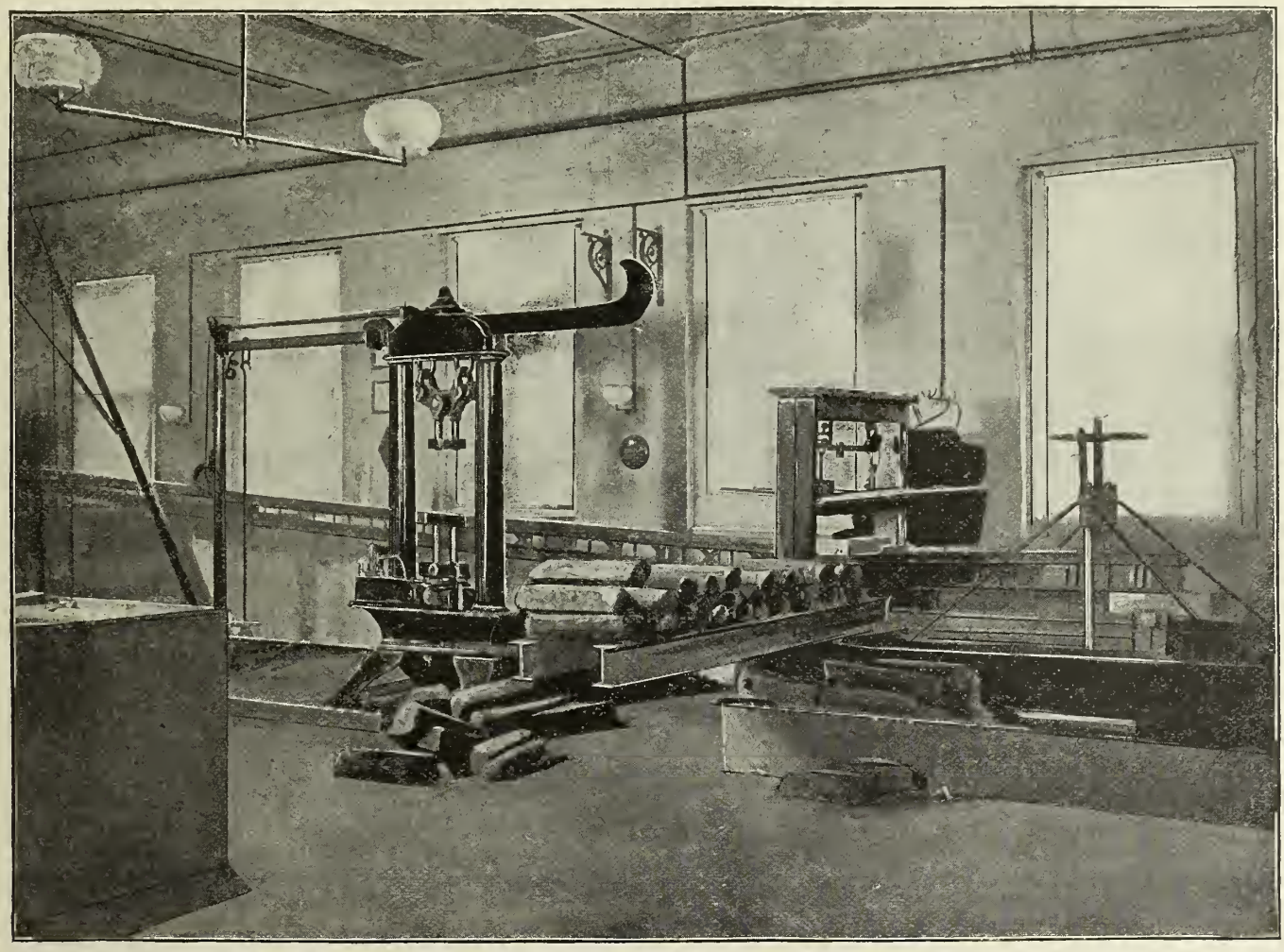
Two pole machines are still being made by the various manufacturers, but this type is used in comparatively small dynamos or generators. As the capacity of the machine is increased the number of poles is also increased, and there are numerous advantages in multipolar machines; they will occupy less floor space than any other type, weigh less for the same output, are more efficient, and when one magnet is ruptured it can be "cut out" temporarily and the machine can still be used, although it will not, of course, give its full output, but this is better than stopping altogether, such as would be the case with a two pole machine. Multipolar machines are undoubtedly more expensive to build, as to labor per pound, than any other type, and although the material used is decreased, there is not enough difference in the cost to cover the increased amount of labor. Manufacturers of such machines should, therefore, demand a higher price than would be asked for two pole machines, but competition will probably again interfere and regulate the difference. Unfortunately competition is frequently the death of some firms, although it is usually said to be the life of business. Electric machinery to-day is being sold in the form of dynamos, generators and motors at a price, in a great many cases, which is all out of proportion to the cost of manufacture. This is all very well for the purchaser, but he should look well into the kind of any article offered, when the price is much below that of other bidders. Prices for apparatus of the kind mentioned are extremely unstable at this time, and from personal experience we know that sales are too often made with no profit whatever to the manufacturers, but this has nothing to do with dynamo construction.

Since writing the above I have glanced over the latest weeklies on electrical work, and in one of them I saw a description of an entirely new design of direct current machine of the multipolar type which rather upsets one of the advantages peculiar to the multipolar machines already outlined, in regard to "cutting out" one magnet in case it is damaged, and still continue to operate with a proportionate output. This new machine has only *one* field coil, although there may be six, eight, ten or more poles. Truly, while we are spending time to-day discussing improvements, and making certain deductions therefrom, to-morrow will dawn with some new type which will cause us to re-investigate and change our comment to suit.

That the future uses of electricity will require larger units of generators no one can gainsay. These units have already attained 350 and 500 H. P. in this country, and 1,500 H. P. in Europe, with engines or prime movers coupled direct. There are not many cities in this country, however, where the demand for lighting would require such large units as the latter, but the introduction of the "juice" is coming to be of such moment for all classes of work where power is required that we predict that a unit of 1,500 H. P. will, in a few years, seem to us what 200 H. P. did four years ago, and there will be many places where such units will be in daily, if not nightly, operation, furnishing current for carrying multitudes of workmen to and from their occupations and for operating the machinery which furnishes them employment. What an Elysium it would be to reside in a city where there were not more than one, two or three immense central stations which would be capable of furnishing light, heat, power of all kinds, including rapid transit, confining all the disagreeable soot, and so called smoke consumers, to the district occupied by the station, discarding the "each-man-for-himself-and-devil-take-the-hindmost" plan now so

entirely in use in large cities particularly, where every office building, every store and factory has its own boilers, engines, and frequently electric lighting department, thus permeating the atmosphere with volumes of smoke and other gases, and defrauding us all of what is most essential for our welfare, pure air. This, no doubt, is pleasant dreaming, but who can foresee the extent or limit of possible electrical engineering? Fifteen years ago we should undoubtedly have been liable to look upon a man as a confirmed crank who could have predicted conversing with a friend separated by 200 miles, or could have foreseen going from place to place through cities and suburbs at from five to twelve miles per hour by the "broomstick" train.

If we are to judge by the "signs of the times" the World's Fair electrical exhibition will demonstrate that in all matters pertaining to the welfare and industry of the universe, there has never been such rapid advancement as has been made in the art of electrical engineering since rumors of its usefelness as a method of practical illumination were in circulation in the latter part of the "Seventies." There may be to-day, perhaps, some of the doubters, men who are intending some day to make use of electricity in their business, and are only waiting (so they say) until the new field is in a more settled condition, so that they will know positively that when they do purchase, the machine and its appurtenances will embody all the improvements possible. To such I can only say, that under these conditions you will *never* use the current; you will never know what convenience is; you will be left far behind your progressive competitors in business, because, like all arts, electrical inventions and improvements *never* will attain a "more settled condition."



STRENGTH OF POLES.—CORNELL UNIVERSITY TESTING ROOM, SHOWING FIRST POLE DURING TEST.

Strength of Poles.

Some interesting and careful tests of the strength of iron poles used in street railway work have recently been made by Profs. R. H. Thurston and R. C. Carpenter, of Cornell University, Ithaca, N. Y. The tests were made at the request of Milliken Bros. of New York, and through the courtesy of this firm we have been enabled to present below an abstract of the report submitted by Prof. Thurston.

The object of these tests was to determine the behavior of built up iron poles when subjected to a pull at the end in a direction normal to the axis of the poles and of sufficient magnitude to cause permanent deformation or "set." The poles for this test were furnished by Milliken Bros. of New York, and were five Milliken poles, which are numbered I, II, III, IV, V; three pipe poles, lettered A, B, C, and one chestnut pole. Poles I, III and IV were of special make and not standard, and were tested simply to get data so as to arrive at formulæ to enable Milliken Bros. to exactly figure poles for special work. Poles II and V were the standard side pole and pull-off pole respectively, manufactured by Milliken Bros. for street railway use, and during the tests were filled with Portland cement from the butt to a point six inches from the butt.

They differed somewhat in weight, in the arrangement of the "lacing," and in the various "gusset plates" used in the construction, as detailed in the following table:

No. of Pole.	Length Over All.	Length Unsupported.	Lacing from.	To.	Gusset-Plates between Butt and Top Plates?
II.	26 ft. 6 in.	20 ft. 7 in.	Butt Plate.	Middle Plate.	Yes.
V.	28 ft. 6 in.	22 ft. 6 in.	Butt Plate.	Middle Plate.	No.

Poles B and C were of the kind of tubular pipe or pole generally used in street railway construction as a side and pull-off pole, respectively, A being a much lighter pole. The "pipe" poles were made by uniting three sections of steam or hydraulic pipe, of different sizes, telescope fashion. The joints were made in two ways, according to the relative sizes of the pipes jointed; (*a*) by shrinking or forcing the large over the smaller, or (*b*) by driving a "liner" of proper thickness into the annular space between the two pipes. The wooden pole was a chestnut telegraph pole. Their respective dimensions are given below.

	Length of Eye.		Length of Sections (apparent). 1st.		2d.		2d.		External Diameter. 1st.	2d.	3d.	Total
No.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	in.	in.	in.	Weight.
A.	27	3	14		7	6	5	9	5½	4½	3½	368 lbs.
B.	28	5	14		7	1	7	4	6⅝	5 9-16	4½	486 "
C.	28	2½	15	3	5	9	7		6⅝	5½	4½	750 "
Ches'n't.	28	6	About 10 in. at butt									316 "

The method of making the test adopted in the case of all the iron poles, except V and C, was as follows:

The object of the test being to find the pull the pole would stand, and its deflection, the base was placed on the platform of a transverse testing machine, and a fulcrum formed by a tie rod of iron bolted to the base of a scale, as shown in the accompanying engraving. The load was applied to pull the top of the pole up. The tangent of the angle of curvature was measured by observing three points, one each side of the fulcrum and twenty five centimetres apart.

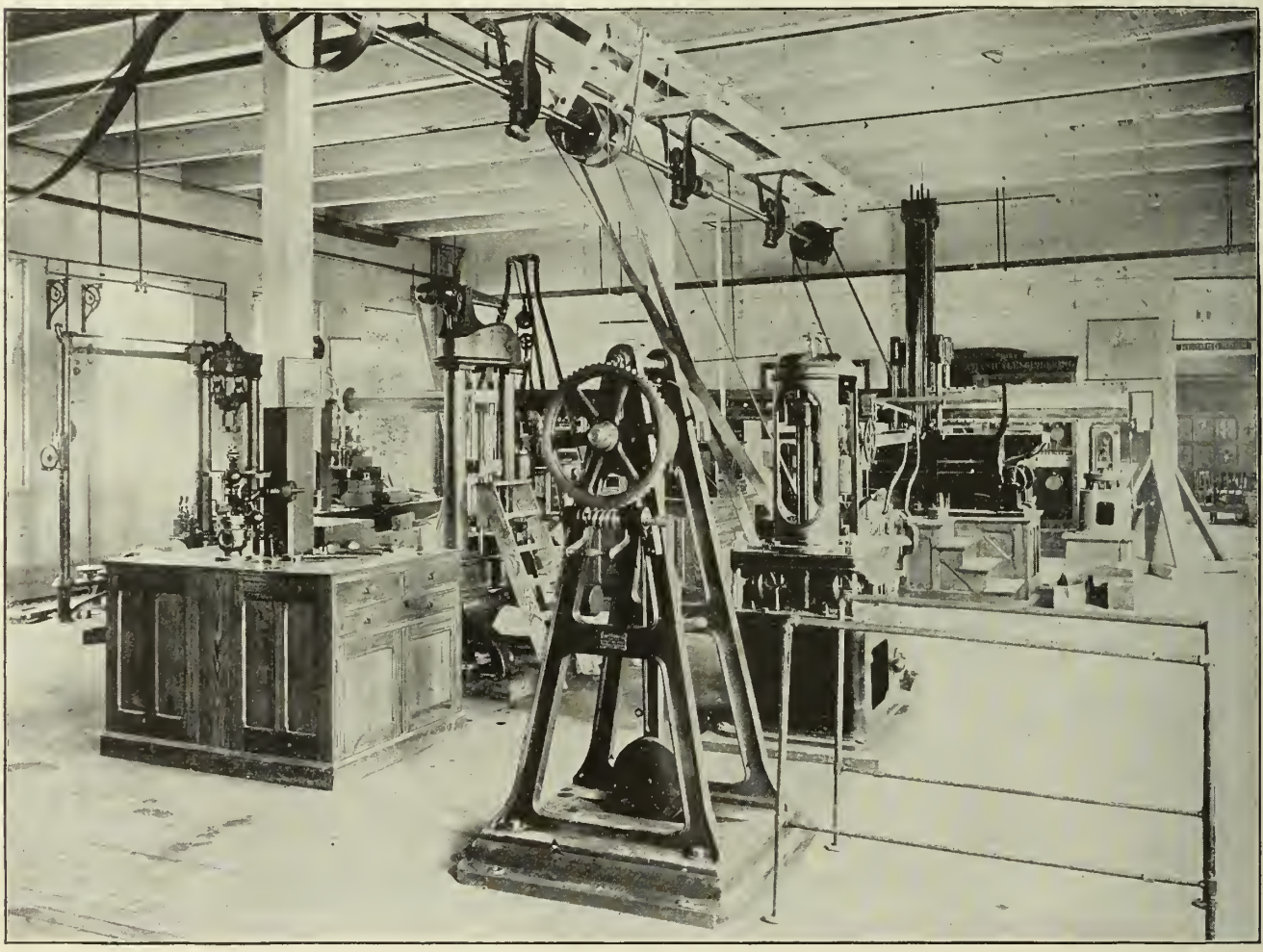
An attempt was made to test No. V in like manner, but the capacity of the chair block and that of the testing machine used as anchor were reached before permanent deformation of the pole could be pro-

duced. No. V was then placed in a larger machine as anchor, and was bent by a hydraulic jack acting against the "boss" on the cap of the pole through which the eye-bolt passes, by means of a piece of gas pipe of proper size. The jack was placed on the testing machine used in the previous tests, which thus served to weight the force exerted in bending the pole. The first attempt to bend the pole with this arrangement did not prove successful, but a slight change in the disposition of the anchor machine overcame the difficulty, and the pole was finally "set." Pole C was received while test on V was in progress, and was, as a matter of convenience, placed in the machine used to hold V, and tested in a like manner. At the conclusion of the above tests the chestnut pole was tested to rupture in the same apparatus used for V and C.

In Pole	No. II	the elastic limit was	1540 lbs.;	corresponding deflection,	10	ins.
"	" V	"	"	3340 lbs.;	"	"	14	"
"	" A	"	"	675 lbs.;	"	"	12.2	"
"	" B	"	"	920 lbs.;	"	"	16.5	"
"	" C	"	"	1420 lbs.;	"	"	13.6	"
"	" Ches'n't	"	"	960 lbs.;	"	"	37	"

When tested to destruction, Pole No. II broke by fracture of segments about 1 ft. 8 ins. in front of fulcrum. The segments were fairly pulled in two; the plane of fracture was at right angles to axis. Pole V gave a slight permanent set at fulcrum, preceded by cracking of the cement near the fulcrum. All pipe holes bent in the second joint from one foot to three feet ahead of the first joint of section of pipe. The chestnut pole yielded by opening slightly on the under side, near the fulcrum. In conclusion, Prof. Carpenter states, in referring to the Milliken standard poles:

"We now have a pole of as nearly homogeneous structure as possible, and for a given weight of iron of maximum strength. The pole is stronger than can possibly be required for any work ordinarily connected with the carrying of wires."



STRENGTH OF POLES—CORNELL UNIVERSITY TESTING ROOM, SHOWING PULL-OFF POLE DURING TEST.

THE work of changing the Williamsport Passenger Railway of Williamsport, Pa., to an electric road, commenced last May, has been accomplished. The road, at the time work was begun, had five and a half miles of centre bearing rails and nine one-horse cars. Four of these miles have been replaced and two miles of new double track laid with sixty pound Wharton girder rails. The rolling stock equipment now consists of ten sixteen foot cars with McGuire trucks and Westinghouse single reduction motors, the power being furnished by the same company's make of generators. The overhead construction was carefully done regardless of cost, to remove any municipal objection that might be made. The road will be extended in the spring.

The officers are: H. R. Rhoads, president; John Lawshe, treasurer; J. F. Starr, secretary; H. C. Young, superintendent.

Municipal Ownership and Control of Street Railways.

By R. D. FISHER.

Corporations are a creation of modern times and their career and power have been remarkable. A history of their growth would in some respects be coincident with that of rapid transit, since 100 years ago only the most primitive ideas of a corporation were in existence. But this century has been one of wonderful industrial development, and corporations have been born of necessity, since individuals could not furnish the aggregation of capital required for the numerous stupendous undertakings of the age.

The transportation problem was one with which corporations were particularly fitted to cope, owing to the immense expense involved in the construction of plants, and though some evils have undoubtedly arisen owing to the control of *quasi* public enterprises by private capital, the alleged remedy for all these troubles—that of municipal ownership—does not seem to promise the accomplishment of all the good and eradication of all the wrong in the subject, though this conclusion is often reached by socialistic thinkers.

In the question whether the municipalities should own the railways another naturally arises whether the experimental record of management of enterprises on a large scale has been in its favor. It is a matter of internal history that the attempt of a few states in this country to undertake the construction and operation of railways on their own account resulted in failure, and such roads were completed by companies or abandoned. There are two short lines, one in Georgia, the other in Massachusetts which are owned by the respective states but operated by private corporations.

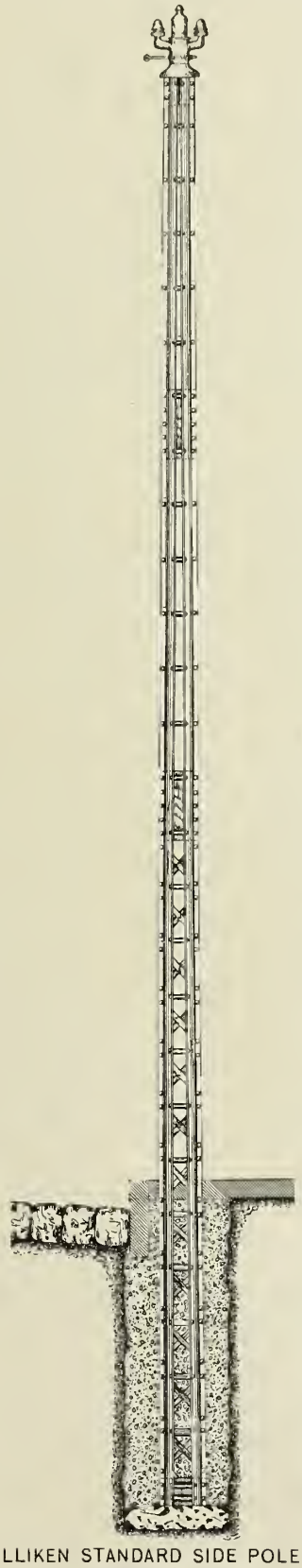
American cities have become accustomed to a standard of efficiency and economy in street railway service which no other country equals. Corporate management of such service is distinctively on a higher level than in similar undertakings by municipal control, and the latter is equally arbitrary and far less responsible, the economic waste, if any, falling on the people and not on the managers.

Another point which naturally suggests itself is that if street railways controlled and owned by municipalities were operated without reference to the payment of interest or profit, it would be not only a burden on the taxpayers, but a matter of outrageous favoritism as to which districts of a city should have roads for the convenience of the citizens thereof to the exclusion of other districts. If they were operated with a view to profit, they would probably be managed on, very largely, the same principles as private roads. There would, however, be less aggressiveness, less competition, and less readiness to intro-

duce the latest and most improved machinery or power; while a false economy often practised under municipal ownership and management for political effect, but which in the end proves most extravagant, would prevent the building of lines, and the establishment of street car service which would barely pay under private corporate management. Municipal ownership, therefore, cannot well avoid involving a city in a maze of absurdities.



MILLIKEN PULL-OFF POLE ON WHICH TESTS WERE MADE.



MILLIKEN STANDARD SIDE POLE ON WHICH TESTS WERE MADE.

A conclusive and weighty argument against the operation of street railways by municipal control and ownership is that it would introduce into our politics a large amount of patronage which must largely become the spoils of professional and scheming politicians. If the present matters involved in and belonging to the business of the various municipal governments cannot (as it is not) be administered with a view solely to efficiency and economy but used as a reward of skill, influence and bounty in swaying the popular vote, would not any future reformation of municipal politics be made utterly hopeless if the patronage were increased by an interest involving a matter so vast as the control of street railway corporations?

When our American politics are purified so as to exclude from them selfish ends and improper means, it may be possible to bring the street railways under municipal control without making them a source of general municipal corruption. But when such a millennial stage in human progress has been reached there will be no need of railways of any kind.

At the command of those in authority, quite likely the dominant political party, multitudes of men would be driven from their chosen vocations with each change of administration and their places given to favorites. Narrow economy would render extensions impossible, dwarf the growth of the city and check the advance of values in real estate, and instead of allowing the artizan to live in the suburbs where it might be possible for him to own his home, and with moderate expenses rear his family, it would compel him to live in the vicious tenement house near the heart of the city. Operation of a street railway system at cost, without profit or reserve, would check the march of human progress and mar the future of the city that attempts it.

Having now stated the reasons why the municipal control of street railway lines would be objectionable, let us consider whether any other remedy can be suggested for the evils which, it is claimed, sometimes arise under private ownership. The popular claims seem to be that in some cases privileges and franchises which belong to the people and grow in value from year to year with the increase of the city, have been given away to become the instruments of corporate greed and gain. If this is the only evil the remedy to apply would seem to be simple. Taxation has been tried with a fair degree of success, and license fees equitably fixed and carefully collected will preserve to the public an equitable part of the money value of a street railway franchise. Original licenses may be graded or increased on a basis of the gross income of the railway company and in keeping with the growth of the city. The tendency of the age is to place all taxes on corporations. Existing laws allow a tax to be levied on the capital stock, on the dividends, on the franchises, on the gross receipts, on the net receipts, on the cars, on the shares of stock, on the market value of the stock or on the estimated value of the corporate property or plant. In the near future it is possible that state and municipal taxes will be almost entirely raised by taxes levied on corporations owning and operating plants by virtue or franchises. There are other plans and ways whereby the street car companies, or monopolies as they have been stigmatized, are required to pay a portion of their revenue to the city or provide for the repair and paving of the streets through which they operate.

Other countries have, in a limited way, adopted municipal ownership and control of such corporations, but not with such gratifying results as to warrant American cities to attempt it. The plan advocated by some is that each city should own its own street railways, not necessarily for the purpose of operating them but for leasing them at a fair rental for short periods of time; but the thoughtful citizen has doubts about the expediency of such a plan. It would not lessen the controversies between the operators and the people nor charge for carriage, while many of the evils attached to municipal operation would be retained.

The writer confidently expects that the vague and indescribable dread and suspicion of the present aggressive corporation will pass away in time. They are the creation of the people. Their powers may be changed, their duties increased and a still greater good result to the public on account of their vast interests. Modification and regulation will render less dangerous their power, hostility will give way to encouragement, and the solution of the vexed question become satisfactory and complete.

Statement from St. Louis.

Below will be found the number of passengers carried and the number of round trips made by the St. Louis street railways in the last year, 1891.

The largest and most phenomenal increase of passenger traffic of any road in St. Louis, goes to the credit of the Lindell Railway, which, during 1890, carried but 5,549,729 passengers, while during 1891 it carried 10,945,585, an increase of 5,394,856.

ANNUAL REPORT FOR 1891.

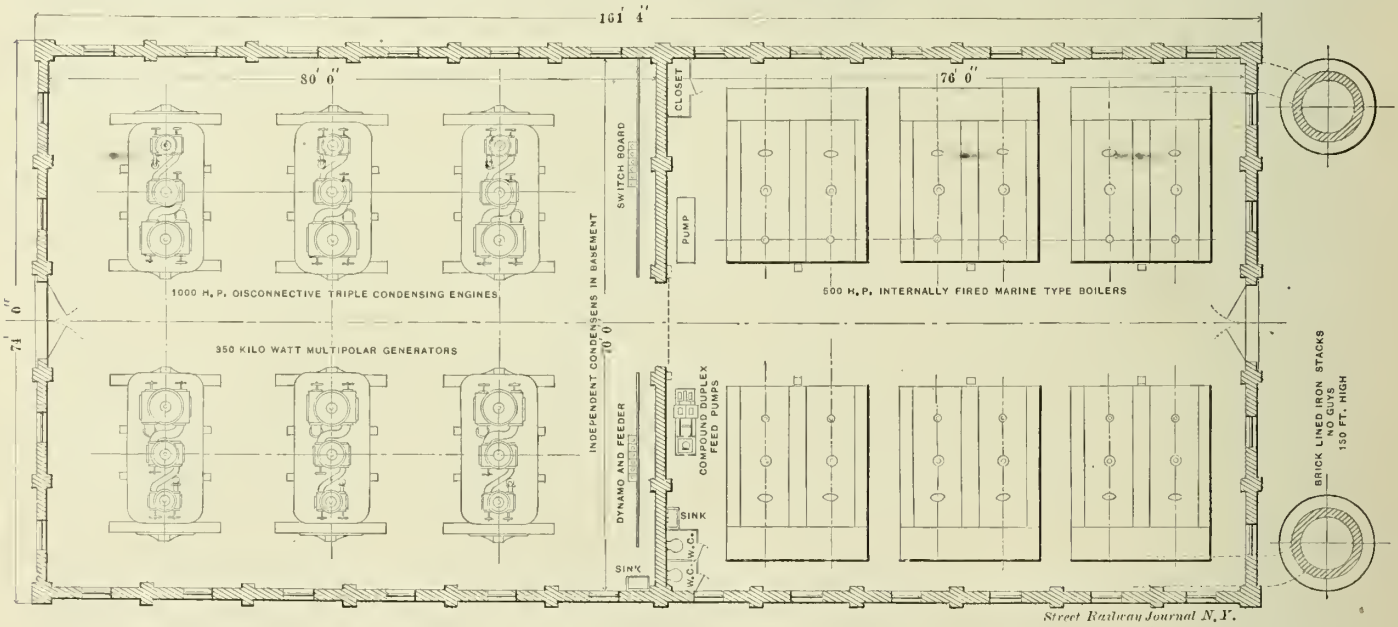
Rank 1890.	Rank 1891.	Name of Road.	Trips.	Passengers.
17	16	Baden & St. Louis	16,980	214,987
11	14	Benton & Bellefontaine	214,538	1,765,186
8	10	Cass Ave. & Fair Grounds	218,568	3,303,856
2	4	Citizens'	373,596	8,864,2 2
15	.....	Forest Park & La Clede. Included with Mo. Ry.	.....	.....
16	15	Fourth St. & Arsenal	97,442	433,723
14	12	Jefferson Ave.	1?1,470	1,838,047
5	2	Lindell	546,386	10,944,585
1	1	Missouri	1,042,814	13,551,097
10	8	Mound City	243,454	4,143,942
13	11	Northern Central	166,97?	2,207,707
6	6	People's	222,128	4,367,652
3	3	St. Louis	716,721	10,811,160
7	9	St. Louis & Suburban	102,160	4,027,888
9	7	Southern	347,588	4,270,105
12	13	Union	204,556	1,816,270
4	5	Union Depot	490,072	8,443,330
		Total	5,225,452	80,997,767
		Increase since 1890	1,011,934	12,892,206

Development in Designing Central Railway and Power Stations.

BY C. J. FIELD AND E. J. COOK, OF THE FIELD ENGINEERING CO.

There has been within the last year a marked improvement in the designs of central stations. They are more carefully planned, so that they better serve the purpose for which they were constructed. Still, there is room for advancement, and the next year will see, we believe, no little progress in this direction. The particular line of improvement to which we desire to refer at this time is the adoption of the directly connected engine and generator. By this arrangement the smallest possible amount of space is needed, and the best economy in operation is secured.

The earnings of companies are more materially increased by close attention to details in the generation of power than in any other branch of the business. In the past too little engineering skill has been given to this work. There has been an absence of harmony and plan in the general design. The engine man designed his engines ; the electric man his generators ; the boiler man his boilers ; the architect his building, but there has been no one to bring these plans into unity. The result has been that the plant was a conglomerate. It is a matter of fact that this has been the method pursued in the case of most power stations in existence to-day. On the other hand, if the matter is taken up with the fundamental idea that a station is a totality—not a loose combination of several departments—then each part is planned in accordance with this central principle and is made subordinate to the general harmonious arrangement. In such a plan a competent engineering firm may design the general plant, work with the makers of the machinery for the best apparatus, and assemble it in a station planned to conform to the machinery, in contradistinction to forcing the machinery to conform to the station. By this plan the best results may be obtained.



PLAN OF CENTRAL POWER STATION (DIRECT COUPLED) 6,000 H. P. CAPACITY—DESIGNED BY FIELD ENGINEERING CO.

A year ago our vice-president and mechanical engineer, Mr. E. F. White, was sent to Europe to ascertain the latest developments in engines of the direct connection type. We had realized that American push for standard commercial work had been so great, that the desire to achieve results in the briefest possible time had become so prominent that we, in this country, were somewhat behind in this particular line of work. Mr. White devoted several months to investigating the subject throughout Europe. He consulted the engineers and companies that had developed anything of value in this department. We were even more strongly impressed than before with the advantages attending the operation of directly connected engines when Mr. White's reports were presented. We do not believe in importing any considerable amount of apparatus, for we think American manufacturers can build as good machinery, if not better, than that designed abroad, but in the matter of directly connected engines they had to be forced by the demand to commence the work.

At the present time we are designing several stations in which this kind of machinery is used, and one of the best of these structures is illustrated in the accompanying diagrams. Engines heretofore in use in this country in power stations may be divided into three classes : First, high speed directly connected ; second, slow speed Corliss, connected to a countershaft ; third, slow speed Corliss, belted direct. Without discussing the relative advantages of these three methods we may say we believe in connecting generator and engine as closely as possible, and are opposed, consequently, to countershafting. We are convinced that, all things considered, better results can be obtained at the present time in power stations if this mode of connection is left out of the question entirely.

The style of station here shown is, in our opinion, the most desirable from every point of view for the progressive company. The engines and generators here described are now being turned out, and several stations with this kind of apparatus will be built during the present year.

The engines are being designed and built by the Lake Erie Engineering Works at Buffalo, and they are constructed with the idea of combining the advantages of the Corliss and high speed engines. They take a moderate rotative speed rather than a high speed ; but still they yield the economy obtainable by the double valve system usually shown only in the Corliss type. They operate at a speed of about 130 revolutions, and have independent steam and exhaust valves. The regulation is closer than that obtainable with the Corliss ; the centrifugal shaft governor used with the engines makes it possible to secure a regulation within one per cent., even with the low speed mentioned. With engines built for this work special attention must be paid to the matter of providing ample flywheel capacity, so that strains on the working parts may be relieved. This fact seems to be lost sight of by some of those who are preparing to build engines of this class. In the engines designed for the station described here the flywheels are placed between the cylinders. This is shown in the view of the engine and dynamo room. For direct connection the generators are attached to the end of the shaft ; when belting is used the generators are replaced by band wheels ; the main flywheels remain between the frames, as shown.

The cylinders of the engine are so connected and arranged that one or more can be disconnected and the engine be operated as a compound. This is an advantage in case of accident or for running any continual length of time on reduced capacity. The engine is also arranged to give good economy, either condensing or non-condensing. The general cylinder dimensions shown are as follows :

Diameter of high pressure cylinder			16 inches
" " intermediate	"		26 "
" " low pressure	"		40 "
Stroke			34 "

Speed, 115 revolutions.

They are built to operate under 140 or 150 lbs. condensing, or 200 lbs. non-condensing. They have a normal capacity of 1,000 H. P.

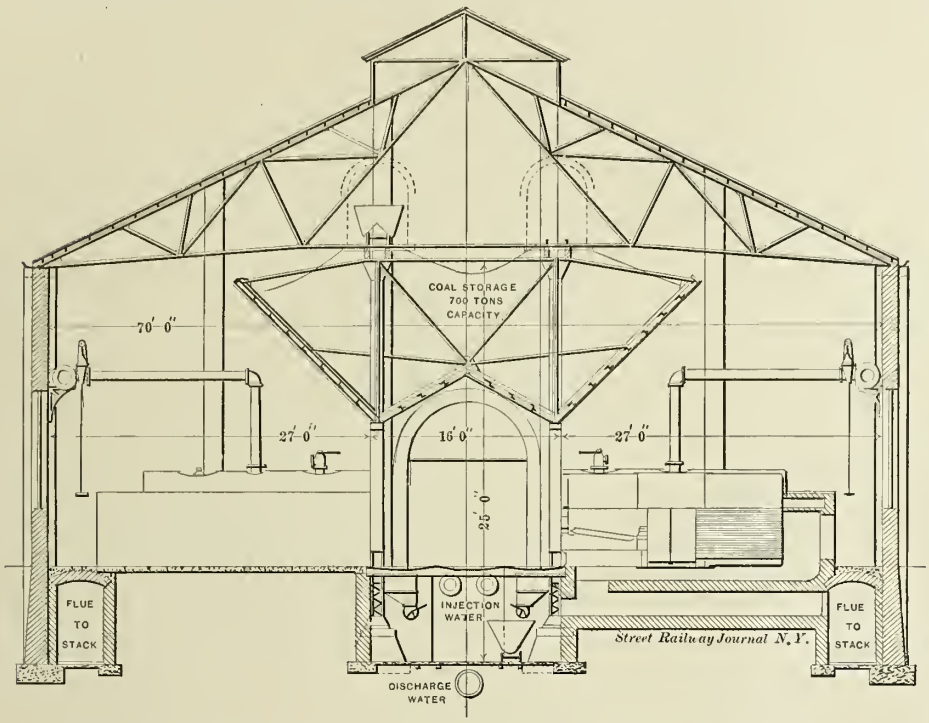
The generators designed for direct connection to the engine are multipolar. The type shown in the diagram occupies, perhaps, the smallest floor space. Generators of the general character employed are built by several of the prominent electrical manufacturing companies.

The boilers shown in the sectional view of the boiler room are a developed type of the marine boiler, designed for stationary work. These boilers are internally fired with corrugated fire box and combustion chamber, and give a very high economy. The general flue arrangements are shown in the plan. Two of the boilers, each of 500 H. P., are planned to operate one of the engines with fifteen pounds evaporation per H. P., which would be about the general economy for a plant of this kind.

In the centre of the boiler room is shown an economical arrangement for storing as well as handling the coal. The fuel is brought in on an overhead trestle by a car, or conveyor, from the boat or freight car. This method of handling coal reduces the labor item. At the same time it does not interfere with the light and ventilation of the boiler room. Too often the arrangements are such that the boiler room resembles closely the stokehole of a steamship. By the means here provided the coal is conveyed to the front of the boilers through the supporting columns of the bin proper. The columns are built of channel bars, with plate sides, riveted, and arranged with proper openings for depositing the coal on the boiler floor in front of the fire doors.

The stack which we are designing for the station is of the general type used in the steel works in Pennsylvania. It is of heavy iron and is brick lined to the top. Such a stack, while practically indestructible, is cheaper than one made of brick. The two stacks conform to the idea of duplicating all parts of the plans.

The station is planned as a brick building, with sixteen inch walls with buttresses every thirteen feet. The general dimensions of the station are 170 x 70 ft. over all; the engine room is 70 x 80 ft. Considerably more engine capacity could be provided for in the room, but for this kind of work we believe in one story buildings with ample room and without danger of crowding. In the engine room is provided a traveling crane of sufficient capacity to handle any part of the engines or generators.



SECTION OF BOILER ROOM.

The roof construction is the Fink type of iron truss riveted with Z purlins and plank or corrugated iron covering. When plank is used it is slated. A louvre extends the length of the engine and boiler rooms, with heavy ribbed glass on top.

The Rapid Transit Controversy in Detroit.

Detroit needs better transportation facilities. While electric railways are in operation in the outskirts, the great majority of citizens have to depend entirely on horses. Most cities possessing one-tenth as many inhabitants as Detroit, enjoy more rapid transit, and the result has been that the bitterest complaints have been made by citizens. No one realizes this state of things more keenly than does the largest local railway company on whose lines the majority of people daily ride to and from the business section; the preceding sentences, in fact, are almost a paraphrase of the introductory portion of a communication recently sent by the company to the City Council.

The situation has been peculiar in Detroit. The developments of the last year, with its record of strikes, public meetings and purchase by the Citizens' Railway Co. of their extensive street car system are so familiar that no summary is necessary in this place. The most serious attack on the company ensued when their franchises were called in question. City officials asserted that certain of the rights expired much sooner than appeared on the surface. The Woodward Avenue franchise, it was claimed, expired within a year. The point raised was a technical one, and it seems scarcely probable that it would be approved by the courts. That seemed to be the general impression in Detroit. Nevertheless, as threatening their very life, the company were forced to consider it important. On January 5, the company made a move for the settlement of the difficulty. They sent a communication to the Common Council, in which they agreed to convert their lines into a rapid transit system, provided that the threatened attack of the city were abandoned. The document is an interesting one. It speaks at length of the need of rapid transit in Detroit, and states that an investment of $2,000,000 will be necessary to provide the desired facilities. This sum could be readily raised were not the company the object of such bitter attack. Coming to the merits of the attack against them the company say:

"Whether this attack is justified by any reasonable doubt as to the law need not be discussed here. The fact remains that, before investing in the stock of this company, the present owners of the stock obtained the legal opinions of some of the ablest counsel in the state concerning this question, and were advised that the contention of the city had not the shadow of a basis in the law. The cases upholding our rights are numerous, clear and decisive; while not a single case has been found to the contrary, or even raising any doubt on the subject.

"Nevertheless, the attack has been continued, and it is preventing the company from putting in a rapid transit plant. Rapid transit is not possible until the question of the right to use the streets is settled, and only two ways of settling it seem to be open. These are either litigation or a recognition of the rights of the company.

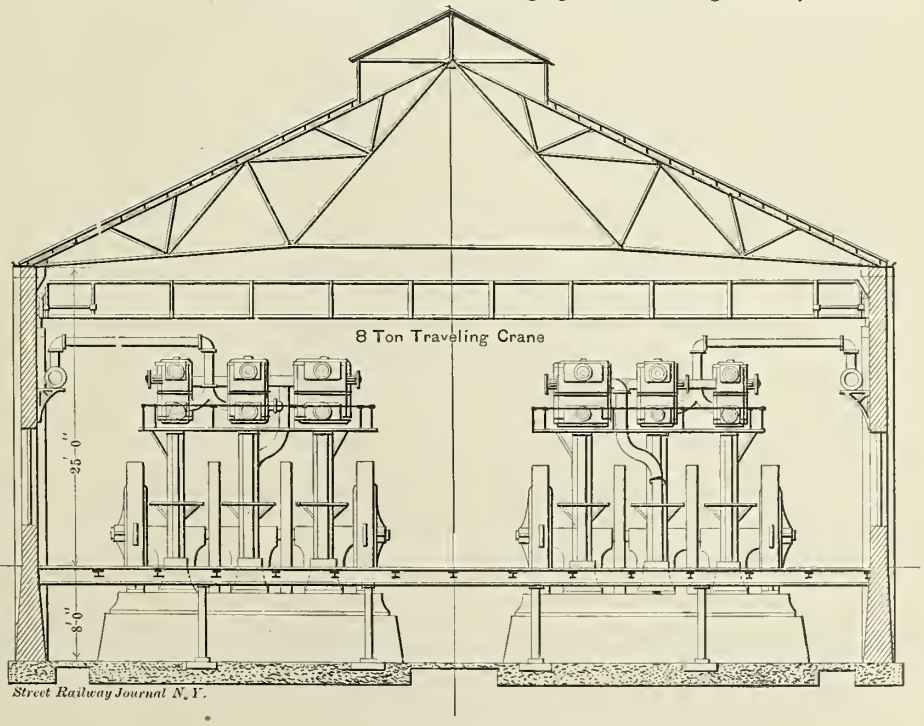
"Litigation involves expense and delay. If there is any way in which an adjudication suitable to such vast interests can be intelligently and satisfactorily obtained in a brief time it is unknown to us. Certainly we, who have made so large an investment in a property worth several millions, must exhaust every possible defense known to the law to defend our rights and interests.

"It is safe to say that, unless terminated sooner by a decision favorable to the company, no conclusion in the litigation can be reached in less than six or seven years from the commencement, thus consuming over one-third of the time which is in controversy. It is not to be expected that any decision destroying the value of this great property will be acquiesced in so long as the contest can be reasonably continued. In the meantime, rapid transit is impossible. In the midst of litigation, money cannot be raised.

"This company are ready and willing to proceed at once with the work of equipping the lines of railway with a rapid transit plant. They will do so as soon as the city reconsiders its proposed attack on the right of the company to operate their lines under the existing ordinances, and as soon as the city removes the present distrust by recognizing that those ordinances confer rights which are valid until the expiration of the time provided therein.

"This company believe that the best interests as well as the good faith of the city call for such a confirmation and, inasmuch as the work of preparation should commence at once, if anything is to be accomplished this year, the company respectfully request early action in regard to the matter.

"We make the formal proposition that, if the city officials will withdraw their opposition to our efforts for improvement and will take action in the way of acknowledging and confirming the city's contract, so that the additional investment required can be made, this company will proceed at once to the equipment of their system with a rapid transit plant."



SECTION OF ENGINE AND DYNAMO ROOM.

As far as can be judged, this proposition met the favor of the residents of the city. If it were declined, the prospect of rapid transit would be postponed indefinitely. If it were accepted under reasonable guarantees, the question which has caused so much annoyance would be settled at once.

Mayor Pingree took an entirely different view. In his annual message to the Council on January 12, he urged the city to fight the franchises. Here is the extract:

"I am pleased to note that the city, through its representatives, has joined hands with the citizens, through their committee, in determining to contest in the courts the enjoyment of these immense values, and to ascertain definitely whether they belong to the public or to private corporations. I do not think that the city owes any consideration to the street railway companies, or to the individuals who are their directors or stockholders in this matter. For many years, when the rights of the street railway companies were not in dispute, they have been importuned repeatedly and continuously by our citizens to furnish them with some means of rapid transit, and though they have promised it time and again they have never made their word good. The result is that Detroit is now practically the only city in the United States of upward of 10,000 inhabitants which is still dependent upon horses as a means of street car transit. These street car companies now assure us that if we will leave them in peaceable possession of their claim for seventeen years' exclusive rights in the streets they will furnish rapid transit at an early date. But this is the same assurance which they have been giving the public for many years, and we have no more reason to believe them now than we had years ago. I feel assured that even our enterprising citizens who own large amounts of real estate in the suburbs, will be as willing as those who live in the more densely populated portions of the city, to forego for a short time the advantages of rapid transit, if by that means they can turn into the public treasury several millions of dollars properly belonging to the public and secure a three-cent fare, all day, on every route of the city.

It is an interesting fact that the mayor in his message also declares against overhead wires so that the company would be barred from putting in an electric system.

Relative Advantages in Cable and Electric Power on Street Railways.

We frequently hear and read a great many random statements as to the relative commercial efficiency of electric and cable street railways, both as to first cost and cost of operation, and it is often heard that this engineer or manager is an advocate of the cable, while that engineer or manager is a staunch electric railway man. These expressions are as absurd as if it were said to-day that the one was an advocate of the wagon, while the other was a staunch carriage man, as each of these, like the cable and electric railway, has it proper place and part, and fulfills in its separate way the end sought and under different conditions, the one more economically and efficiently than the other.

While it is a fact well known that the conditions existing on a large majority of streets of American cities demand the electric railway, it is at the same time apparent that a number of cases exist where the cable railway is, and will be, the more economical and efficient, and it is impossible for an engineer, with the data now obtainable from electric and cable railway cost of construction and operation, to be prejudiced to that extent that he will be an advocate in all cases for the one or the other, as it is fully demonstrated by actual service that, under varying conditions of car mileage made, load, travel, grades, number and radius of curves and climatic conditions, the cable road is often the better adapted for the work at hand, and *vice versa*.

We may hear at times from laymen the expression that the electric road is cheaper for a given work because sixty per cent. of the power on a cable line is used for moving the driving machinery and cable, or, in other words, the dead load. While this is true in some cases, it is by no means true in all, from the fact that the greater the number of cars that are run on a certain length of road, the less the percentage of dead load becomes, and it is principally owing to this fact that cable railways become more economical for a given work, if that work be very large, and if the work be large enough they become more economical than electric roads.

The question of percentage of power lost in propelling the cable while a certain number of cars are stopped to take on or let off passengers (whereas in the electric railway all power not used remains in the reservoir or trolley wire), is not taken into consideration in the following comparison, except as it influences the operating expenses.

We know that the first cost of a cable railway is more than the cost of an electric railway of the same length and capacity, but this difference is, on recently built roads, much less than is shown by a Census Bulletin, No. 55, recently issued, which publishes the statement that the relative total cost of electric and cable railways is respectively $46,697.59 and 350,324.60 per mile of road, where there were selected for purposes of comparison, ten electric and ten cable roads, the above being the average cost of ten in each case.

While we do not doubt the authenticity of the above, we believe the statistician to have been unfortunate in the selection of roads for comparison, and it is to be regretted that this is so, as the Bulletin is in all other respects a valuable acquisition to street railway literature, bearing upon the practical question of cost and operation.

Managers or railway owners are not as much interested in what ten or more roads have done badly or expensively, as what one or two roads have done well, and what they themselves may naturally expect to do with the proper selection and management of a system, which, it is contemplated, shall be built and operated, and in this article, one well built and managed cable, and one electric railway have been taken for purposes of comparison as to relative first cost, efficiency and economy of operation and the two roads selected are, as nearly as possible, of the same length and operated under nearly the same conditions as to traffic, grades, curves and work performed.

COST OF CONSTRUCTION.

System.	Miles Double Track.	Cost Complete with Equipment.	
		Total.	Per Mile, Double Track.
Electric	2.6	$252,569	$97,142
Cable	3.299	353,268	107,083

OPERATING EXPENSES.

System.	Time Taken.	Passengers.	Car Miles.	Operating Expenses.			
				Total.	Per Mile, Double Track.	Per Passenger.	Per Car Mile.
Electric	12 mos.	1,124,720	287,766	$38,114	$14,659	$0.0339	$0.132
Cable	12 "	1,303,117	386,228	50,330	15,256	0.0386	0.130
Electric	If interest at 6 per ct. on the cost of construction is added to cost of operation.			53,268	20,488	0.04736	0.1851
Cable				71,526	21,681	0.05488	0.1852

If the electric railway, with the number of passengers or the same traffic, were to change its power to cable traction, if operated at the same cost per car mile as the cable railway cited, it would carry its passengers at a cost of $0.04738 apiece, or practically the same that it did when an electric railway, and the same is true as regards the cable railway, that is, the cost per passenger on these two roads is dependent on the number of passengers carried per car mile and independent of the motive power.

Referring to the valuable paper by R. J. McCarthy, published in the STREET RAILWAY JOURNAL for November, 1890, there will be found the itemized cost of motive power per car mile for an electric road having a car mileage of 233,287, as follows:

	CENTS.
Engineers and firemen	.540
Repairs of engine and machinery	.002
Oil and waste for engines	.029
Fuel for engines	.829
Water for boilers	.051
Repairs of dynamos and motors	1.223
Repairs of line and trolleys	.291
Lubricants for dynamos and motors	.113

And for a cable road having a car mileage of 802,718:

	CENTS.
Engineers, firemen and helpers	.296
Repairs of engines and machinery	.491
Oil and waste for engines	.026
Lubricants for cables and pulleys	.043
Fuel for engines	.590
Water for boilers	.057
Renewals and repairs of cables	1.425

Also that for any other car mileage of this electric road the expense for engineers and firemen, repairs of engines

and machinery, and oil and waste for engines per car mile, will be inversely proportional to the total car mileage; the total increase of cost of fuel and water will be to the increase in car mileage as two is to three, and the expense per car mile for repairs of dynamos and motors, lubricants for dynamos and motors and repairs of line and trolleys will be constant.

In the cable line the expense per car mile for engineers, firemen and helpers, repairs of engines and machinery, oil and waste for engines and lubricants for cables and pulleys will be inversely proportional to the car mileage; the increase of cost of fuel and water will vary as in the electric road, and the total cost of renewal and repairs of cables will increase with the car mileage in the proportion of two to four.

If, then, x represents any car mileage, the cost of motive power per car mile for the electric road will be,

$$\left.\begin{matrix}.540\\.002\\.029\end{matrix}\right\} \times \frac{233,287}{x} + \left.\begin{matrix}.829\\.051\end{matrix}\right\} \times \frac{233,287 + \frac{2}{3}(x - 233,287)}{x} + \begin{matrix}1.223.\\.291.\\.113.\end{matrix}$$

$$\text{or } \frac{201,637.73}{x} + 2.214 \quad . \quad . \quad . \quad (1)$$

and for the cable road

$$\left.\begin{matrix}.296\\.491\\.026\\.043\end{matrix}\right\} \times \frac{802,718}{x} + \left.\begin{matrix}.590\\.057\end{matrix}\right\} \times \frac{802,718 + \frac{2}{3}(x - 802,718)}{x} + 1.425 \Bigg\} \times \frac{802,718 + \frac{1}{2}(x - 802,718)}{x}$$

$$\text{or } \frac{1,432,202,698}{x} + 1,144 \quad . \quad (2)$$

placing these two quantities equal to each other and solving,

$$x = 1,150,000$$

That is, if the car mileage on each of these two roads had been 1,150,000, the cost of motive power per car mile would have been the same on both, and an inspection of formulæ (1) and (2) will show that for a less car mileage the electric power will be cheaper, and for a greater, the cable power.

The electric road in this comparison is using double reduction motors; whereas, had it been using a gearless motor and other improvements that are being made daily, the cost of motive power would have been so cheapened that there might have been one-tenth greater car mileage before the cable railway became more economical than the electric.

It is to be regretted that there are not sufficient data to enable the making of these formulæ more complete, so as to include all the operating expenses as well as the interest on the capital invested. Both the cable and electric lines now built, vary so widely in the cost of track, plant and equipments, that no general formulæ will give the relative value of each of these items as they enter into the total cost of operation per car mile.

In conclusion, the greater the car mileage per annum the greater will be the difference in cost of operating expenses per car mile in favor of the cable road, and contarywise, the smaller the car mileage, the greater the difference in favor of the electric road.

If grades are numerous, and over ten or twelve per cent., cable railways are better than electric. If curves are numerous, and of short radius, electric traction will be found cheaper.

It is evident that there are roads to-day, which, if re-equipped, would do much better as cable, than if they were to adopt electric traction; also that there are a great many more roads where it would be very much worse to re-equip or operate with cable, and where electric traction should be adopted.

A DISPATCH from Uniontown, Pa., says that David Richey, of Leisenring, was put off a street car for some reason, on January 14, and demanded the return of his fare, which was refused. He went to his home, got his shotgun, held up the next car, and made the conductor hand over five cents. The company have had him arrested on several charges.

Additional Power for the Tenth Avenue and 125th Street (N. Y.) Cable Line.

A new 1,200 H. P. engine has recently been installed in the cable power station at 128th Street and Tenth Avenue, rendered necessary by the recent act of the city compelling the company to operate their cars twenty-four hours per day. At present from sixty to one hundred and fifty cars are being operated. The new engine was manufactured by the Dickson Manufacturing Co., of Scranton, Pa. The cylinder is 38x60 ins., the fly wheel is nineteen feet in diameter and weighs 100,000 lbs., the rim being 14x30 ins. The original power consisted of two 350 H. P. Wright engines, which have been in continual service since August, 1885, and though they have been run at a higher speed, and required to do much more work than was originally intended, not one penny has ever been spent on them for repairs, and they are apparently in as good condition to-day as ever. This is a record which does great credit to the builders.

The problem of installing and coupling the new engine by pinion and gear to the main shaft of the power station without interrupting the operation of the cable lines has been a very interesting one and has been solved in an admirable manner. The plant is equipped with four sets of driving drums, either one or all of which may be operated at the same time, friction clutches being provided on the main shaft between each set of drums, and the original engines were geared to a countershaft and connected to the same by means of flanged couplings with cross key, and this into the main shaft. The new engine is placed on the opposite side of the main shaft from the original engine, and the gear is attached to a sleeve which embraces a portion of the main shaft, about seventeen feet of which was renewed for the purpose of attaching the sleeve. Friction clutches are also provided at one end of the sleeve through which the shaft revolves. The new shaft pinion and gear were made by the Robert Poole & Son Co., of Baltimore, the same firm having designed and built the entire original construction. The new gear and pinion are of enormous strength, being respectively 164 x 81 ins. in diameter with twenty-eight inch face. As soon as the new equipment is in operation, the present main gear is to be placed upon a sleeve and connected to main shaft by friction clutch in the same manner. This will avoid the necessity of stopping the ropes in order to connect and disconnect engines, as is now done, by means of flanged couplings. This makes the plant perfectly independent and allows of running the rope twenty-four hours a day.

The boiler equipment, which originally consisted of six return tubular boilers, has also been increased by the addition of two new boilers of the same type, 100 H. P. each, manufactured by D. M. Nichols, of New York City. The new boilers are also equipped with the McClave shaking grate. A new 1,500 H. P. Berryman heater has also been installed, and a new tapering sheet iron flue has been substituted in place of the former one to lead the smoke from the different boilers to the stack. New steam piping, both for the direct steam and exhaust, has been installed, and is one of the most interesting features of the improved plant. Fifteen inch wrought iron piping is three-eighths of an inch thick, the sections being connected together by means of cast iron flanges screwed on and held together by sixteen one-inch bolts.

Special attention has been given to cutting the threads on pipe, and in flanges this was done in a lathe having a taper turning and boring attachment, thus making the taper on the pipe and on the flange to fit so perfectly that leakage is avoided. The steam pipe is provided with a copper elbow of five feet radius to allow for expansion and contraction.

Since the plant was installed the only important changes made in the machinery have been the replacing of the original flywheels, which weighed twenty tons, with new wheels weighing twenty-five tons. Some of the arms in the old wheels were cracked by excessive increase in loads. The new wheels, though they weigh but little more than the old ones, have the metal of the

arms placed in the direction of the heaviest strains. The new wheels were manufactured by the Pennsylvania Iron Works Co. a year ago or more.

These lines, as will be remembered, are operated with duplicate cables, those of the Tenth Avenue section being 33,100 ft. long, and those of the 125th Street line 25,000 ft. in length, both being run at a speed of ten miles per hour. Solid driving drums are employed which are driven by intermediate gear, and are each twelve feet in diameter. The tension weight on each rope is 2,645 lbs. Notwithstanding the light tension employed only three laps of the cable upon the drum are employed, and no trouble from slipping has ever been experienced. The last rope which was put in service is one and five-sixteenths inches in diameter, and was manufactured by the Trenton Iron Works Co., of Trenton, N. J. A striking comment upon the advantage of feed water-heaters in connection with steam plants is illustrated in connection with the changes being made in this station, it being necessary to remove the old heaters while the new one is being installed, the exhaust has been allowed to escape directly into the atmosphere. Before this change it required only eleven or twelve tons of coal per day to operate the lines, now it requires twenty to twenty-two tons per day. Changes in the dampers and flues also affect the increased amount of coal consumed. With the new heater, which is referred to above, it is expected that even less coal than formerly will be required to operate the lines with increased power.

Possibilities of Electric Car Service for the Development of New Districts.

The announcement that the Pennsylvania Railroad Co. are interested in the construction of an electric railway between their ferry in Jersey City and certain streets in Newark, N. J., somewhat distant from any of their stations in that city, is full of significance not only to all the steam railways in the country, but to all our cities and even our towns, which might, by noting this important example, reach distant railway or steamboat stations in similar ways. Another large railway company in the West is reported to have adopted a similar plan for building an electric railway feeder to the main line from a neighboring town, and thus expects to obtain an economy of service which the construction of a regular steam railway would not permit.

Connected with this subject is a decision, just handed down by the Supreme Court of the United States, regarding a claim on the part of the people of Yakima City, State of Washington, that the Northern Pacific Railroad Co. should construct freight and passenger stations in that city in order to accommodate its people. This city had obtained a writ of mandamus from the State Supreme Court, compelling this railway company to construct such stations, but upon appeal to the United States Supreme Court, the State Court's decision was reversed, and Yakima City will not get its stations. The aggravating point to the people in this case is, that the railway company has a a station at North Yakima, a much smaller town not far away, and in consequence, North Yakima is being rapidly developed in a business way at the expense of the larger town. An opportunity presents itself here for the people of Yakima City to adopt a plan like that mentioned above, construct an electric branch between the two towns, and bring freight cars over such branch, thus obviating the need of a regular steam railway station. The construction of such a road might bring the city of its projectors into such prominence in a business way, that the railway company would before long seek to construct the stations which are now a matter of indifference.

These examples and possibilities open up a wide field in the construction of suburban electric railways, which when more carefully looked into, may result in a very large business, somewhat independent of a street car service proper, but managed and constructed upon similar plans, with the additional feature of carrying freight and obtaining high speed in country districts. One of the features of the new electric road between Jersey City and Newark above mentioned, is a test of the possibilities of the trolley system in its possibilities of speed. The tracks in this case will run across the Jersey flats which are comparatively unoccupied by buildings in consequence of their low level. As there will be no obstruction to a high rate of speed across these flats, electricians and everybody interested in the trolley system, will watch the trial with keen interest, as it will be a practical test of value between steam locomotive service and the most improved electric method. Should this trial result in any economy in favor of the trolley system, or even if the cost of operation is no more, or just a little more, than steam locomotion, the effect may greatly stimulate electric railway construction in all parts of the country.

A glance at any railway map of our country exposes enormous areas unprovided with any system of hauling either freight or passengers except it be by means of ox teams or horses ; but as these are very expensive conveyances when any particular distance over our average country roads must be traversed, the property for farming, industrial, and residence purposes, is valued at a very low figure. As far as farming is concerned, whenever the cost to the farmer of living, production, and hauling, exceeds the amount received for the produce, farming does not pay, consequently, one may see anywhere almost within an hour's ride of many of our big cities, large quantities of undeveloped or unimproved land. If these lands were connected by a feeder electric road, direct with a steam railway, for freight and passengers, the result, by reducing cost of haulage, would develop such districts precisely in the same way that any locality is developed by a good and rapid means of inter-communication.

The cost of such undertakings might be defrayed by the nearest railway company, or, where this advantage was declined by the railway on account of want of funds, those most interested in such properties could combine and build such feeders themselves. The signs of the times, however, indicate that the railways themselves will extend this kind of feeder system to their main lines which will completely fulfill all the requirements of the localities in their vicinity. Separate corporations could be organized and a large share of the stock be subscribed to by local residents, as a distinct system of locomotion would permit true estimates of cost and consequent profit, a matter which a branch utilized by the locomotives of a main line precludes, or renders so difficult that profits are not capable of being properly separated.

In these days of active research for profitable sources of industry and investment there is a large field of profit in companies organized to buy up country property and put such electric railway feeders upon it. In the long run such businesses are found to be as remunerative and possessing as little business risk as any industry in the country. In truth, profits in such undertakings, after they have started, may become almost fabulous, so long as alternate lots for habitations are retained until the towns and cities occupying the previously unoccupied districts have developed. There are a number of celebrated instances which have been developed by Englishmen in our Southern states during recent years, where the dividends upon the capital employed have been enormous. But we have no space here to describe such cases any further than a reference that they were founded upon a ready inter-communication between natural and industrial products and the people.

The instances where such electric roads can be profitably constructed in cities and towns where a steam railway touches an outskirt or some one section, leaving the other sections to rivals, are not few. It is a particular of this kind we have noted in the case of the Pennsylvania Railroad Co. Their new electric road will tap new and untouched districts having a numerous population, and entice them in the way which that railway company would have them go. J. M. B.

THE street railroad in St. Joseph and Benton Harbor is to be converted into an electric railway. W. W. Bean, president of the company, was in Chicago recently, and stated that he expected the road would be in operation with the new motive power by June 1.

Notes on the Columbian Fair.

The Patent Office will exhibit a comprehensive array of models to illustrate the progress of mechanical development.

A miniature model of the town of Pullman, 30×80 ft., will be a part of the exhibit made by the Pullman Palace Car Co.

During December 10,000,000 ft. of lumber was used upon the buildings, and 1,445,200 lbs. of iron work was placed in position. One-third of the number of ornamental pieces of "staff" required have already been cast.

A design is being prepared for an iron lift bridge between the Agricultural Building and the opposite side of the canal. This bridge is to be so constructed that it may be raised and permit the passage of boats up the main basin to the centre of the Exposition grounds.

The project of establishing a Columbian Memorial Museum, which shall be a permanent attraction and which, it is expected, will be given many thousands of curios and other objects exhibited at the Exposition, is being warmly supported by a number of Exposition officials and others.

Thomas A. Edison has applied for 35,000 ft. of space or about one-seventh of all that the Electricity Building contains. "I have it from Mr. Edison himself," said Chief John P. Barrett, "that his display at the Fair is to be the greatest achievement of his life. In talking of his application for space Mr. Edison admitted that he was asking for a large section of the building; 'but every inch will be put to good purpose,' he added. 'I shall not waste a foot of the area assigned to me, but will present a series of the most interesting electrical inventions ever produced.'"

Transportation rates on articles intended for exhibits at the World's Fair will be the regular tariff rates of the railroads, plus eight cents per 100 lbs. for switching charges at Jackson Park. This will bring the rates from the various Atlantic seaports all the way from twenty-eight to eighty-three cents per 100 lbs. according to the class of freight in which the goods fall, and the port from which they are shipped. The goods will be returned to starting point free of expense, except for the switching charges at Jackson Park. Of the eight cents per 100 lbs. switching charges, three go to the Illinois Central and five to the Exposition company. Freight charges on exceptionally fine goods, such as statuary, china, etc., and on horses and other fancy animals, will be somewhat higher than indicated above.

The two principal factors in carrying crowds to the World's Fair grounds at Jackson Park in 1893 will be the Illinois Central Railroad and the cable lines of the Chicago City Railway Co. The Illinois Central will lay two additional tracks on their right of way along the lake shore exclusively for World's Fair business. The distance to the grounds is about seven miles, and at the present time it takes the Suburban trains of the Illinois Central over thirty minutes to make the distance, but thirteen stops are made. When the World's Fair expresses are operated not over half this time will be consumed in reaching Sixty-third Street.

The South Side cable lines will be extended to the grounds. It will be necessary to pass the Illinois Central tracks, and as the trains will be passing continuously a grade crossing is out of the question. It is probable that the crossing will be made above grade.

While these lines will be the principal means for reaching the grounds, enormous crowds will come over the Baltimore & Ohio right of way. Several railroads will use these tracks. Steamers will prove a formidable competitor of the railway lines in pleasant weather. In all probability a large fleet will make Chicago headquarters during the Fair season. The authorities of the Exposition are thoroughly confident that the throngs which desire to go to the grounds can be comfortably accommodated. The Department of Promotion and Publicity made the following statement in a recent bulletin:

"Transportation to and from the Exposition, both for visitors and exhibits, will be as perfect as it is possible to make it, both in the matter of facilities and rates. Greatly reduced rates on all railroads and some of the steamship lines will prevail. Definite arrangements are yet to be perfected. Much attention is being given to the question of furnishing abundant facilities for reaching the grounds from all parts of Chicago, and it can be asserted that existing means, already extensive, will be increased so that a maximum of 400,000 a day can be carried to and from the grounds."

Overhead Wires in England.

A memorial relating to the overhead wire question, addressed to the president of the English Board of Trade, has just emanated from the London Chamber of Commerce. All electrical engineers have been requested to sign the petition. In brief, the petitioners ask that no hard and fast rule be adopted by the government. It is surprising in the present state of the art that it is found necessary to inform the government on matters which, in this country, are so thoroughly understood. For example, the petition sets forth the well recognized difference between great cities and towns, as far as overhead conductors are concerned, in these terms:

"We are aware that in the case of the metropolis and of large towns your department has already decided that overhead conductors can only be permitted as a temporary arrangement, and that all permanent conductors must be laid underground. Whilst we are of opinion that that decision may even yet have to be reconsidered in the light of subsequent experience, we are anxious to make it perfectly clear that in this communication we have no wish to question the correctness of that decision, but we desire to emphasize the fact that a marked distinction exists between undertakings which are to be carried out in the metropolis, in large cities or towns, and undertakings in small provincial towns or rural districts; and we beg leave to submit, that however cogent may be the reasons which have led your department to decide against overhead conductors in large towns, such reasons do not apply with the same force in small towns or in rural districts. The objections to overhead conductors based upon the inconvenience to traffic and the danger to life, are in the country far less serious, if not altogether absent, whilst on the other hand the advantages which such conductors afford are greater."

Coming to the question of electric traction the petition states:

"Another and almost equally important question arises out of the use of electricity for motive purposes. We are of opinion, that for the purposes of electric traction in rural districts, overhead conductors will be found to be the only mode on which long lines can be made commercially successful and that a fixed rule which forbade their use throughout the United Kingdom would seriously retard the development of electrical motive power."

Overhead electric railway systems have made such marvelous progress in the United States; they have operated so successfully; they have given the public such great satisfaction; they have solved the rapid transit problem in so many different places, that one reads with amazement that it is necessary for the English engineers to petition the government to refrain from action which will unquestionably prevent the adoption of electricity as a motive power. The petition illustrates in a very striking way the difference between the English and American methods of dealing with electrical matters.

The Lang lay rope, manufactured by George Cradock & Co., of Wakefield, Eng., recently imported and put in service on one of the lines of the North Chicago Street Railway Co., was accidentally cut after five weeks service, and being badly kinked for three or four hundred feet, was rendered too short for the line, and was consequently removed. We are informed by one of the officials of the line that, from indications, the rope was of excellent quality and that had it not been for the accident it would have had a long life. It will be again put in service on one of the shorter lines.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
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The Relative Advantages of cable and electric motive power for street railways will be found to be quite fully presented elsewhere in this paper both by our correspondent, Civil Engineer, and an article with the above heading. That there is an honest difference of opinion among engineers, who have formed their judgment in regard to the matter wholly from printed statements, cannot be denied. We think, however, that if the subject is studied along the lines that we have indicated, there will soon be greater harmony of opinion. All the conditions must be known before an absolute verdict can be rendered. Some who have heretofore been studying the subject claim that the fictions are so much like the facts and the facts so much like the fictions, that, with respect to many most interesting particulars, their belief is neither given nor withheld, but remains in an uneasy and interminable state of abeyance. They know that there is truth; but they cannot exactly decide where it lies. Happily, now, the distinctions between fact and fiction are becoming marked and those who desire to know can easily inform themselves.

Wall Street Combinations or disagreements influence the value of steam railway securities in a way which has no counterpart in street railway affairs. The result of the deliberations of a few representatives of different trunk lines in New York City can affect the value of extensive railroad properties situated widely distant. The business of the street railway, on the other hand, being local, and confined to the city or the portion of the city in which it operates, is largely independent of pools and combinations, and is not so liable to be disturbed by freeze-outs, rate cutting, scalping and other causes which often reduce the profits of a railway company. Even the danger of having profits reduced by the construction of a parallel line is much less in the case of a street railway than a steam railway, if the franchise of the former is at all comprehensive and it is in the first place built on the most desirable thoroughfares for street railway purposes. To the investor, these points of difference have an important bearing. The property farthest removed from unforeseen attacks and influences impossible to predicate is the one most desirable for investment, and for this reason alone, if for no other, street railway securities should attract the attention of those having money to invest.

Centralization seems to be the goal toward which transportation companies are tending. Already nearly one-half of the entire steam mileage of the country is owned by forty corporations, while in many of our large cities we meet with instances of the genius of a few men consolidating a number of struggling street railway companies into one, bringing order out of chaos, reducing operating expenses, and at the same time increasing traffic. From this a transfer of the field of operations by a syndicate from one city to several is a logically economical step. To the socialist the advantages attending centralization, as outlined, give unmistakable proof that a unification of all business enterprises, or certainly of all possessing a public or semi-public character, as the street railways in the hands of the government, is desirable. But experience in our large cities, where much of the public work is carried on under municipal direction, has shown that the same results can not be obtained as under private enterprise, and that political services are more often made the cause of advances to places of trust than merit. The railway systems of Europe, which are under governmental direction, are notably inferior in appointments and service to those in England and America which are conducted by private individuals. The management of street railways by city governments, for which many of the *soi disant* reformers of the present day are calling, could not fail to bring equal lethargy to the service by opening the offices to political favorites and making the economy and convenience of the system a secondary consideration. While consolidation and the placing of many lines under one head very often is attended with beneficial results, the transfer of the control to municipal authorities in any city of the street railway system, with its wide opportunities for political patronage, would seem to be a step in the wrong direction.

The Tall Buildings which have been erected in Chicago during the last two or three years have had more than one effect upon the street car traffic of the city. It has been repeatedly pointed out that the inevitable result of building such high structures is to cause the congestion by which the railways are fairly overwhelmed at certain hours. There are several of these buildings in Chicago from which an army of several thousand occupants leave at about six o'clock, all bound in practically the same direction. They form a crowding, impatient throng, and each one is determined to board the first car that comes along. Such a crowd would not respect for an instant any regulation providing that only a certain number, sufficient to fill the seats, should be allowed to enter the car. Foreigners mindful of their comfort, and esteeming it of greater importance than a few moments time, are willing to wait for cars. Call it what you please, there is something in American nature which makes it impossible to brook delay in catching street cars.

It was a characteristic American who once said that he felt the loss of his leg acutely only when he found it impossible to run for a car. To relieve the congestion, Mr. Yerkes, of Chicago, has recently suggested that the Chicago River be wiped out of existence. In this event, a chance for the expansion of the business district would be made possible, and the multiplication of tall buildings would be less probable. This project we think will not be seriously entertained for years at least. The river is considered of too great importance in navigation for such an iconoclastic proposition to meet with favor, although, as Mr. Yerkes says, the docks should even now be located on the lake shore. Could the filthy, disease-breeding river with its foul odors, rivaling the famed "several and distinct" stenches of Cologne, be done away with, Chicago would be a much more desirable place of residence, viewing the matter both from an æsthetic and sanitary point of view. The tall buildings have had an effect on street car travel in another way. The construction demands enormous quantities of steel for the framework. When this material is delivered from the wagons a blockade of street cars is almost invariably caused. If the work is done in the day time there seems to be no remedy, but,without a doubt, delivery should be made at night if the great inconvenience to the public is to be averted. The street cars seem to have less right to thoroughfares in Chicago than in almost any city in the country. The freedom with which teamsters block the public conveyances is refreshing in its impudence. There is one point in Chicago at which blockades are caused with almost ridiculous frequency. This point is at the Post Office, where wagons delivering coal keep the Adams Street cars stringing out for blocks at times. The remedy for such troubles as this ought to be provided by the police power. They are minor troubles, but if overcome the betterment of the street car service would naturally follow.

The Street Railway Exhibit at the World's Columbian Exposition will prove extremely interesting and instructive. It is hoped that the demonstrations of systems which will be made on the grounds will settle many of the problems now under consideration. There are those who are sufficiently enthusiastic to predict that the question of the best means of operating street cars in cities will be definitely determined. There are manufacturers, who doubtless think the problem is even now settled, but the street car man is still open to conviction. The activity among inventors working in the street railway field is astonishing. New systems are springing up daily. Some of them involve new motive agents; others embody new modes of application. If an illustration were necessary a reference to the various plans for operating electric railways by underground conductors would serve the purpose. The number of these schemes proposed within the last year is sufficiently great to appal anyone who desires to keep track of them. Inventions designed to improve street railway service, without doubt, fall in the same classes as do those relating to any other field of industry; a few are good, more are indifferent and the great majority hopelessly bad. Every street railway man would be interested in the first class if he could only determine what belonged to it without a vast amount of discouraging and profitless work. If the sifting process were assumed by a thoroughly competent body of men he would be greatly interested in their findings. Something along this line it has been proposed to do at the World's Fair. It has been suggested that an experimental road on which would be operated motors of every kind would prove not only an interesting exhibit but extremely valuable as well. A jury, of course, would be appointed to watch the tests, of the several systems, to determine their practicability, their economy and efficiency in practical operation. They would report on the merits of the various projects, and recommend awards. The tests could be made at certain times so that all those interested could judge for themselves of the several demonstrations. The expense of such an exhibition would not fall heavily on any single company. The Exposition company could afford to provide the ground, and furnish electricity for such exhibitors as needed that power. Several companies at the present time stand willing, we believe, to build a mile of road, each mile embodying a particular style of construction. Those who desired to make exhibits could send to the grounds cars equipped for regular service. No one questions the value of such an installation. It would prove of very striking interest to the street railway man, and even to the ordinary visitor, for citizens have been waking up to the importance of the intramural transportation question within the last few years. There is a question whether the authorities would approve of such a project as has been here outlined. In the first place such an installation would require considerable space, and such grants are not looked upon with great favor. The authorities, too, might feel that such a plant would not add to the "beauty and symmetry" of the Exposition grounds. The æsthetic side appeals very keenly to the construction department. Should not the practical side be considered also?

The Censure and Abuse which of late have been heaped upon the managers of the transit lines of nearly all the large cities of this country, and in some cases against the managers of foreign lines because of lack in facilities, is in the majority of cases unwarranted. The critics seem to forget that the real cause for the present overcrowding in most cases is the splendid service the roads have already rendered. Take Chicago, for instance; its street railway lines, more than any other factor, have contributed to its phenomenal increase in population and given enormous values to its suburban property. Should not the companies, then, in all fairness, be given credit for what they have already done and be allowed the largest liberty in providing new facilities for taking care of the surplus that now makes traveling disagreeable and slow? Their experience and position will enable them to understand the situation and its needs better than others, and knowing all the conditions they are better able to provide means for meeting them. These same companies showed marvelous enterprise in instituting the present plants, and there is no reason to doubt their willingness to expend as lavishly in efforts to meet the great demands now and yet to be made upon them. Hence, the public seems to be following a policy like that of the man who killed the goose that laid the golden egg. No one could have predicted the present condition of transit affairs in our large cities, because the business has grown faster than was anticipated, and for a little engineers seem to be baffled. But the trouble is not wholly with engineers nor with capital, but chiefly with local authorities, who, moved by the public, which in turn is actuated by the suspicion that is abroad that corporations are working more for their own

interest than that of the public, withold consents, or when granted burden them with conditions which practically render proposed schemes inoperative. Perplexing as the problem is, we have no fear that human genius will be baffled either in soon discovering some means for correcting popular prejudice or for providing safe, rapid and comfortable means of transit from crowded centres for numbers far in excess of those now clamoring for rapid transit. To us it seems that elevated lines will in most cases meet the requirements. We do not mean that trunk lines should be built in all cases, but in the case of Chicago, a belt elevated line bordering the congested district would seem to be the most practical. On this line cars propelled by steam or electricity could be employed; or, better, the step platform system could be adopted. From this elevated structure the surface lines should radiate and not come within the bounded district, but deliver or receive their passengers at the point of contact. The stations on the belt line should be located at frequent intervals in order that passengers can readily reach their places of business. To make this scheme practicable all sailing craft should be prohibited from entering the river, thus enabling the elevated structures to cross the stream at a reasonable height. The same plan would doubtless suit the conditions of Boston. New York has but to enlarge her present elevated structures sufficiently to provide for four tracks, and perhaps build a double decked structure along the river fronts, when her traffic for a long time to come will be fully accommodated. So many of the Philadelphia lines cross each other at right angles, that the city has no congested district, and that surface lines when equipped with electricity or cable can satisfactorily handle all the traffic. While the problem, from a mechanical standpoint, seems simple enough, the political features and the jealousy of rival lines will doubtless prevent its consummation for many years. The failure, however cannot be charged to the want of engineering skill or the willingness of the present companies to undertake the task.

Compensation for the Use of Streets by rapid transit companies is a question which just now is agitating the people of our older cities as never before. As we survey the whole field a remarkable contrast is presented. In the Eastern cities and some of the larger Western cities, especially where new concessions are being asked, for the purpose of introducing improved methods of traction, a demand is made, based on the popular belief that the business is an exceptionally profitable one, that the operating companies be required to pay into the local treasury a large percentage of their gross receipts, while in some of the growing cities of the great West large subsidies are offered, both by local authorities and property holders, to such corporations as will build street railways or extend existing lines. Perhaps, the same cities, when they shall become large and prosperous through the direct agency of these same roads, will bemoan their generosity and seek to alter or amend the franchises granted in the days of their youth and need. All this shows the necessity of some universal method of granting concessions, one that will fit all the changing conditions of city growth. Another anomaly presents itself as we study the situation. In those localities where compensation is demanded we see the so-called "labor element" joining with the property holders in making the demand. What benefit, we ask, do the former expect to receive from the amounts, be they more less, which may be paid by the corporation into the city treasury? The property holders, of course, expect to be benefited, in the direction of decreased taxation, but the action of the other class in the matter can only be explained because of the distrust and hatred of corporations with which their minds have heretofore been filled, so that now they think they will be able to extort some rights and benefits which they imagine have heretofore been withheld from them. In nearly every instance where the battle is on between city authorities and street railways corporations, we think both parties are making grave mistakes; the former for supposing they have the right to make the demands, and for using unfair means to make the public believe that their rights are being ignored by the corporations, while the corporations by making a compromise for the sake of harmony are crippling their means for giving an efficient service. The streets of a city and highways as is generally understoood, and in the laws of some states stated explicitly, are free, belonging to the rich and poor alike for the use of vehicles and pedestrians only, and no one man or number of men can use or control them for any other purpose than the free use of the whole public alike. How then can municipal authorities rent or sell the franchise and use the proceeds to pay a part of the taxes of the rich? A better plan would seem to be to provide that corporations be permitted to operate their rapid transit lines under the direction and control of commissioners elected by the people, who should allow the operating company to earn a fair and just percentage on the capital invested, and when the earnings of the road exceeded the percentage allowed, after keeping in good repair a portion of the streets on which they operated, the public should have the benefit by a reduction in fare. By this means the great laboring classes and the poor would be greatly benefited, but by collecting a large annual rent from street railway companies and applying it to meet city expenses, the money goes directly and only to the benefit of the property owner by reducing his taxes.

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There seems to be a disposition in some localities on the part of street railway companies, which have secured exceptional privileges, to oppose any agitation of this subject, for the reason that in the present divided state of public opinion, there is little hope of adjusting matters in a manner that will benefit them or insure their remaining undisturbed in their chartered rights, but it is bound to come, and those who are now most secure will be hurt the most. There are those who advocate municipal control of transit facilities as a solution of the difficulty, but this, we believe, is opposed to the spirit of our institutions, and where tried it has not succeeded to the satisfaction even of those who advocated it. The STREET RAILWAY JOURNAL will be glad to receive and publish any suggestions that may aid in solving the difficulty.

Electricity and the Trolley System have won another signal victory in the events that have recently transpired in the city of Brooklyn, N. Y. This matter is one of great moment, not only to street railway men but also to all persons interested in the question of improved transit. The importance of the location, the vigor and stubbornness of the remonstrants and the weight and value of the testimony produced by the petitioners, conspired to make this one of the most striking victories that has been won by street railway men anywhere in their

efforts to give the public an improved service in the face of popular prejudice. Among the complications which delayed the final result, was the fact that after the ordinance, granting the trolley rights, had passed the Board of Aldermen and come before the then mayor, for consideration, his term of office expired before he acted upon it. It is not difficult to see that a hotly contested question of this sort was an awkward legacy for his successor, and that, therefore, that gentleman found himself between the horns of an unpleasant dilemma. On the one hand the legal term (ten days) for considering the matter was so short that he did not have time to study the merits of the ordinance; on the other, he was besieged by the hue and cry of the remonstrants. He did what a good many conservative men would have done under the circumstances, he vetoed the measure. If he had rested his action entirely upon the fact that he did not have time to fully examine the matter, he would have taken a pretty strong and prudent position, but, curiously enough, he felt called upon to give other reasons for his veto, two of which show how little knowledge the ordinary man has on the trolley system. One of these reasons was the fact that he could not learn that the system had been in successful operation in any city of the size of Brooklyn, and the inference from this is that he concluded that the size of the city had something to do with the success of the system. All persons who know anything about the subject, will read this with a smile. Size, as size, has nothing to do with the case; it is as practicable to operate the trolley in a city of a million people as it is in a city of a thousand people. *Configuration* does have something to do with it. Narrow, tortuous and crowded streets, heavy grades complicated with sharp curves, might become factors for serious consideration, but granting all these, the success of the trolley in the intricate streets of Boston, where these various features combine, had proved its fitness even under such trying circumstances.

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Another reason given by the Mayor was the risk of injury to citizens following the introduction of the system. This is only interesting as showing how persistently a false idea may linger, long after it has been disapproved. The trolley wires for years have been suspended over the heads of millions of people; the trolley cars for years have carried in safety and comfort, billions of passengers. and during all that time not a single human being has been seriously injured by the current on trolley street car circuits. In spite of all this, which was clearly proved to the Brooklyn people, the danger spook was paraded to an amusing extent. The hearings were haunted by the ghosts of victims who had never been slain and echoed with accounts of casualties that had never happened, and in the end we find an intelligent gentleman and conscientious official gravely assigning this delusion as one of the reasons for his veto. Absurd as this may seem to those who know the facts, it is, perhaps, not surprising that the general public and even some of its prominent representatives should take this position. On the face of it, it naturally appears to those who have not studied the question and learned the difference between high and low pressure circuits, that if a current of electricity were strong enough to pull a car, it would be strong enough to kill a man. But it is surprising that the great press of New York City, that has every facility on earth for learning all that there is to be learned on any subject should have tumbled head and shoulders into the same error. During the progress of the Brooklyn matter the press of New York frantically shrieked and screamed in utterances of dense ignorance and misconception on the whole danger question. Ordinarily, New York papers treat public themes with great dignity and fairness, but when it comes to the trolley they lose their heads and become hysterical.

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After the veto of the first ordinance a second measure of similar character was introduced and carried by a vote of fifteen to four. The Mayor now having time for more mature consideration, treated the subject with great fairness and instituted inquiries among many of the cities where the trolley had been in operation. Some of the replies to his questions are given in another column, but his final conclusions as quoted by the *Brooklyn Eagle* of January 23, are worth careful reading.

"I do not consider it my duty to take any further action in the matter. I have once vetoed the resolutions, and they have been practically passed over the veto with only two dissenting votes, I think. Since they came before me the second time I have used all the means at my command to ascertain the workings of the system in other cities, and to learn the wishes of our own citizens. Such information as I have gained has thrown no new light of importance on the subject, and no new reason for action has appeared, so far as I am able to see. The fact that the question really rests with the State Commissioners is an important factor in the consideration of the subject. Another veto of the resolutions might easily be regarded as simply a needless obstruction to what is inevitable. Therefore, I have come to the conclusion that there is nothing left for me to do beyond what I have already done in the premises."

We recommend the force of the word "inevitable," as used by him, to the attention of any other Mayor who may be placed in a similar position.

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One fact of the utmost importance during this whole controversy was clearly shown, namely, that the opposition to the trolley system did not come to any extent from the persons who patronize the cars and to whom they are a great and growing necessity of daily life, but from over sensitive asthetics or unduly anxious property owners. The great popular vote of the masses is for the trolley; the opposition comes chiefly from the un-American class and caste faction.

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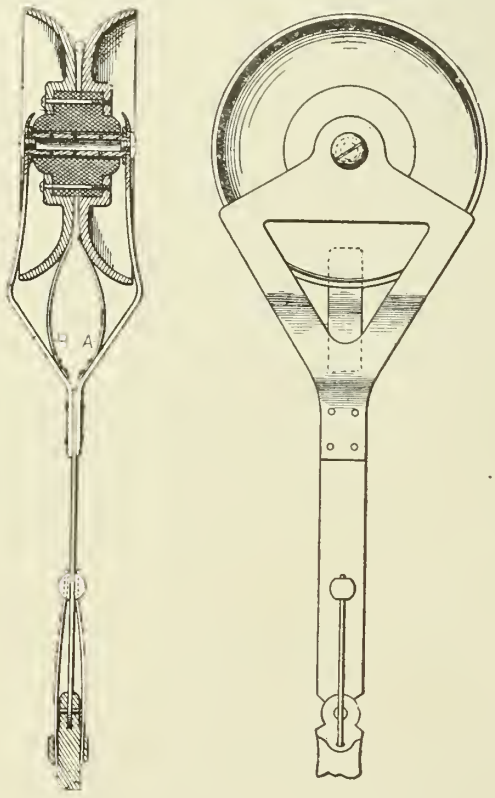
In conclusion we congratulate the aldermen of Brooklyn upon their foresight for the public good in passing this measure in the face of so much unreasoning prejudice. We congratulate the Mayor upon his wisdom in finally withdrawing from any further trifling with the hands of a clock that were sure to turn ahead. We congratulate General Slocum, Mr. Lewis, Colonel Partridge and Messrs. Richardson, father and son, upon the courage, tenacity and intelligence with which they have conducted this matter to a successful issue; and finally, and above all, we congratulate the people of Brooklyn upon the the prospect of soon enjoying the benefits of an improved system of rapid transit.

Cable Cars for Broadway.

Just as the STREET RAILWAY JOURNAL is going to press, the information has been received that Mr. D. W. Pugh, of the John Stephenson Co. has secured an order for 100 cars to be used on Broadway. The cars will be exceedingly handsome in design, and will embody the latest improvements. The road is one of such magnitude that the operation of these cars, forming part of the new equipment, will be watched with great interest by railway men.

A New Trolley.

At the present time considerable attention is being paid to the improvements in the details of electric car equipments, and of late many new trolleys have been introduced. The device shown in the cuts was designed to provide a better electrical contact from the wire to the motor. To the top of the trolley arm is a steel extension which is attached to the latter by a hinge or knuckle joint. The extension is a flat steel bar which has considerable flexibility in a lateral direction, but is rigid under a



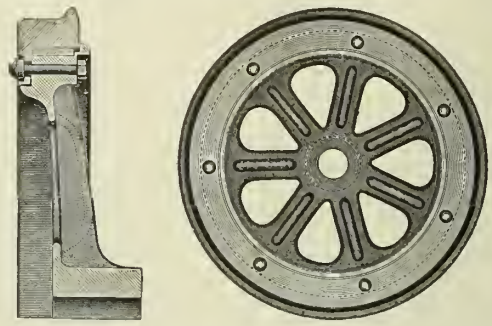
forward or backward pressure. On either side of the bar are bearing springs, which engage in guides, as shown in the illustration, and which hold the extension in position.

The contact springs *A* and *B*, take the current from the trolley wheel, a method which the inventor considers superior to the ordinary means, inasmuch as the heating of the shaft of the latter is prevented. It will be noticed that the two disks constituting the trolley wheel are so joined that they form a flare, the lower portion of which is narrower than the wire. This causes a "scouring" effect, which the patentee thinks advantageous. The construction of the contact wheel makes it light, and the lignum vitæ hub revolving on a fixed shaft reduces the friction, it is claimed, very materially. The trolley is the invention of John Kuehnle, of Detroit.

A Cushioned Car Wheel.

The accompanying illustration shows a half section and plan of a cushioned car wheel which has been used with very successful results in both steam and street railway practice. The centre is made either of cast iron or steel, preferably the latter, and in either plate or spoke form. When once on the axle it is not intended that it should be removed for ordinary repairs, all that is necessary being to remove the tire from the centre. The former has a flange on its outer face through which it is bolted to the centre, the latter having also a flange projecting so as to engage the inner face of the tire. To attain the cushioned effect a rubber strip of three-eighths inch thickness is placed between the tire and centre. In order to press the tire on over this cushion without injury to the rubber, the latter is covered with a shield in the shape of a steel band one thirty-second of an inch thick. The tire is so securely bolted to the centre that there is very little danger should the tire be broken since the various parts would be retained in place.

The claims made in support of this cushioning device are that its use makes the wheel practically noiseless, absorbing the vibration caused by uneven tracks, thus relieving the rails from pounding; also, that the cushion greatly reduces the vibration of the wheel centre and axle, therefore, by preventing all tendency of crystallization, is practically indestructible.



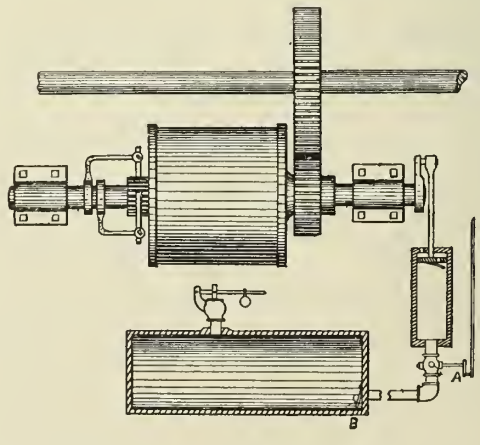
Some remarkable records have been made in the use of this wheel. On the Indianapolis, Decatur Western Railroad one wheel made over 45,000 miles, during which time the thickness of the tire was reduced only one-thirty-second of an inch. Two others made over 72,000 miles each, one wheel having a tire was worn three thirty-seconds of an inch, and in the other the tire was worn a little over one-sixteenth. Practice has shown that the average wear is about one thirty-second of an inch for every 25,000 miles run. Among the electric roads using this wheel is the Calumet Electric Street Railway Co., of Chicago, Ill., who speak of it in the highest terms.

The wheel is manufactured by the Cushion Car Wheel Co. of Indianapolis.

Continuous Running Electric Railway Motor.

It is well known that the efficiency of an electric motor depends upon the ratio between the counter electro-motive force developed and the initial electro-motive force, and a number of plans have been devised by which the motor on a car can be kept in continuous operation whether the car be in motion or not. One of the devices recently proposed for accomplishing this purpose is shown in the accompanying engraving.

The motor armature is connected directly with the car axle, and the field magnets are so sleeved on the armature shaft that both magnets and armature are free to revolve in opposite directions, and, as an approximately constant speed is maintained between the armature and fields when in operation, as the rotations of one increase

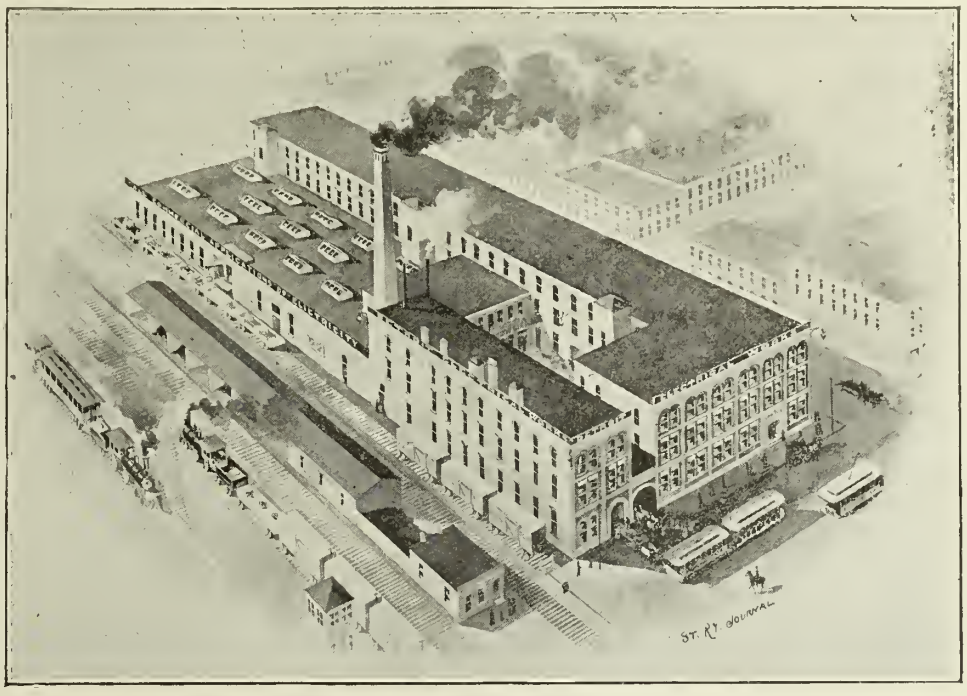


those of the other decrease. The connections are so arranged that the rotation of the field magnets will operate the air pump or compressor shown in the cut, the latter having a valve at A which is under the control of the motorman. This compressor is connected with an air reservoir under the car, which is provided with a safety valve, so that the air pressure cannot increase beyond a certain amount.

The operation of the motor is then as follows: Assuming that the car and motor are at rest with the air reser-

voir empty upon admission of the current, that part of the motor without any load—in the present instance the field magnets and shaft—immediately commence to rotate, and soon assume their maximum rate of speed, the valve A being open. Under these conditions no resistance is offered to the plunger of the compressor, no air passing into the reservoir, and the motor takes only enough current to overcome the friction of the apparatus. To start the car the valve A is turned on so as to make connection between the compressor and the reservoir, either partially or entirely depending upon whether a sudden or gradual start is desired. As resistance to the rotation of the field magnets is created by the pressure in the reservoir, the movement of the armature shaft is commenced and increases correspondingly to the retardation of the field shaft. To check the car the vent valve is opened, the check valve at B at once closing to prevent the reduction of pressure in the reservoir, and the field magnets are left free to rapidly increase their rotation, while the armature shaft is correspondingly reduced in speed.

The mechanism described is devised for the use of air, but fluids, such as glycerine or oil, may be employed to create resistance with equally good results, the only essential being that such fluid as escapes by way of the vent valve should be returned to the system or fresh liquid be supplied. The device is the invention of John H. Palmer, of Boston.



NEW FACTORY OF THE DETROIT ELECTRICAL WORKS.

The Detroit Electrical Works New Factory.

The railway business of the Detroit Electrical Works has become so extensive that the company have decided to build a new factory as an addition to their present plant on Woodward Avenue. The main extension will be constructed in the rear of the present building, and will be three stories in height. This addition will fill up the block in which the present structure is situated. That portion of the present plant which is one story high will be built up to three stories. The new machinery will be of the latest type. It will be divided into three sections, power for each of which will be furnished by an electric motor. Current will be generated by a 500 volt machine, located in the engine room. The changes here outlined will enable the company to treble their capacity for manufacturing street railway apparatus. The factory will be completed and equipped with machinery by May 1.

Car Heating by Steam.

The success attained in heating steam railway cars by steam, and its wide adoption by many of the leading transportation companies, has attracted the attention of many street railway managers, and has called forth a number of devices in which steam as a heating agent is made applicable to the conditions presented in street railway service. In connection with their new cable cars, described on another page, the Third Avenue Railway Co. of New York are making practical test of the desirability of heating cars by steam. One of the systems being tried with a view of adoption that owned by the Gold Car Heating Co. of New York City, and the same, with the exception of a few minor changes, as that adopted upon many prominent steam railways, among which are the Delaware, Lackawanna & Western Railroad, the Manhattan Elevated Railroad of New York and the Suburban Rapid Transit (elevated) of New York.

In the system, being installed on the car of the Third Avenue Railroad Co., two large pipes, five inches in diameter, are carried under the seats of the car and are connected by cross pipes of smaller diameter at each end. Within each large pipe is a hermetically closed cylinder filled to seven-eighths of its capacity with brine. This cylinder is sufficiently smaller and shorter than the pipe to admit of variations in the size of each through expansion and contraction. Gas burners, consuming about ten cubic feet of gas per hour each, are located at the centre of the car, one under each longitudinal pipe. These burners are supplied with gas from reservoirs under the car, which also supply gas for illumination. Some time before leaving the car house the steam couplings of the car pipes are connected with stationary steam boilers, so that the pipe system is charged with steam, the interior cylinders containing brine acting as reservoirs for the heat. While the car is in operation it is found that by lighting the burners under each pipe, sufficient heat is produced to keep the car warm indefinitely. The pipes are bent at the centre so that the condensed steam in running to the lowest point will be directly above the burner.

For street cars which are not lighted by gas and in which, consequently, it might be found inconvenient to carry a reservoir of gas, it is found that sufficient heat is stored from the first charging of boilers to keep the car warm for at least three hours.

As will be seen, this method of heating cars has a number of important advantages; the heaters take up no valuable space in the cars, and require no fuel or attention; the heat is a pleasant hot water heat and is radiated equally the entire length of the car. There is no smoke, dust or unpleasantness, and in wet weather the floor of the car is always dry. The cost of heating a car by this system, if a gas burner is used, is reckoned at twenty-five cents per day. If the cars are charged from central stations, which is the best plan when trips made are not more than three hours, the cost is only about ten cents per day. The manufacturers are also fitting with their system one of the new Pullman double deck cars and will furnish further particulars on request.

THE magnitude of the building operations now going on at Jackson Park can be surmised from the fact that an average of from thirty-five to forty car loads of construction material arrives daily. The Exposition buildings are rising with wonderful rapidity. More than 1,500,000 lbs. of steel and iron will enter into the construction of the Mines and Mining Building.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Cable and Electric Motive Power on Street Railroads Compared.

EDITORS STREET RAILWAY JOURNAL:—

The management of the principal street railroads in Brooklyn, has determined to substitute electric for horse power on the several lines; it would be interesting to know what reasoning finally induced the clear and hard headed men who control these properties to come to this decision.

Few street railroads in the country operated by horse power, have to move more cars and up steeper grades, than is done over parts of some of the trunk lines in Brooklyn; surely, no street railroad using electric power, has to haul so many cars up a steep slope, and consequently, at these points, the proposed substitution must be largely experimental. Whether by any electric system yet introduced, the heavy traffic up Fulton, Washington and Adams Streets, on moist or wet days, when the rails are coated with liquid mud or slush, can be handled without vexatious delays, interruptions and stoppage, is quite uncertain.

"Rainbow hunting" is not confined to the political world. Judging from the public utterances of the promoters of some of the electric systems, the hope of better things to come, in unquestioning faith, is taken as materialized and in hand. Electric motors have been from time to time offered for sale as being perfect in every detail and then in a brief period, presumably from an unfavorable experience gained in that interval from their operation, they are replaced by other and improved designs, also perfect. That these frequent changes are not made in a "missionary spirit," is evident from the fact that such often involve a large expenditure of money and effort.

The wag, who offered to the throng passing over London Bridge, golden sovereigns for silver crowns and sold not one, because the people would not believe what he quietly proclaimed, won his wager; had he advertised sufficiently, the British mint could not have satisfied the demand he created; contrarywise, by skillful, persistent and nervy iteration, the venture of a crown piece, may and often does bring back the sovereign in return.

Upon what grounds in this instance is electric power chosen instead of cable? The promoters of the former will say because it is better and cheaper. That an electric system, when intelligently applied and faithfully operated, on many street railroads may and often does, serve the passengers excellently well, is conceded. The managers generally, quickened perhaps in some way by the subtile agent which rotates their wheels, exhibit an alacrity and purpose in meeting popular demands, which with profit, in a degree at least, might be copied by the "horse men" who with more or less unwisdom operate many of the older or competing lines. On most electric railroads the best cars are run, and at such short intervals that each passenger may be seated. All this and more, however, is possible on a cable road, and therefore cannot be claimed as incidental to the motive power employed.

Also it is urged, that when the cable stops so do all the cars hauled by it come to a stand; but when from any cause the electric current is not applied, all the cars on that circuit are unable to move. The electric system may be worked in sections; true, but so may the cable if the power houses are well located, and if the cable is duplicated, in case one fails the other is at hand and ready for use.

Again it is asserted, that when delays occur, lost time may be made up by running at higher than the usual speed; quite true, but if the maximum speed is limited, as it should be on city streets, and the cable is run at that speed, what advantage in this respect has one system over the other?

Hence, so far as relates to the public service, it is doubtful whether for either system superiority can justly be claimed.

The promoters further say that electric power is cheaper than cable power, surely in first cost and *perhaps* in operation. Is this entirely correct? Given two railroads, each of the same length and grades, running the same number of cars and carrying the same large number of passengers, one operated by electricity and the other by cable, continuously for a term long enough to establish what for each is the cost of operation and repairs, and also what sums shall be set apart from the earnings for renewals when the tracks, equipments and plants are worn out; the question is, which if so managed, will pay the larger regular dividends on the permanent investments. That an electric railroad, with overhead conducting wires, *may* be built at a less cost than a cable railroad is acknowledged; but if the two are to perform each as large a service as required on most of the Brooklyn lines, and are alike faithfully constructed and equipped, the electric may nearly or quite equal the cable in first cost.

Thus, the track system for the first must be as heavy and strong as for a well constructed steam railway; while for the second, that of an ordinary horse railroad will serve. The cars of the first must be heavy enough to ensure sufficient track adhesion, to enable the motors to haul the cars; while for the second, they may be the lightest that will carry the passengers. The electric motor, one to each car, will cost as much to make as several cable grips and there will be a like dispartiy in their maintenance and repairs. The first cost of the electric plant will be somewhat greater than that of the cable plant; the cost of operation, to supply the power, for each to transport an equal number of passengers will be far greater for the electric plant, which has to move much the larger dead weight of cars per passenger, than for the cable plant; and this, exclusive of consideration of the losses from imperfect conductivity and insulation as well as the undue resistances of application, peculiar to electric power. It is understood that with electric power, these losses and resistances increase *more* rapidly, while with cable power, the resistances increase *much less* rapidly than the quantity of useful work done.

So far in this comparison, the excess of cost is against electric power. For the remaining item, the wiring system, including the supports and connections from the plant to the cars on the tracks, will generally cost less at first than the cables, their pulleys and the conduits which contain them; the best overhead electric practice, however, is to increase the efficiency of this system, by stringing wires of larger diameters, using better insulating material and setting more durable supports, all at an additional first cost. If the conducting wires were put in conduits as they should be, the difference in this item between the two motive powers, would be much diminished and possibly might disappear.

The comparison thus made shows that, except in one item, the electric is not superior to the cable power for large traffic, on street railroads; and that in this item, if the two railroads compared are alike in their important features, the first may cost nearly as much as the latter. For fair comparison, however, the conditions governing the railroads compared, should be similar in quality of construction and ease of operation; this generally is not observed when the two systems are contrasted; cheap work and restricted investment should not be compared with expensive construction and liberal expenditure, particularly when the one may entail larger and more frequent outgoes for repairs and renewals than the other.

Parenthetically, it may be said, the design and construction of cable railroads, often is put in charge of managers unfamiliar with this special department of engineering; the result being that valuable experience gained in the operation of such railroads is ignored and new and untried devices are sometimes embodied in the plans, in place of others which have been fully tested and found most suitable for their purpose. Again, the capitalist, to lessen first cost, may and often does prescribe conditions

which entail continued and burdensome expense in operation.

The writer for years has been familiar with the design and management of cable railroads; he has watched with questioning interest the application and development of electric power and he would gladly, if it were possible, exhibit in parallel columns, the items of cost of construction, operation, repairs and renewals of two railroads as instanced, one using electric and the other cable power, so that the separate totals would prove or disprove the correctness of the position herein taken. For cable power this might readily be done, but for electric power, after diligent enquiry and investigation for considerable time, the best that may be stated is to quote what was written by one in a position to know, in reference to a leading electric railroad: "So far the operating cost, as summed up, is not greater than with horses, and several items are yet to be entered in the account." Since this was said, it is understood that radical changes in the plant and equipment of the railroad, involving large expenditures have been determined on.

It is left to the candid observer to explain, if he can, what is the cause of the singular reticence of those promoting or managing electric railroads regarding the several items of cost; sooner or later, dividends if paid, will be from net earnings and then these items must be published and the result will lead innocent shareholders to award praise or condemnation as may be justly due.

But little reference has been made to the interest of the public at large in the choice of a motive power on railroads, in streets so narrow and crowded at times, as some of those are, which will be occupied in Brooklyn. It is stated that in 1890 more persons were killed and injured on the streets of London than on all the steam railways in the United States. The strongest reasons are required to justify any increase in the danger which now menace life and limb on thronged city streets. Municipal authorities, charged with much that affects the well being of citizens, should consider well how far, to secure an uncertain and imperfect improvement in street transit, they may wisely add other and grave risks to persons and property, by an additional circulation on the public thoroughfares of an agent, which without warning may maim or kill the unsuspecting wayfarer or consume valuable structures.

As a requirement, contingent upon granting the privleges asked for by the management of Brooklyn street railroads of the municipal government, it would have been a just and wise measure to have, at least, stipulated that the introduction of electric power on these railroads should be in accordance with specifications prepared by and executed under the supervision of competent and disinterested experts, thoroughly familiar in all its details, with the work to be done and clothed with sufficient authority to enforce all of the conditions imposed to fully protect the public interests. CIVIL ENGINEER.

January 21, 1892.

The Elevated Road Projects in Chicago.

It would be an unusual day that did not bring to light some new railway project in Chicago. The number now under consideration is legion. They are of all kinds, good, bad and indifferent. The birth of most of these schemes is heralded with a flourish of trumpets, but as the great majority of the projects are either chimerical or insufficiently backed, they soon sink out of sight. There have been, for example, a great variety of underground schemes proposed, but at the present time, in spite of the extraordinary agitation of the intramural transportation question, not one of these comprehensive plans is considered. Still, additional facilities are demanded, and the projects formed to meet the demrnds are filling the colu mns of the local press.

At a recent meeting of the City Council an ordinance was presented extending a franchise to the Chicago & South Park Elevated Railway Co. The company want the right to operate from the World's Fair grounds over Sixty-seventh Street. The ordinance was accompanied by a majority petition. The matter was referred.

The company propose to use the Day elevated suspension system described in our last issue, and the motive power will be either electricity or steam. Two miles of road are to be completed by May, 1893. Two downtown routes are spoken of. It is said it may be built on Halsted Street from Lake Street. An L road over the Rock Island tracks is spoken of as a connection of the road.

The West Side Rapid Transit Co. are the successors of the West Chicago Rapid Transit Co., which once had a franchise for Randolph Street and Ogden Avenue. It was declared invalid, however, because it had failed to secure the necessary frontages. The company propose, if granted a franchise, to build a road on the Boynton bicycle system and propose to make the construction as light as is consistent with safety. The road will be operated by electric motors. The managers claim that as soon as a fair franchise can be obtained from the City Council the money will be immediately forthcoming to build and equip the road.

Resolutions of Respect.

At the monthly meeting of the Third Avenue Railroad Employes' Mutual Relief Association of New York, November 27, the following preamble and resolutions were unanimously adopted. The original was handsomely engrossed and was bound in the form of an album covered with seal leather, mounted in silver and presented to Mrs. Lyon.

Whereas, We have learned with deep regret of the death of our honored member, LEWIS LYON, President of the Third Avenue Railroad Co., who departed this life on Thursday, October 29, 1891, therefore be it

Resolved, That in the death of LEWIS LYON, this Association recognizes the loss of a member who had at all times the interest and welfare of this Association at heart, a true and generous friend, a man of sterling integrity and untiring energy, whose genial manner endeared him to every member of this Association. And be it further

Resolved, That we deeply sympathize with his bereaved family in their great loss; and that the resolutions be spread upon the minutes of this Association and a copy suitably engrossed be presented to the family.

J. H. ROBERTSON, President.
JOHN BROLLES, Vice-President.
WILLIAM G. ROCK, Secretary.
JOHN BEAVER, Treasurer.

How They Do It Abroad.

We are in receipt of a handsomely printed programme containing an illuminated address to the general manager of the North Metropolitan Tramways Co., of London, and an invitation to attend an entertainment tendered by the directors to the employes of the company, an account of which we quote as follows from the London *Daily News*:

At the Foresters' Hall, Clerkenwell Road, last night, the directors of the North Metropolitan Tramways Co. gave a smoking concert to a large number of their employes, on the occasion of the presentation by the employes of an illuminated address and testimonial to Mr. R. L. Adamson, general manager of the company. Mr. George Richardson, chairman of the directors, presided. After the principal portion of an excellent programme had been listened to with much pleasure, the chairman called upon Mr. A. Hume, secretary of the presentation committee, to read the illuminated address. The address stated the various benefits in the way of shortened hours of labor and other improved conditions of service which had been conferred upon the men through the efforts of Mr. Adamson, who, the men said, had elevated their position above that of others similarly employed in the metropolis. The address was signed on behalf of subscribers numbering 1,437 employes, and the testimonial took the form of a silver tea and coffee service, weighing 200 ozs.

The Chairman, in making the presentation, said the company had always been ready to meet the just demands of their employes and they had succeeded in doing so to the satisfaction of the shareholders and also of the men. During the late omnibus strike trouble was averted on their lines by the careful and just consideration of the men's wishes and the valuable service of the general manager. The directors had no objection to unions, and gladly gave help to the men's provident fund, an excellent union which existed among the employes. Mr. Adamson suitably responded, and at the conclusion of the concert a vote of thanks was given to the chairman for presiding.

Trolley Literature.

The amount of matter that has appeared in the Brooklyn papers for and against the merits of electric traction would, if collected, constitute a large volume. It has served its purpose well; for by it the mayor has learned that the mass of the people desire this method of traction. The people have learned that wherever it is in operation it is in favor with the public. All have learned that evidence is wanting to sustain the charge that it is dangerous to human life.

Mayor Boody, after vetoing the Aldermanic resolutions in the trolley case, which were afterwards again passed with some modifications, as explained in our editorial columns, in order to inform himself on the system, addressed a note to the mayors of a number of cities, asking for information on the subject. The following are some of the replies, all of which are favorable except the one from Chicago, and this because the authorities of this city have had no means of learning of its practical value, and are yet to be convinced by the same means that has worked a change of attitude with so many others.

The Mayor of Buffalo, N. Y., wrote: "There was considerable prejudice against the system previous to its introduction, but it is wearing away, and I believe it is regarded more favorably every day. There have been a number of accidents, but they are due more to the carelessness or ignorance of employes than to the trolley itself. Has the result of its use been satisfactory thus far? Generally, yes, though there have been some complaints about the irregular running of cars, which might be expected of any new system. The system has been in operation here about six months. The views which I had when the substitution of the trolley for horse power was proposed have been materially changed. There is still room for improvement, but I believe, when properly managed, it is an excellent system."

W. H. Miller, mayor of Akron, O., wrote: "There is no opposition here to the trolley (at least not expressed). There is no doubt that if some other system were devised dispensing with the overhead wires it would be safer and allay the apprehension which may exist. No person has been injured. Several horses have been killed and injured, the cause being indirectly the overhead wires. Thus far the trolley system has been very satisfactory. My views are very much in favor of the system. In fact, there is hardly such a thing as a comparison to be made between the old method and the present. The trolley is much superior in service and is proportionately better patronized. This has been my observation here. I do not think there is any probability that the approval of the change herein suggested could result in other than public favor. While there will no doubt improvements follow the present motive power systems, I firmly believe that the electric power has come to stay and will be the great factor to furnish the motive power for street railways. I am not either directly or indirectly interested in electric street cars."

Mayor William G. Rose, of Cleveland, O., wrote: "The public is satisfied that the trolley system is a vast improvement over horse cars, being more rapid, cleanly and affording greater facilities for moving large crowds. Two or three horses have been killed. The result of the system has in the main been satisfactory." He advised that whatever the system, great care should be taken in regulating the speed, proper signals and close watchfulness.

C. S. Clark, Mayor of Erie, Pa., wrote: "Our people are pleased with the working of the trolley. There have been several accidents, but none directly attributable to the trolley—several parties run over. The result of its use has been very satisfactory. It has been in operation for four years."

Mayor H. I. Gourley, of Pittsburgh, Pa., wrote: "It is, up to the present time, more feasible than the underground system for electric traction, and much better than the old horse car mode of traction. In a couple of instances a dead wire falling across the trolley and touching the ground, had been the means of killing two horses. No human beings were killed by the trolley. In icy weather, on steep grades, there is occasional trouble, but attention by way of sweepers in keeping tracks clean obviate this."

Mayor George B. Guild, of Nashville, Tenn., wrote that all kinds of transportation had been used in that city except the cable, and now an electric system was in use, and that it gave general satisfaction. There had been a few accidents as the result of the system; five horses, but no men, had been killed. The system had been in use for four years. "At first," he writes, "we were a little apprehensive, and the proposition was not favored, but I am now satisfied that our people have changed their opinion and are well satisfied."

The Mayor of Columbus, O., wrote that the people of that city were satisfied with the trolley system. He says accidents have occurred, but does not go into any particulars. The result of the operating of the system has been so far satisfactory, although it has been in use but four months. He would not exchange the new system for the old horse cars.

Mayor Washburne of Chicago referred Mayor Boody's circular letter to J. P. Barrett, superintendent of the fire telegraph bureau of that city, and Mr. Barrett, in replying thereto, wrote: "The trolley system is not in use within the old city limits of Chicago. The system is now used in two of the annexed districts of the city, built through a sparsely settled part of the city. I have heard of no particular objections to them there, and have heard of no accidents. The public feeling of Chicago is against overhead construction of any kind, whether it is telegraph, telephone or electric light, and especially against the trolley system. We are now constructing a subway system in the northern part of the city for the purpose of experimenting with electrical conductors underground for the purpose of moving cars. This is not sufficiently advanced to justify an opinion as yet, but I believe it is the coming system."

We append the text of Mayor Boody's veto:

Jan. 2, 1892.

To the Honorable the Common Council:

Gentlemen,—I am constrained to return to your honorable body, without my approval, the resolution attached to the report of the Committee on Railroads, known as Resolution No. 32, A, B, C, D, E, F, G, H, I, referring to the application of the Brooklyn City Railroad Co.; the Atlantic Avenue Railroad Co. (Resolution No. 33); the Coney Island & Brooklyn Railroad Co. (Resolution No. 34); the Brooklyn City & Newtown Railroad Co. (Resolution No. 35), for the consent of the local authorities for a change of motive power from horse power to overhead single trolley system, passed by your honorable body on December 21, 1891.

As two days only have elapsed since I entered upon my official duties, no time has been afforded me to give the resolutions that consideration which their importance demands.

The fact that my predecessor in office, with his large knowledge of the results which would follow their adoption, did not affix his signature to the same, may well increase my appreciation of their importance and my doubt concerning their beneficial effect.

It certainly is our duty to encourage those enterprises which will increase the comfort and convenience of our fellow citizens, and promote the prosperity of our city, but there are features of a grave character connected with the privilege which the said resolutions grant:

First—While it may be shown that the proposed method for propelling street cars is in successful operation in certain cities of the country, it cannot be said that any city of the size of the city of Brooklyn has felt justified in adopting that system.

Second—The resolutions grant important privileges, which impose new conditions on our citizens, but for which the city receives no equivalent.

Third—It is claimed that the proposed system is dangerous to life. While it is true that we are called upon to yield many of our personal conveniences for the public good, no citizen in time of peace can be justly asked to hazard the loss of life or limb. No amount of material benefit can compensate for the loss of one life.

Without further discussing the subject at this time, I am clearly of the opinion that it is my duty to return the resolutions for the further consideration of your honorable body.

Respectfully, DAVID A. BOODY, Mayor.

Legal Intelligence.

HOUSE MOVING—INJUNCTION—JURISDICTION OF COURT—DESTRUCTION OF PROPERTY—INTERRUPTED TRAFFIC. The evidence in the record of this case showed that a church congregation, of Elkhart, Ind., sought to move its edifice, and contracted with the appellant to do the job. The appellee street railway company had an electric line on one of the streets appellant wished to take the building across, and the structure was so high that it would have necessitated the cutting of the overhead wires in taking it across the track. To this the appellee objected and got out an injunction in the Circuit Court to stop the moving or cutting of wires. The contractor and church people claimed that the court had no jurisdiction; that the City Council only had the right to exercise authority over the streets. There was a further claim that the company had forfeited its charter since it had constructed an electric road, the charter giving it no specific right to use electricity as a motive power. The trial court decided in favor of the company, and the contractor by the aid of the church people appealed.

Held, 1. That the act for the incorporation of cities neither takes nor means to take from the courts the authority to decide legal controversies concerning personal or property rights, and vest in common council of cities the power to determine such controversies.

2. That a failure or refusal of the common council of a city to take steps to prevent the injury or destruction of a line of electric railway does not preclude the owner from seeking redress in the courts of the state.

3. That no individual can insist that the corporate existence of a company has terminated, or that he may at pleasure confiscate or destroy its property in order to move a house across its track. Citizens have the right to

the ordinary use of the streets, but they cannot interrupt traffic and discommode the public by tearing down a car line. It would be strange if buildings could be moved along streets without control or restriction. The injunction of the lower court sustained.

Williams et al. v. *Citizens' Street Ry. Co. of Elkhart.* Ind. S. C., Dec. 18, 1891.

Conditions—Pavement—Right to Determine. In an action brought to enforce payment of the cost of repaving a street, with interest thereon, the court *Held:*

1. That a city (Philadelphia) may impose conditions in giving use of streets to railway companies, and that the city has a right to determine when streets should be paved and what kind of pavement should be used.

2. That the city (Philadelphia) has the right to refuse its consent to the construction of a passenger railway upon its streets; it has also the right to prescribe the terms upon which its consent will be given, and it may, therefore, require, as a condition precedent, that the company shall enter into an agreement to be subject to all ordinances in relation to passenger railway companies, then in force or thereafter to be passed.

3. And the defendant company having been formed by the merger of three other corporations, is subject to the duties and obligations which originally devolved upon them. As to so much of its route as belonged to the College Passenger Railway Co., the charter of the latter corporation, contained in the Act of April 15, 1858, which expressly declares that the franchise granted by it shall be subject to the city ordinance of July 7, 1851. imposing upon the defendant company the duty of paving all streets occupied by it, and of repairing or maintaining the pavements thereon.

4. That this requirement applies to the whole roadway between the curbs, and not merely that part of it which lies between the tracks.

5. That when a passenger railway company is under an obligation to pave and repave a street, all questions as to the necessity of doing the work and of the kind of material to employ, are to be determined by the municipal authorities. There is no implied provision that no kind of pavement, except that in use when the obligation was entered into, shall be required.

City of Philadelphia v. *Ridge Ave. Street Ry. Co.* Penna. S. C., Oct. 15, 1891.

Notes on the Short Railway System.

It appears to be a curious and interesting feature of the Short gearless motor that it will operate excellently during snow storms, maintaining the schedule time where other motors fall rapidly behind. The only reasonable explanation of this is found in the fact that the weight of the motor is centered directly over the axle, so that maximum traction is attained. In support of this theory, it is noticed that the wheels of the gearless motor rarely or never slip even under the worst conditions of track. Another reason is probably found in the special controlling device used by the Short company, which prevents a sudden rush of current through the motors, which frequently causes the wheels to slip and prevents them from taking a good grip on the rail. That this latter experience has some weight, is proven by the fact that on several occasions the Short double reduction motors have operated during the past month under conditions of track and weather where other motors of the same type have completely failed.

The two fifteen H. P. short gearless motors which operated a car at the Pittsburgh convention were sent to St. Louis, Mo., immediately after the convention and attached to a thirty foot double truck car, which was placed in regular service on the road. During the time which has elapsed since, there has not been a single trip lost through mechanical or electrical defects in the motive apparatus. The motors run almost cold, showing that there is no waste of energy. The car is the fastest on the line, especially on grade work. The traction is remarkably high, the car is noiseless, and upon all sides come the most flattering reports of the motors. The Lindell Railway Co., of St. Louis, on December 30, made a test of the power consumption of the gearless motor car, the results of which are given below:

At 4:26 P. M., the car started from the barns on its regular trip, which was one of the heaviest of the day. On the outbound trip it carried twenty-five passengers, and on the inward trip ninety passengers. One-quarter minute readings were made of both current and voltage on the car. On the outward trip the gearless motors took an average of $17\frac{49}{100}$ amperes, 459 volts, or $10\frac{76}{100}$ H. P.; and made the half trip in $29\frac{3}{4}$ minutes, or two and three-quarter minutes less than the time usually taken by the other cars. On the inward trip the motors took an average of $28\frac{32}{100}$ amperes, 448 volts or $17\frac{1}{100}$ H. P., and made the half trip in $37\frac{1}{4}$ minutes, or $1\frac{1}{4}$ minutes less than the usual time. The average horse power required for the round trip will thus be seen to have been $14\frac{19}{100}$, which was $1\frac{46}{100}$ less than that taken by a similar car equipped with double reduction motors.

Between November 11 and December 15, Col. Lewis Perrine, president of the Trenton Passenger Railway Co., of Trenton, N. J., laid fourteen miles of track, besides putting up 700 poles, complete with all necessary wire construction. Those who know the energetic colonel will not be at all surprised at this result. He has given personal supervision day and night to even the smallest details of all of his construction, and during part of the time has had as many as 800 men at work. Those who have seen the work as thus far finished, say that Colonel Perrine will have one of the finest street railway properties in the country. The road will be equipped throughout with Short single reduction motors, and the station with the new type of multipolar Short generators. Colonel Perrine expects to have his plant complete and ready to start in operation on or about February 1.

The Short Electric Railway Co. have been fortunate in securing from the Minneapolis Street Railway Co. an order for the entire spring requirements for that road, which, it will be remembered, is one of the largest in the country; 120 motors will be used in all, and the Short gearless has been selected. The motors are to be in operation by April.

The Consolidated Street Railway Co., of Grand Rapids, Mich., have just placed an order with the Short Electric Railway Co. for twenty, forty H. P. gearless equipments, to be used on their lines, which are being changed over to electricity. This contract was made after very careful personal investigation of all the leading systems by the general manager of the company, Mr. J. R. Chapman.

Co-operative Electric Railway Plan For the World's Fair.

In the last number of The Street Railway Journal it was stated that five miles of railway would be built in the World's Fair grounds at Jackson Park. A suggestion was made recently of a plan by which the Exposition company could secure the road without cost. E. E. Higgins, general manager of the Short Electric Railway Co. and Alex. Kempt, Western agent of the Brush Electric Co., called at the Electricity Department and suggested the possibility of the Fair managers inducing the several electric railway companies to enter into a co-operative plan by which each would agree to equip a mile of line as an exhibit, the Exposition company to furnish the current. It was at first stated that such a plan would necessitate a change of cars at each mile, which certainly would be objectionable. It would seem easy enough to avoid such a contingency. Certainly, to provide for the crowds wishing to ride it will be necessary to run cars in trains. The first cars, then, could be changed every mile and the trailers could be through coaches. This suggestion is an interesting one, but there is no probability that it will be adopted. It is stated, on what should be excellent authority, that the Exposition authorities propose to operate the intramural road themselves.

Street Railway News.

Akron, O.—Ira M. Miller has been elected vice-president of the Akron Street Railway Co., vice, J. S. Casement.

Allentown, Pa.—Since the completion of the Allentown & Bethlehem electric railway, it has been found that the railway circuit often throws out of action the electric train signals of the Lehigh Valley Railway Co. In some cases it was found that by reversing the batteries used to operate the railway signals the trouble was removed; in other cases more batteries were required. A singular point stated is with batteries on different instruments not one mile apart one would require zinc to ground, the other copper.

Amsterdam, N. Y.—The Amsterdam Street Railway Co., since January 1, have combined the offices of secretary and treasurer with that of general manager. Mr. H. K. McCay has resigned from the company.

Atlanta, Ga.—The Atlanta, West End & McPherson Barracks Street Railway and the Grant Park Electric Street Railway, two of the leading lines in the city, have been consolidated under the title of the Atlanta Traction Co. The officers of the Consolidated company are: George E. Hoppie, president; J. H. Mountain, vice-president and general manager; H. L. Woodward, secretary; Henry Lanier, treasurer.

THE Grant Park Electric Railway a new line has been recently completed.

THE motormen and conductors on the line of the Consolidated Street Railway Co. want their pay advanced from fifteen cents per hour to twenty. A strike was declared and was lost.

THE Atlanta & Chattahoochee Electric Railway is under contract with the Short Electric Railway Co., of Cleveland, O., and is to be in operation by February 15, by which time, it is expected, fifteen miles of track will be completed. Ten cars—four closed and six open—will be supplied by the J. G. Brill Co., of Philadelphia.

Austin, Tex.—Mr. M. M. Shipe has tendered his resignation as superintendent and manager of the Austin Rapid Transit Co. Mr. J. K. Urie will succeed him.

Baltimore, Md.—A dispute has arisen between the Baltimore City Passenger Railway Co. and the new Baltimore & Curtis Bay Electric Railway Co. Both roads claim the right of way from the end of Light Street to Light Street Bridge via the road which runs along Spring Gardens; and both companies have laid tracks thereon. The tracks of the two roads in many places are not more than six inches apart, and it will be utterly impossible for cars to run on either line if both companies try to operate.

UNDER the superintendency of Frank H. Humbleton, of the Traction company, the Epworth Methodist Episcopal Church is being transferred into a cable power house.

THE Hon. Oden Bowie was, at the annual meeting, re-elected president of the Baltimore City Passenger Railway Co. for a nineteenth term. The directors also re-elected S. L. Bridge, secretary and Joseph W. Clarke, treasurer. George R. Gott, the architect of the proposed power houses for the cable lines, submitted the plans of the same.

THE contract for constructing the electric railway from Light Street Bridge to Curtis' Bay, has been awarded to Rutherford & Seddon.

Barnum, Colo.—The Denver, Lakewood & Golden Railroad have given a bond to complete their electric lines, which will enter Barnum, by April 1. A ten minute service is promised. The cars will enter Denver at Fifteenth and Arapahoe Streets over a third rail placed by the Tramway company.

Beaver Falls, Pa.—H. N. Brooks of Erie, Pa., has been appointed to the general superintendency of the Beaver Valley Traction Co. in place of E. N. Bliss, resigned.

Belleville, Ill.—At the meeting of the City Council, January 4, a letter was read from James Atterbury in which he declined the franchise recently passed by the Aldermen. It was so loaded down with conditions that Mr. Atterbury asserted he could not accept it.

Beverly, Mass.—Beverly Selectmen have named such stringent conditions to the Naumkeag Street Railway Co. that there seems to be no more chance for electric cars in that town than before the Selectmen voted to allow them to run through Rantoul Street.

Birmingham, Ala.—Fifty out of fifty-three of the conductors on the electric cars here struck on January 4. They had been getting twelve and a half cents an hour and demanded fifteen. The strike resulted in the tying up of the whole system. The strikers at once organized a hack company to run parallel to and in opposition to the electric cars. They had twenty-five hacks and charged a five cent fare.

Bloomington, Ill.—The street railroad company and the City Council are engaged in a war concerning the T rail. The company will not lay any other on several streets and the Council steadfastly refuse to give their consent thereto.

Boston, Mass.—The West End company have contracted with the Pullman Car Co. for two more double deck cars.

THE plant formerly belonging to the New England Glass Works at East Cambridge, recently bought by the West End Street Railway Co., has been made into a mammoth power station. The main building is 100×125 ft. The plant consists at present of three engines, two of 100 H. P. each. One engine, ready for use January 1, will furnish the power for operating twenty dynamos of 110 H. P. each. These twenty are only temporary ones, as the Thomson-Houston company are at work on ten 500 H. P. dynamos, which will supplant the smaller ones just as soon as they can be constructed.

ON MOTION of Mr. Everett of Ward 9, the president and two members of the Council are to appear before the Legislature and oppose the use of any part of the Common in the manner suggested by the Rapid Transit Commission.

MR. F. S. PIERSON, in a recent interview published in the Boston *Journal*, makes some interesting statements in regard to heating by electricity. The West End Street Railway Co., are now making an experiment of heating cars by this agency, and have introduced it into twenty cars. He also stated that when the power station of the West End road should be in operation the cost for electric power would be probably reduced about one-half.

Braddock, Pa.—The Braddock & Turtle Creek Street Railway Co. have elected the following officers: President, William Yost; vice-president, John Rinard; secretary, Fred. W. Edwards; treasurer, G. L. E. Stamates; superintendent, G. T. E. Stamates.

THE Braddock Electric Street Railway was put in operation January 13, and carries passengers between Bessemer and Hawkins. This company have the right of way to Wilkinsburg through Hawkins. It is said that if an attempt is made to lay tracks in Hawkins, Congressman John Dalzell, Judge Hawkins and R. P. Duff will oppose the undertaking.

Bristol, Tenn.—The new electric cars for the Bristol Belt Line have arrived, and three of them will be put in at once. S. N. Nicholson, the superintendent, it is said, will, after February 1, no longer be connected with the concern. He will go to the City of Philadelphia, where he will pursue his profession as an electrician. It will cost the company several thousand dollars to put their road in as fine shape as it was before the great fire, which lately burned the stables and five electric cars. The loss was $20,000; partially insured.

Brockton, Mass.—The Brockton Street Railway Co. are enlarging the power station at Montello, and two more engines and two more boilers will be added. The overhead wire from Randolph to the Brockton line has been put up, and the Brockton portion of the work will be shortly completed. The Belmont car stables have been turned into a workshop, and the cars are being equipped with motors. It is the intention of the company to put on some of the big cars, similar to those in use on the West End road for service on the Whitman and Randolph extensions. The Brockton road conveyed 2,320,500 passengers last year, and the East Side and Whitman roads 458,979.

Brooklyn, N. Y.—The Brooklyn Heights Railroad Co. have applied in the City Court for an injunction restraining the city from interfering with their constructing a track from the Wall Street Ferry along Furman and up State Street to their power house.

THE new Mayor vetoed the aldermanic resolutions empowering the Brooklyn City Railroad Co. to equip their line with the overhead electric system. The Aldermen, however, promptly re adopted the resolutions and the Mayor, seeing that further opposition would not avail, did not veto them. He wrote to the mayors of other cities in order to ascertain how the trolley worked there, and asked that all opponents of the system call to see him. A full discussion of this matter, together with abstracts of letters received by the Mayor, will be found in another column.

AT the annual meeting of the Brooklyn City Railway Co., the only changes in officials were the selection of Secretary Thompson as treasurer, and the election of Crowell Hadden as auditor. Mr. Thompson will also retain the position of secretary. The road, it is stated, contemplate the extension of their electric system to Fort Hamilton.

UPON the third application of President Slocum of the Coney Island & Brooklyn Railroad Co., the Board of Railroad Commsioners have granted permission for a change from horse power to electricity on that portion of the line extending from the circle in Flatbush to the corner of Ninth Avenue and Ninth Street in Brooklyn. One of the conditions imposed is that every car shall be provided with wheel guards, and shall have not less than two men to operate it.

Buffalo, N. Y.—The report of the committee appointed by the mayor to investigate the proposition of the Buffalo Railway Co. in regard to establishing a free transfer system and granting other privileges in return for release of paying percentages on the earnings of certain lines to the city as at present was presented last month and was most exhaustive. The equivalent proposed by the committee in behalf of the city for the establishment of a free transfer system was the relinquishment by the city of the statutory percentages payable by the street railway companies, that is, the three per cent. which the Crosstown and West Side companies are required to pay annually by the Act of 1890 for the first five years, and the five per cent. thereafter, to the city together with a portion of the Elmwood Avenue percentage. In regard to the contract percentage payable by the Crosstown lines of eleven and three-quarters per cent. and that payable by the Elmwood Avenue line of thirty-six per cent. which the railway company showed could not be paid without operating these lines at a loss, the committee proposed the substitution of a percentage, payable to the city on the gross earnings of all the lines, as follows: Two per cent. of the annual gross earnings up to $1,500,000; two and a half per cent. of the annual gross earnings when under $2,000,000 and over $1,500,000; three per cent. of the annual gross earnings when over $2,000,000. These amounts to be paid annually. The proposed concessions to the police and fire departments were not discussed as being deemed of little importance compared with the main question. That of selling eleven tickets for fifty cents was not demanded. The committee also recommended the extension of the time allowed the Crosstown line to complete their system, three years. The report was accepted by the street railway companies and municipal authorities as the best measures

under the circumstances. A satisfactory contract has been made and signed by the Mayor and the three companies.

TONAWANDA has been connected with Buffalo by the electric road which was opened January 1. The opening was a decided success.

THE Elk Street electric line is now in full operation.

Charlotte, Va.—The Charlotte Consolidated Construction Co. have sold their interest in the Charlotte street railway to the Charlotte Street Railway Co. The railroad company have issued 100 bonds of $1,000 each to the Mercantile Trust & Deposit Co., of Baltimore.

Chester, Pa.—AT the Chester Street Railway Co.'s annual meeting Col. Samuel A. Dyer was elected president and Richard Peters, Jr., vice-president.

THE Union Railway Co. elected Richard Peters, Jr., as president.

Chicago, Ill.—The West Chicago Street Railway Co. will not accept the franchise for the extension of West Lake Street line, because of a provision that letter carriers must be carried free.

THE Chicago & Evanston electric railroad is meeting much opposition from the "committee of property owners on Southport Avenue." It is asserted that the merchants along the street have been threatened with a boycott if they sign a petition for a franchise. The outlook for the new road is somewhat gloomy.

ONE of the local papers has made an attack on the Carette line. It claims that the horses are overworked, and are poorly cared for. The horses draw the carettes twelve miles a day, and it is claimed that drawing the heavily loaded vehicles up the steep grades at the bridges constitutes cruelty.

A BLUE Island Avenue night car was stopped recently about two o'clock A. M., at the corner of Ward and Lincoln Streets, by three men, who attempted to rob the conductor. The cries of the latter and the driver brought two policemen to the spot, and they succeeded in arresting two of the highwaymen. They were fined twenty-five dollars on their statement that they did not intend robbery, and on the failure of the employes to identify either of them as the one who actually tried to secure the conductor's cash.

JUDGE HORTON has refused to issue an injunction in the case of Charles W. Rigdon against the Chicago City Railway Co. The suit was brought to restrain the defendants from increasing their capital stock and investing it in the bonds of the Alley L road. The plaintiff is the owner of eight of the 60,000 shares of the City Railway Co. The bill showed that the company owned more than one-half the stock and $500,000 worth of the bonds of the elevated road. The court in his decision held that the act of the defendants in purchasing the stock was illegal, but not so as to the bonds. The defendants had no right to invest their assets in such stock, and to do so might result in serious loss to the stockholders, which would entitle them to an injunction. The stock in the Alley L, now held by the Chicago City Railway Co., was purchased prior to the purchase by Rigdon of his stock, therefore he will be considered as stopped from making complaint in regard to that stock. Rigdon alleged that the directors proposed to invest the $1,000,000 in the treasury in stock and bonds of the Alley L, and that negotiations to that effect were now pending. A court of equity, said the judge, could not restrain mere negotiations. The case came up on a demurrer, which was sustained, and the motion for an injunction was denied.

Cleveland, O.—The East Cleveland Street Railway have put a new car on their line from their own shops. It is thirty-eight feet long, built after the Pullman fashion and very ornamental. It is four feet longer than any other car on the road.

AT the annual meeting of the East Cleveland Railroad Co., held last month, A. Everett was elected president, C. W. Wason, vice-president, H. A. Everett secretary and treasurer, L. E. Beilstein assistant secretary and assistant treasurer, Edwin Duty, superintendent.

WORK on the electric equipment of the Woodland Avenue & West Side Street Railway Co. has been pushed during the last few months. Six miles of new rails have been laid of eighty pound girder on oak ties, which are two feet between centres. The ties are 5×8 ins. ×7 ft. in length, and the joint ties 5×10 ins. of the same length. A tie is placed on each side of the joint within six inches. The tie rods are placed every six feet. Five difficult curves have already been laid of the same eighty pound girder rail. The track wiring is done with No. 00 galvanized iron wire, two bonds, one inside and one outside of the rail being used at each joint, with necessary cross connections.

Columbus, Ga.—The electric railway in this city was formally opened on December 22.

Columbus, O.—Before next April horse cars will be things of the past in this city, the Consolidated company having entered into contracts with the Thomson-Houston Electric Co. and the Buckeye Engine Co. of Salem for the necessary equipments for the electric system they will put in.

BY an ordinance just passed, the Glenwood & Greenlawn Street Railroad cars may not be run in the more crowded parts at a greater speed than eight miles an hour, and in the outlying parts not exceeding fourteen.

Covington, Ky.—Superintendent Jenkins of the South Covington & Cincinnati Street Railroad, in company with a number of directors of the road, recently gave a trial to a lately invented air brake that he proposes to attach to each of the cars in his charge.

Denver, Colo.—The new Stout Street electric line began operations January 1. The track which formerly connected the Stout and Curtis Street lines on Twenty-eighth Street has been cut off and will be removed.

MR. A. L. PERRY, the former superintendent of the West End Electric Railway, has resigned his position with that company.

DuBois, Pa.—The DuBois Traction Passenger Railway Co. have chosen the following officers for the year: President, M. D. Wayman of Ford City; vice-president, A. C. Balley of Ford City; treasurer, G. E. Grier of DuBois; secretary and superintendent, C. E. Bostwick.

Duluth, Minn.—Judge Hart recently decided that street railway companies have the right to condemn private property in order to extend their lines. It is the first case of the kind ever brought into court in this state.

REPRESENTATIVES of several electric companies have lately been here looking for the contract for the new street railway machinery to be purchased soon.

East Liverpool, O.—The popularity of the new electric line is greater than was expected, and the receipts therefrom reach $1,000 per week from fares alone.

Easton, Pa.—At the annual meeting of the Easton, South Easton & West End Passenger Railway Co. H. A. Sage was elected president, H. W. Cooley, secretary and treasurer, and H. A. Sage, Jr., superintendent.

Fairhaven, Wash.—The Fairhaven & New Whatcom Street Railway Co. have an electric street railway in operation from Ocean dock, Fairhaven, to Lake Whatcom.

Fredonia, N. Y.—Superintendent Crawford of the Dunkirk & Fredonia Railway Co. has handed in his resignation. His successor is A. T. Marsh, of Jamestown. It is understood that Mr. Marsh will adopt new rules in the government of employes, and a general change in the running of cars will be brought about under his administration.

Galveston, Tex.—On February 6 last year the first electric car of the new electric equipment left the motor house of the Galveston City Railroad Co. The company have entirely rebuilt twenty-six miles of track. The remainder of the lines will be completed by May, 1892, when the total mileage operated electrically will be forty, all within the city limits. Twenty additional motor cars are to be delivered on or before May 1, 1892.

Griffin, Ga.—The Griffin Street Railroad Co. at their regular annual meeting re-elected their officers. The first report of the secretary and treasurer, showed the road to have been well managed, with much valuable property and a handsome surplus made over running expenses up to date, during the eight months it has been in in operation. The company have a school rate of two cents.

Hamilton, Ont.—The projectors of the new Hamilton, Grimsby & Beamsville railway propose to have the terminus in Hamilton either on the south side of the Gore Park, on Main Street opposite the Court House or on King William Street at James Street. The directors are threatened with strong opposition from the street railway in their efforts to gain entrance to the city.

Hartford, Conn.—The annual meeting of the East Hartford & Glastonbury Horse Railroad Co. was held January 1. The directors elected for president, Daniel R. Howe; vice-president, Isaac Brodhead; secretary, George D. Curtis; treasurer, Elmer M. White; general manger. E. S. Goodrich.

Helena, Mont.—The work of equipping the road of the Helena Rapid Transit Co. with electric power is progressing rapidly, and it was expected that twelve miles of track would be in operation by the 1st of February. The electrical equipment was furnished by the Thomson-Houston Electric Co., and the cars by the Northern Car Co. of Minneapolis. The steam plant has a capacity of 375 H. P. The Helena Rapid Transit Co. also operate the road of the Helena, Hot Springs & Smelter Railway Co, and the Union Electric Railway Co.

Indianapolis, Ind.—In the early part of last month the eighteen lines of the Citizens' Street Railroad Co. were tied up by a strike of the drivers, conductors and motormen. The cause of the strike was an order withdrawing the badges which gave the employes the freedom of the cars when off duty, and even going to and from work. The trouble was, however, referred to arbitration and the lines put in operation.

Jersey City, N. J.—The officers of the Jersey City & Bergen Railway Co. do not think the recent decision of Supreme Court Justice Reed in the Newark trolley road case will affect them, and work is being vigorously prosecuted to get the Jersey City roads equipped by spring. It is claimed that Justice Reed's decision, which declares that the law of 1886, empowering railroads to use electricity, did not contemplate the adoption of the trolley system, will be carried to the Court of Appeals, where it will be shown that the trolley was actively experimented with in 1886, and was as well known as any other system at that time. The decision also holds that the Newark Council should have given the street car companies their new powers by ordinance instead of resolution, and that the failure to do so is a vital defect. The doubt is also raised whether the Council could grant permission for the obstruction of streets with trolley poles. The officials of the Jersey City company claim that none of these points apply to them. The authority to adopt the trolley system was secured by ordinance from the Aldermen, and later from the Street Commissioners. Permission was obtained from abutting property owners for every pole erected.

Kansas City, Mo.—L. E. Simmons, formerly superintendent of the Eighteenth Street line of the Metropolitan Street Railway Co. has been appointed general superintendent of all the lines of the road, the old system of separate superintendents being discontinued. L. V. Barnes formerly superintendent of the Twelfth Street line, leaves the service of the company.

THE sale of all the assets of the Union Cable Railway, which was to have taken place last month, was by agreement of all interested parties postponed until February 15.

Kokomo, Ind.—The electric railroad is finished.

Lancaster, Pa.—The annual report of the Lancaster City Electric Railway and West End Passenger Railway companies presented last month shows that 1,249,250 passengers were carried during 1891. It is only a few years ago that horse car lines were introduced here, and financially they were not a success. The last year that the horse car lines were used, 183,000 passengers were carried, and the first year of the electric system the number was 426,000. These companies have now fifteen miles of track, and during the summer they will build belt lines in all sections of the city. During the past year the companies paid five per cent. interest on their bonded debt and put aside a large reserve fund for future improvements.

Lawrence, Mass.—The electric line officials have taken the precaution this year to construct catch basins, between the tracks, and connected with the nearest cesspools, to carry off the water formed by the melting of snow, a nuisance that, last year, gave them much trouble.

Leavenworth, Kan.—Rumor has it that outside parties are negotiating for the purchase of the Rapid Transit line, running through this city and connecting Leavenworth and the Soldiers' Home. It is said that in the latter event the road will be transformed into an electric road.

Little Rock, Ark.—The City Electric Street Railway Co. accepted their road December 23, the day upon which the thirty-day trial period expired. The road operated without a hitch or delay of any consequence during the entire thirty-day trial period.

Lynchburgh, Va.—The electric street railway is now completed and in working order from the hotels at Baltimore wharf, Old Point, to West Hampton, a distance of over three miles.

Lynn, Mass.—The directors of the Belt Line Street Railway Co., at their last annual meeting organized as follows: President, O. A. Towns; treasurer, William B. Littlefield; clerk, Frank W. Jones; auditor, A. B. Martin. The office of auditor was created at the meeting. It was voted to purchase a new generator for the power house.

Macon, Ga.—Receiver Winters has filed a petition in the Superior Court asking to sell or be allowed to issue receiver's certificates to the amount of $55,000 for the purpose of erecting a power station at a cost of $25,000. and to further extend and improve the road at a cost of $30,000. He says the road suffers from a lack of power, owing to which the armatures of both dynamos and motors have been burned out at a loss of $4,000.

McKeesport, Pa.—The McKeesport & Reynoldton electric railway is now in full operation.

Memphis, Tenn.—An order restraining the Citizens' Street Railway Co. from laying T rails on Poplar Boulevard was issued by Judge Galloway, but was soon afterwards withdrawn, the matter having been amicably settled, and now the extension to McLean Avenue will continue without interruption.

ELECTRIC cars will probably be put on the East End dummy line soon. The City & Suburban line is in good condition, and in time, instead of stopping on certain streets, these cars, along with electric cars on the East End dummy line, will go through the city and over the most prominent streets.

Middleton, Del.—Some strong opposition has been shown by the road commissioners and a number of the citizens to the building of the Odessa & Middleton Electric Railway along the public road.

Milwaukee, Wis.—The National Avenue & Walnut Street line was operated by electricity for the first time January 1. A car was also run over the Third Street line. The opening of the road was attended with the usual jubilations, and was a great success. The Third Street & Chestnut Street lines were operated by electricity a few days later.

Minneapolis, Minn.—The first "made over" motor car to be turned out of the Northern Car Co's. shops has been put in service here. The body is twenty-two feet long, and the length over all thirty feet. It is the result of joining two sixteen foot Stephenson horse cars from St. Paul. Others of the same pattern will be completed as fast as the company can turn them out, and they will be the most commodious ones upon the line.

Nantucket, Mass.—The Selectmen of Nantucket have refused the petition of the Nantucket Beach Street Railway Co. to extend their tracks to Siasconset, the route through the town being the objectionable feature, and have proposed the Water Street route, which probably will be accepted by the company.

New Castle, Pa.—The Street Committee Council have recommended an ordinance to the City Councils requiring the street cars to not exceed seven miles on the streets or more than four miles on the bridges.

New Orleans, La.—At the annual meeting of the Board of Directors of the New Orleans, City & Lake Railroad Co. an election of directors for 1892, took place in the office of the company. The president showed the road to be in excellent condition. A summary of the financial report is as follows: Cash on hand November 30, 1890, $49,519.56; receipts for fares for the year 1891, $701,649.45; rents dividends and sundry revenues, $18,401.25; making a total of $769,570.26. Less expenditures as follows: Paid for general expenses, including taxes and licenses, purchase of mules and extraordinary expenditures on tracks, $504,936.01; paid for retirement of bonds and coupons, $60,596; miscellaneous $29,800; paid for dividends, $102,446.50; total $697,778.51, leaving a cash balance on hand of $71,791.75; total $769,570.26.

New York, N. Y.—The principal stockholders of the Broadway surface road have had meetings lately with a view of studying methods for pushing the work by which cable cars are to be introduced on that line.

Newark, N. J.—The running of the electric cars to Orange will not begin until February 1 or later. The Newark Passenger Co. have obtained from the East Orange Township Committee an extension of time by representing that they had been delayed in getting cars for the line.

Newark, O.—At the annual meeting of the Newark & Granville Electric Railway held last month, the directors elected officers for the ensuing year as follows: President, R. Scheidler; vice-president, J. A. Flory; secretary, W. C. Christian; treasurer, F. A. Crane.

Newport, Ky.—Hon. Harvey Myers has introduced in the Legislature a bill entitled: "An act to regulate the operation of street cars and street car lines, and companies in cities of the second class, and to fix a maximum rate of charges for the transportation of passengers for such railways. It fixes the fares at five cents and applies to Covington, Newport and Lexington.

Newton, Mass.—Geo. W. Morse has resigned the presidency of the Newton Street Railway Co. That the town has a street railway at all is largely due to Mr. Morse's efforts and he retires with the good will of all.

Norristown, Pa.—The Norristown Passenger Railway Co. have re-elected their former officers, with the exception of the president; Hugh McInnes takes the place of H. M. Lutz, resigned. The retiring president stated in his report that electricity must ultimately supersede the present system of horse power.

THE Citizens' Passenger Railway Co. have re-elected their former officers.

Norwich, Conn.—The following gentlemen have been elected officers of the Norwich Street Railway Co.: C. P. Cogswell, president and E. P. Shaw, Jr., superintendent and treasurer. The popular superintendent, E P. Shaw, Jr., was last month presented with a gold watch as a testimonial of regard from the stockholders of the company. This is the result of his efficient management of the street railway company's affairs in Norwich, and a well earned recognition of his ability.

Oakland, Cal.—The City Council have passed an ordinance regulating municipal licenses so that ten dollars per annum shall be paid for every street railroad passenger car drawn or propelled by any kind of motive power, said license to be paid on the first days of January, April, July or October of each year.

AT a recent meeting of the directors of the Haywards electric road it was stated that the work, such as laying rails and building bridges, had begun in earnest, and would be prosecuted to an early completion. It was decided to complete the road, if possible, by April 1, 1892.

THE Oakland Consolidated Street Railway Co., the corporate name of the Berkeley electric road, have elected the following officers: G.W. McNear, president; J. E. McElrath, vice-president; First National Bank, treasurer; R. C. Beggs, secretary. The rumor that the Southern Pacific Railroad Co. have obtained control of this road is officially denied.

Omaha, Neb.—The officers of the Omaha Street Railway Co. were re-elected at the recent annual meeting.

Ottawa, Ont.—The recent heavy snow storms had but little effect on the running of the electric cars.

Owosso, Mich.—Saginaw and Detroit capitalists have purchased the Owosso & Corunna Street Railway. The property is very valuable, and the deal is sure to prove a financial success. The road is four and a half miles in length, runs through the principal streets of both Owosso and Corunna, passes several railway depots. It is well constructed, and has a fine and well appointed station and car house between the two cities.

Parkersburg, W. Va.—The Parkersburg street car company's stables, together with fifty tons of hay, waiting room, blacksmith shop, one car and a lot of feed, harness, etc., were burned January 1. The loss was $3,500; insured.

Paterson, N. J.—The electric road from Paterson to Passaic is completed into the heart of Paterson and cars are now running between the two cities at fifteen minute intervals.

Philadelphia, Pa.—It is reported that negotiations between the Traction Co. and the People's Passenger Railway Co., which have been pending for some time, were brought to a successful conclusion by the People's line being leased to the Traction for a long term of years. But it turned out afterwards that the lease was not ratified. The People's line is one of the most valuable street car properties in the city, and one of the Traction Co's. most formidable competitors. It owns or controls forty-five miles of road, The capital stock is $2,075,000, and the bonded debt $750,000. It is said that the Traction Co. have concluded negotiations for leasing the Citizens' (Tenth and Eleventh Streets) Passenger Railway, and that they will soon take possession of the road. Also that the Hestonville system is about to come under their control.

AT the annual meeting of the stockholders of the Thirteenth & Fifteenth Streets Passenger Railway Co. lately held, it was decided to decided to lease the company's line to the Traction Co. Some little opposition was developed, but it was overcome.

Pittsburgh, Pa.—The Duquesne Traction Co. and the Pittsburgh, Allegheny & Manchester Co. have lately made some radical changes in the running of their power stations. At the Duquesne the former chief engineer has been succeeded by Wm. Gorman, a relative of Robert Wetherill, the engine builder of Chester, and an expert from those works which constructed the great Corliss engines used in the power house.

THE Pittsburgh, Allegheny & Manchester Co. have also employed one of Wetherill's expert engineers, who can not only run their engines, but give them the necessary overhauling after they have run any length of time. George Ross of Allegheny is their new chief. New generators will be added to their present motive power, so that additional cars, which the increased traffic demands, can be put on the road. Two of the largest of the Thomson-Houston generators will be added to their power.

COMPLAINT has been made that the Duquesne Traction Co., which bought out the East Liberty & Wilkinsburg Street Railway Co., have recently laid tracks over the railroad bridge and extended them down as far as Shady Lane without authority, as the East Liberty & Wilkinsburg franchise only gave that company the right to come as far as the bridge.

THE Pittsburgh Traction and the Duquesne Traction companies were consolidated on January 1. The consolidation is distasteful to the employes of the Duquesne, who are Knights of Labor, and threaten a strike.

THE stockholders of the Pleasant Valley Traction Co. held their annual meeting last month, heard reports of the president and treasurer and re-elected officers for 1892. George Gorman presided and Jas. E. Rogers was secretary. Passengers carried during the year, 7,770,108; miles run, 1,345,149, against 6,612,913 passengers carried in 1890 and 1,223,600 miles run. President Henry congratulated the stockholders on the fact that in two years their lines had carried over 14,000,000 people and their cars had run 2,500,000 miles without hurting a single passenger on a car.

THE Allegheny & Manchester Traction Co's. line was tied up January 15, by a strike of the conductors and motormen.

Portland, Ore.—The work of electrically equipping the Third Street car system is being pushed as vigorously as possible, but the weather has been so bad that operations progress rather slowly.

Providence, R. I.—The use of electric cars has been successfully inaugurated here. The Inter-state Street Railway Co. have completed their surveys, and by December of the present year the entire system will be in operation. Their lines from the Attleboros to Pawtucket are nearly completed, so far as the laying of rails is concerned. The two Attleboro lines will be in operation by the first of next April, the line to Cumberland Hill will be completed so that cars will be run upon it next winter, the line to Providence will be running by the middle of the summer, the loop line in Pawtucket will also be in running order by that time, and it is intended to have the Bullock's Point line to the various shore resorts in operation by Memorial Day next, May 30. It will take about 4,000 H. P. to run the system, and the company are now negotiating for the purchase of the plant of the Richmond Paper Co. at Rumford, in East Providence, to use as a power station. The electric line to Pawtuxet is carrying large numbers of passengers.

THE design for the transfer table which is being installed by the Union Railway Co. of Providence, R. I., for moving twenty-five foot electric cars, was furnished by M. Rounds of Boston, Mass. The same gentleman has furnished a design for an electric snow plow which is being built for the Union Road.

Reading, Pa.—The Reading & Southwestern Railway Co. have awarded the contract to furnish four twenty H. P. motors to the Edison General Electric Co.

Redlands, Cal.—The Redlands Street Railway Co., at their annual meeting, chose the following officers: A. E. Sterling, president; S. J. Hayes, vice-president; E. W. Wilmot, secretary; First National Bank, treasurer. It was decided to procure a new car, and a committee was appointed to purchase the same.

Rockford, Ill.—At the annual meeting of the Rockford Electric Manufacturing Co. the following officers were elected: President, C. M. Haven; vice-president, G. E. Knight; secretary, treasurer and general manager, W. B. Roberts; superintendent and electrician, George A. Mayo.

Rome, Ga.—The Rome street railway is now being operated under the management of Washington capitalists who will soon put in an electric system.

Sacramento, Cal.—The German Savings & Loan Society have brought suit in the Superior Court of San Francisco against the Central Electric Railway Co. and Sacramento Railway & Improvement Co. of Sacramento, to secure the payment of a bonded debt, and to restrain the Central Electric Railway Co. from surrendering the franchise and taking up the track and removing the rolling stock of the street railroad on O Street.

St. John, N. B.—The Eastern Electric Co., of St. John, N. B., the officers of which company own the St. John Street Railway, have absorbed the New Brunswick Electric Light Co., of St. John, N. B., and are transferring the plant of the latter to that of the Eastern company.

St. Joseph, Mo.—The People's Street Railway Co. are rebuilding upon the site of the old Union line shops at St. Joseph Avenue and Fillmore Street. The first building to be put up will be a combined carpenter and paint shop, twenty-four feet wide and 110 ft. long. As soon as this is completed a car house eighty feet wide and 200 ft. long will be erected. Sixteen new motor cars have arrived from Minneapolis.

AN injunction restraining the People's Street Railway Co. from stringing wires along the Messanie Street line underneath the telephone company's wires has been issued at the instance of Manager Stockwell of the St. Joseph Exchange.

THE new motor of the Westinghouse pattern, which Manager Van Brunt of the People's electric railway lately brought to this city for the purpose of giving a test, was tried and run over the principal lines of the city. It was run on the Union line, and given a thorough test. The officers were well pleased with the performance.

St. Louis, Mo.—The directory of the St. Louis County Street Railway Co. held their annual meeting last month. This road will extend from the city limits to St. Charles, on the St. Charles rock road, and will connect with either the Citizens' or Lindell Railway, and become a rival of the St. Louis & Suburban in the section from Fourth Street to Normandy. It is stated, however, that the success of the enterprise depended entirely upon whether the citizens of St. Charles succeeded in putting up another bridge over the Missouri.

Salem, Mass.—At the Salem Electric Street Railway Co.'s annual meeting the new board of directors chose Milton Davis as president and treasurer; E. Whildey, superintendent; J. W. Northrop, vice-president; William Whildey, secretary and general manager. By the annual statement of the amount of business transacted by the company during the past year, it was shown that 218,936 passengers had been carried.

San Antonio, Tex.—The San Antonio Street Railway Co. have just added to their power block on Tenth Street two Thomson-Houston multipolar dynamos, the only two of the kind in Texas.

San Bernardino, Cal.—The Supreme Court rendered a decision against the City Street Railway Co. holding that the city has a lien against the company to pave their track and two feet on each side thereof, and that the company have no right to abandon the franchise pending the proceedings to pave the streets.

San Francisco, Cal.—Good progress is being made in the way of extending the cable line of the Union Street railroad westerly from its present terminus at Steiner Street to Baker Street.

THE Metropolitan Electric Railroad Co. have begun the construction of their power house just south of the Park, and are laying track in that neighborhood. The officers promise to have the road constructed between the Park and the terminus at Mason and Turk within three or four months.

THE North Beach & Mission company are converting a portion of the road into an electric line. The electric road will run from the ferry out Folsom Street, which is now traversed by street cars. The branch lines of the company on Montgomery, Kearny, Stockton, Fourth, etc., will continue to be operated by horse power.

THE Southern Pacific Railway Co., who control the franchise from Sixth and Market to the Potrero and South San Francisco district, via Eighth Street, announce that workmen will be put on as soon as the grading of the streets on the route has been done.

THE Southern Pacific, who also control the McAllister Street cable road have extended the line out Fulton to Seventh Avenue.

San Leandro, Cal.—Work is being pushed rapidly on the electric railroad and the officers of the company say that the road will be in operation as far as San Leandro by April 1.

Sandusky, O.—The Sandusky Electric Street Railway Co. held their annual meeting last month and re-elected their officers with the exception of superintendent, Emil G. Schmidt being chosen in place of Clark Rude. The report of the secretary showed the affairs of the company to be in a very satisfactory condition.

Savannah, Ga.—Work is in progress on the West Broad Street line of the Electric Railway. It is to be completed in thirty days. Work has also been commenced on the Waters road connection between the Isle of Hope railroad and the electric railway. W. D. Thomas has the contract, and the connection will be made soon.

Searcy, Ark.—Work on the street railway is in progress.

Sherman, Tex.—The stockholders of the Sherman Rapid Transit Railway Co. have elected the following officers: J. M. Cullers, president; J. R. Cole, vice-president; J. P. Harrison, treasurer; C. W. Lewis, secretary and H. C. Morrow, superintendent and general manager. Reports from the secretary of the company showed that the enterprise is in a first-class condition. A large amount of money has been expended on the track, and still there is a balance in the treasury.

Sioux City, Ia.—The Haakinson Street Railway was expected to be in operation by January 30. The connection with the elevated road has been made and the service will be half hourly. The storage battery car of the Bradbury pattern will be put on and given a thorough test.

THE Sioux City Street Railway Co. have received three new double motor cars. They were purchased some time since, and the motors are of the Thomson-Houston pattern.

Springfield, Mass,—The Street Railway company have recently received the last of the six motor snow plows built for them by the Ellis Car Co. of Amesbury, and are now prepared for any emergency. The plows weigh nine tons, and are nineteen and a half feet in length.

Springfield, Mo.—The annual report of the Metropolitan Electric Street Railway filed for record in the office of the county recorder, shows that the resources of the corporation exceed $1,000,000.

Steelton, Pa.—The Steelton, Highspire & Middletown Electric Passenger Railway Co. have nearly finished their new line. The company propose to have the new line completed to Highspire, and cars running between this place and Highspire by February. They have

made a contract with the East Harrisburgh Passenger Railway Co. to furnish the power until their new electric plant is completed. The electric plant will be erected east of Highspire.

Stockton, Cal.—The Stockton Street Railroad Co. have sold their rolling stock, motive power, franchise and the outside property known as Goodwater Grove to a company of Stockton capitalists, who have assumed control. It is understood that the consideration for the transfer was $55,000. The general plans of the new company have been outlined. The road is to be rebuilt and extended as an electric road.

Tacoma, Wash.—The Tacoma Railway & Motor Co. were notified last month that their franchise would be forfeited unless cars were put on K Street south of Eleventh. The notice did not have the desired effect on the company, and in view of the fact an ordinance was introduced in the Council revoking the franchise on K Street south of Eleventh.

Toledo, O.—A fire, January 19, destroyed the car house of the Toledo Electric Street Railway Co. on Canton Avenue, and between twenty-five and thirty electric motor cars. The loss on the building and cars will reach at least $100,000, with an insurance of about 80,000. This is described more fully in another column.

ARTICLES of agreement were signed January 19 between the Robison Electric Railway Co. and the Consolidated, whereby they dismiss all wire suits and join in the construction of all overhead material. The two companies will connect so that both roads can use the same wires jointly, one party feeding one curve and *vice versa*.

Topeka, Kan.—It is said that unless some deals now in progress materialize within the next six months the Rapid Transit system will be sold under the hammer in June next. The road has been in the hands of Receiver J. M. Patten for several months and foreclosure proceedings have been brought by the Metropolitan Trust Co., of New York.

Toronto, Ont.—Since the new company took over the railway, several changes have been made in the routes. A belt line has been put in operation around the central portion of the city, embracing King, Sherbourne, Spadina and Bloor Streets, and it has given good satisfaction and been well patronized. The King Street cars run from Lee Avenue through to Dufferin Street, a distance of seven miles, and several of the uptown lines have been tied together, so that passengers can get from the extreme east to the extreme west end of the city without transfer. In this way a better service has been effected with a good saving in horse flesh. Single fares are five cents, six tickets for twenty-five cents, twenty-five tickets for $1.00; school tickets good from 8 A. M. to 5 P. M., except on Saturdays, ten for twenty-five cents; another class of tickets, good from 5:30 to 8 A. M. and from 5 to 6:30 P. M., eight for twenty-five cents. In addition to this, free transfers are given to any part of the city, and the company are now transferring from 10,000 to 12,000 people daily, but notwithstanding all these things the earnings for the month of December were $14,514.10 in excess of the same month the year previous. The total car miles for the same month was 409,586 and the average daily mileage per horse, as per the horse ledger was 16.2; for those in good condition 17.7. After an extensive tour through the States, the city engineer, Mr. Granville C. Cunningham, presented a report to the City Council early in December, recommending the adoption of the trolley system, but the Council has not yet endorsed this recommendation. It is proposed to convert about twenty-seven miles to electric this season.

Trenton, N. J.—In the Supreme Court Justice Reed filed an opinion in the Newark and Trenton Electric Railway cases, in which property owners along the lines of the proposed roads seek to prevent the erecting of poles and wires, and the operation of the overhead trolley system. In the Newark Case, where the authority of Common Council was given by resolution, Judge Reed holds that an ordinance is necessary. In Trenton the ordinance was set aside on the ground that the law authorizing municipal authorities to grant privileges to railway companies, does not legalize the erection of poles and the stretching of wires in a public street.

Uniontown, Pa.—In the early morning of January 12, the power house of the electric street railway was destroyed and three cars were burned. The loss on building and contents is estimated at from $25,000 to $30,000, on which there is no insurance.

THE contract for rebuilding the electric plant destroyed, has been let to the Edison General Electric Co., and is to be finished in March. Five cars will be put on in place of three as heretofore.

Vancouver, B. C.—The National Electric Tramway & Lighting Co. expected to have their cars running on the Pandora Street extension before the end of last month. Only one car will be put on the line at present.

MESSRS. C. LEONARD & SONS write to say that the Ball compound engines in the New Westminster Street Railway plant are developing far beyond the guarantced horse power. They have been running steadily for the past three months, eighteen hours per day.

A SYNDICATE of the shareholders of the Vancouver Electric Light & Street Railway Co. has offered to lease the whole plant from the corporation for a period of ten years from the date of purchase, at a yearly rental of four and a half per cent. on the amount paid by the corporation for such a plant, the corporation making all required extensions, getting same rate on their cost, the lessees undertaking to keep the whole plant in working order.

IT has been decided that the city shall purchase the plant, etc., of the Vanconver Electric Light & Tramway Co. A telegram was sent to Hanson Bros., Montreal, in connection with the financial part of the arrangement.

Washington, D. C.—The Glen Echo Electric Road is to be put into first class condition, so that the Chautauqua of 1892 will have better accommodations and better facilities than it did last year.

THE Anacostia & Potomac River Railroad Co. have made their annual report to Congress. The report shows that the traffic for the year amounted to $45,090.44, the road having carried 1,097,730 passengers. The total receipts for the year were $182,679.40, The total expenditures were $179,397.95.

THE annual meeting of the stockholders of the Washington & Georgetown Railroad Co. was held January 15. President Hurt, in his annual report, said the work of track construction was begun on May 11, and all the tracks are now completed with the exception of the terminals and a short spur. The company have made contracts for 250 cars, seventy grip cars, sixty coaches and 120 open cars, at a cost of $204,865, and are putting in power for 400 cars and will have house room for 600.

IN the case of the National Bank of the Republic of New York against the Judson Pneumatic Railroad Co., a decree was recently signed for the sale of defendant's patent rights.

Wellsville, O.—The electric line owned by Mr. A. L. Johnson and recently put in operation, has been most successful. The cars are not expected to carry over twenty-five people but have frequently been obliged to transport 150 passengers, while an average load at some portions of the day is as much as 100 persons. The receipts are said to be $1,000 per week.

West Superior, Wis.—The electric railway company want to cross the tracks of the Northern Pacific and the Great Northern roads, and the latter will not consent. Several collisions have occurred in consequence, and some arrests have been made.

Westbrook, Me.—At a special meeting of the Westbrook City Council it was ordained that permission be granted to the Portland Railroad Co. to locate their tracks and run their cars by electric power in the City of Westbrook.

Williamsport, Pa.—The Williamsport Electric Street Railway Co. have received two new cars from the Lamokin Car Works, which will be added at once to those already in use on the Third and Fourth Street lines. The new addition will increase the company's facilities to a considerable extent.

Wilmington, Del.—The Wilmington City Railway Co. have received an electric sweeper from the Lewis & Fowler Manufacturing Co. of Brooklyn, N. Y. The sweeper is of the kind already described in this paper.

THE new Fourth Street line is completed, and as soon as Maryland Avenue is brought to grade and the proposed sewer is laid, the road will be extended along Maryland Avenue to a point near the toll gate.

Winona, Minn.—The Street Railway Co. have closed negotiations with the Indurated Fibre Works to furnish the power for the operation of their street railway. The generator is now put in place and the road is in operation.

Youngstown, O.—Judge Phillips recently handed down an opinion to the effect that a street railway company is not liable for injuries or damages sustained in runaways caused by horses taking fright at street cars running through streets over which they have secured rights of way.

IN compliance with a provision of the by-law granting them a franchise for an electric street railway, Messrs. Ross and McKensie have paid to the City treasurer $10,000, which is the security bond for the proper fulfilment of the contract.

Extensions and Improvements.

Albany, N. Y.—The Albany Railway Co. have received ten new cars, one of which is a special car for the use of the directors.

Altoona, Pa.—At the annual meeting of the stockholders of the City Passenger Railway Co., lately, it was decided to put several additional cars on the main line and an additional one on the Broad Street extension. It is expected to have these additional cars running by February 1.

THE City Passenger Railway stockholders held their annual meeting at the Logan House last month. It was decided to put additional cars on the main line and also on the Broad Avenue extension.

Anniston, Ala.—The franchise of the Anniston City Street Railway, now operated with mules, has been transferred to the Anniston Electric Railway Co., and sufficient bonds have been placed to equip and operate the line, which is seven miles long, with electricity. This will give Anniston two electric lines, aggregating sixteen miles.

Aurora, Ill.—The electric street railway will probably be extended to Geneva in the spring.

Baltimore, Md.—The directors of the City Passenger Railway Co. have adopted plans for a power house for the new cable system.

Beatrice, Neb.—The Beatrice Rapid Transit & Power Co. will at once extend their electric road to all parts of the city. They have completed arrangements for an extensive electric light plant sufficient to supply the needs of the entire city.

Boston, Mass.—Failing to secure the co-operation of the Board of Aldermen in the matter of the best type of fenders to select for electric cars, President Whitney has selected a commission and requested them to experiment and investigate in regard to the matter,

Its members are Mr. W. B. Clark, the engineer of the West End. Prof. George F. Swaine of the school of technology and bridge engineer of the railroad commission, and Mr. C. E. A. Barrett, treasurer of the Boston & Lowell road. The committee have advertised for proposals from companies supplying fenders, and their report is expected about Feb. 1.

Bowling Green, Ky.—The Park City Railway Co. expect to make an extension of their line in the spring.

Bridgeport, Conn.—The Board of Trade have passed resolutions recommending the adoption of electric power on the street railway here.

Brigham City, Utah.—There is a prospect that the motor line running from Ogden City limits will be extended to this place.

Bristol, Tenn.—The Bristol Street Railway Co. have been granted privilege to lay an extension on Ninth Street.

Brockton, Mass.—In a short time every street car in Brockton will be run by electricity. This is one of the results of the recent consolidation of the two local lines of street railway, one of which has been operated by electricity since it was built, while the other has horses for motive power. The total number of miles to be equipped by electricity will be about fifteen, connecting Brockton with Whitman, Randolph and Avon. The syndicate controlling the consolidated roads intends next spring to extend the system to Holbrook, Easton and Stoughton.

Brunswick, Ga.—Rumors of a deal between the Northern capitalists and owners of the Brunswick Street Railroad for the purchase of the railroad property are general. Col. W. E. Kay stated that if the deal was consummated the electric power would be adopted.

Buffalo, N. Y.—To relieve the Niagara South line the street railway company propose to build a line on Prospect Avenue. When the Crosstown company purchased their franchise from the city there was included the right to lay a track on Prospect Avenue from Huron Street to Pennsylvania, then to Fargo Avenue and then to Vermont Street. But the consents of the property owners were requisite and were not given. The street railway managers have, therefore, made application to the general term of the Supreme Court for the appointment of three commissioners to determine whether the road ought to be constructed in spite of the remonstrances of the property owners.

Butte, Mont.—A new cable has been ordered for the Walkerville cable line which will cost $4,500 laid down. It is three miles long. One of the new electric heaters has arrived and has been put in car No. 4. If it is a success the other cars will be provided with them.

Chicago, Ill.—According to President Goddard of the South Side Alley L road, a majority of the frontages has been secured in the alley between Prairie and Calumet Avenues as far as Sixty-third Street and Stoney Island Avenue, and there is now no obstacle in the way of the speedy completion of the road. More than half the issue of bonds to the par value of $7,500,000 has been placed. The Baldwin Locomotive Works are building the engines, while a New York house has the contract for the cars. There will be no downtown loop at Harrison Street, but the terminus will be at Congress Street, with a system of stub tracks. Thirty-ninth Street will be arranged with a similar system.

THE West Chicago Street Railway Co, have bought the northwest corner of Twelfth Street and Ogden Avenue for $35,000. It is probable that this will be the site for a power house, as it is likely that Ogden Avenue will be cabled soon.

THE officers of the West Side Transit Co. state that Chicago will soon have twelve miles of elevated road on Ogden Avenue. This company propose to use the Boynton bicycle system. Petitions for frontages on Ogden Avenue from the city limits to Union Park and thence to Randolph Street are circulating. Nothing definite is yet stated in regard to a downtown terminus. The statement is made that a market has been found for the bonds which will yield the company cash sufficient to press the work rapidly forward.

Cleveland, O.—The Columbus Consolidated Railway Co. have been granted permission to extend on Fourth Street.

Clinton, Mass.—The North End Street Railway Co., of Worcester, have asked the selectmen of that place for permission to operate a road in this place.

Columbia, S. C.—The electric light and street railway companies here have consolidated with a capital of $150,000. A large power house will probably be constructed soon.

Duluth, Minn.—The street railway company will probably, during the coming season, extend their East Fourth Street line from Sixth Avenue, a distance of eleven blocks, to a connection with the incline. Nearly three-quarters of a mile will also be added to the line at its northern end, the Motor company guaranteeing the street railway company against any loss in operation. A mile or two of line will also be built at the head of the incline. The 500 H. P. at the electric power house will be trebled, the company being in the market now for a 1,000 H. P. engine, which will probably be built either by the Iron Bay Works, the Marinette company or the E. P. Allis company. Considerable new track may also be laid.

Fall River, Mass.—The transfer of the Globe Street Railway to a syndicate which proposes to operate an electric road, has been completed. Among the representatives present were Messrs. A. G. Yates and J. N. Beckley, of Rochester, and Thomas Murray, of New York. The new owners announced that steps were being rapidly taken to change to an electric road, and they promised that electric cars would be running on the road by the middle of July or the first of August.

Galesburg, Ill.—The College City Street Railway Co. are considering a change from horse to electric power, and are investigating different motors with a view to purchasing. They have six miles of track, and report that they have just finished the best year in their history, and that their patronage is increasing every day.

Denver, Colo.—The Tramway company will probably extend in the Spring to Elyria. It has also been reported that this company will extent the use of electric power over all of their lines and build a large station on Gilpin street.

IN order to afford an entrance to the Santa Fe railway into this city it is rumored that the tracks of the Lakewood & Golden Electric Railway Co. will be used. If this is done an electric locomotive will have to be employed to draw the trains within the city limits as the Golden franchise does not permit the use of steam.

Detroit, Mich.—The directors of the Detroit Citizens' Street Railway Co. filed a proposition with the aldermen January 5, stating their willingness to install an electric system just so soon as satisfactory assurances should be received from the city that the property rights of the street railway company would be respected and that their proposed investment would be reasonably secure from hostile legislation.

Gloversville, N. Y.—It is reported that the Johnstown, Gloversville & Kingsboro Horse Railroad Co. will substitute electricity for horses.

Hamilton, Ont.—The Hamilton Street Railway Co. will shortly apply to the City Council for an extension of their franchise on the understanding that electric cars will be introduced promptly, and that the city shall receive forthwith a certain mileage rental for the use of the tracks as well as a portion of the earnings.

Houston, Tex.—The Houston City Street Railway Co. propose the laying of twelve or fourteen miles of new track, the rails to be forty-five pounds to the yard. The roadbed is also being considerably strengthened in many places and the capacity of the generating machinery in the power house will be doubled.

Jersey City, N. J.—The directors of the Jersey City & Bergen Railroad have adopted plans to equip all the company's lines with electricity. The Thomson-Houston system has been adopted. It is calculated that the cost to change the road will be $150,000, for which bonds will be issued. The committee to select the site for the new power Station have chosen the old ball ground on Grand Street. The electrical and other machinery has been ordered, and it is believed that the work can be finished in three or four months.

Lancaster, Pa.—The electric railway company propose the establishment of a number of belt lines. That which will be built first is said to be on East King and Chestnut Streets.

Lowell, Mass.—The Lowell & Suburban Street Railway Co. propose to have in Middlesex Village one of the best equipped electric power buildings in the country. It is 180 ft. long and 130 ft. wide. A plant to generate 1,500 H. P. will be installed.

Macon, Ga.—At the present Macon Street car system is supplied with power by the Gas Light & Water Co. As the power is insufficient, the street car company may install a plant of their own.

New Castle, Pa.—The New Castle Electric Street Railway will probably be extended to reach the large tract of land purchased recently by M. S. Marquis.

New Orleans, La.—The mayor last month placed his official signature to the ordinance granting to the New Orleans & Carrollton Railroad Co. the right to use electricity as a motive power for the propulsion of their cars.

Newark, N. J.—The Newark Passenger Railway, it is said contemplate restoring the electric system on their Bloomfield division at an early date.

Newark, O.—The Newark City Railway Co. have been granted permission to operate an electric line on Granville Street.

W. C. CHRISTIAN, secretary of the Newark & Granville Electric Railway in his annual report recommended the purchase of three open trailers, one closed car, and another 125 H. P. dynamo.

Norwich, Conn.—The Norwich Street Railway Co. have been empowered to use electric power under certain conditions which have been agreed to by them.

Oakland, Cal.—The Piedmont Consolidated Cable Co. have been granted a franchise to construct a street railroad on Piedmont Avenue from the city line to Mountain View Cemetery. The franchise gives them the right to put in either a cable or an electric road.

THE Oakland Railroad Co. have petitioned the Board of Supervisors for permission to substitute electric power for horses and steam motors in operating their cars along Telegraph and Humboldt Avenues in Oakland township.

Olympia, Wash.—The Olympia Light & Power Co. have successfully negotiated a loan of $250,000 in the East, and will now commence the construction of an electric line on Main and Fourth Streets, and will extend their line to Tumwater if sufficient inducements are offered.

Omaha, Neb.—The directors of the Omaha Street Railway Co. at their last annual meeting authorized the general manager of the road to expend as much as $200,000 if the demands of the public required it in giving the people a better service, No definite plans were decided upon, as it was considered too early in the season to map out the work to be executed,

Ottawa, Ont.—The Electric Railway Co. of this city follow up their recent acquisition of the old horse car company, by a notice of their intention to apply to Parliament for permission to extend the line across the Suspension bridge to Hull and to use electricity.

Philadelphia, Pa.—The Philadelphia Traction Co. propose trying a Pullman double decker on Market Street. If it is a success a large number of these cars will probably be ordered.

THE Traction company, it is reported, in the coming spring will probably avail themselves of the right already granted to erect the trolley wires on Woodland Avenue, Market Street, and in other parts of West Philadelphia, as well as out Germantown Avenue to Chestnut Hill if they acquire the franchise of the People's company.

THE Traction company recently declared that they proposed to give Philadelphia the finest system of street railway service in the country, and as a preliminary to proposed changes have had Thomas C. Nash, of Chicago, a cable expert, in the city for several weeks, making a thorough examination of the present cable system of the company.

Pittsburgh, Pa.—Two through electric roads from Pittsburgh to McKeesport are said to be probable. Both the Pittsburgh & Birmingham and the Second Avenue Traction companies are going to run lines to Homestead and it is reported that both contemplate extending to McKeesport.

TWENTY small cars of the Pittsburgh & Birmingham Traction Co. are being fitted up in their car shops. The cars are sixteen feet long and being very light, will make better time on the road. When they are all turned out the company will have fifty electric cars altogether. They are being equipped with the Short motor.

AT a recent meeting of the directors of the West End Passenger Railway Co. it was decided to adopt electricity as a motive powerr Right of way will be granted over the Point Bridge, and electric cars will probably be running by July.

THE Suburban Rapid Transit Co. are contemplating extensive improvements. It was stated at the recent annual meeting, to the stockholders, that the bonds of the company have been sold, and the contract for putting the tracks in first-class condition has been let to the Johnson Co., of Johnstown.

THE Mt. Oliver inclined plane was closed January 10 for six weeks. Extensive improvements will be made.

Portland, Me.—The Westbrook City Council has been considering an ordinance permitting the Portland Railroad Co. to lay tracks on certain streets in the city.

Richmond, Va.—The Richmond & Manchester Railway & Improvement Co. have asked for an additional franchise on Hull Street.

Roanoke, Va.—The partly completed line of the Crystal Spring Railway Co. will probably be finished this spring.

Rockford, Ill.—The West End Street Railway Co. have increased their capital stock to $75,000 and will extend their road over the Winnebago Street viaduct, in Walnut Street and in other directions.

Rome, Ga.—The sale and transfer of the Rome street railway to Washington (D. C.) capitalists has finally been consummated, and it will be converted into an electric line.

St. Louis, Mo.—There is before the Council a bill authorizing the Cass Avenue & Fair Grounds Railway to absorb the Northern Central and Union Railways, all to be run by electricity, whereupon the Railroad Committee have had a disagreement as to what shall be paid into the City Treasury in consideration for the franchise. It is possible that two reports will be made to the Council, one recommending a payment of one per cent. of gross earnings for each six months down to January 1, 1900, one and a half per cent. to 1910, two per cent. to 1920 and two and a half per cent. to 1930. Another, a larger percentage of the gross earnings, the increase being about one per cent. on each decade.

Sacramento, Cal.—J. H. Henry of the Central Street Railway Co., has asked for a franchise to build a road on P Street.

San Franciso, Cal.—The North Beach & Mission Co. will soon begin the work of constructing an electric line on Folsom Street.

GOOD progress is being made in extending the Union Street cable line westerly from Steiner Street to Baker. Excavations have been made, and several blocks are ready to receive yokes and cementing. Within a few months the steam dummies will cease to run out Point Lobos Avenue, and the Geary Street cable extension will have been completed. The company have selected a site for the engine and car house at First and Point Lobos Avenues.

Salt Lake City, Utah.—The West Side Rapid Transit Co. have a petition before the County Court asking for an extension of their franchise to the shore of Salt Lake, the intention being to strike the beach about a mile this side of Garfield, and the purpose being to put on a complete and ample electric plant to carry on a perfect service.

Saratoga Springs, N. Y.—The Union Electric Railway will be extended at the village terminus to the Grand Union Hotel on Broadway. From this point a new line will be built to the race track and Saratoga Lake. It is said $200,000 will be expended. The railway is now owned by a new company composed of residents of Albany, the officers of which are Charles E. Arnold, president; Edward J. Slattery, treasurer; Myer Nussbaum, secretary.

Scottdale, Pa.—The Citizens' Street Railway Co. have decided to build the road between here and Bradford at a cost of $50,000,

Spokane, Wash.—The Spokane Street Railway Co. have purchased the franchise and tracks of the City Park Transit Co. on East Sprague Street from Division Street east to the east city limits and will soon commence some extensions in this portion of the city and lay double tracks.

Springfield, Mass.—A big petition has been presented to the Springfield Street Railway Co. to continue their line from its present terminus near the Springfield hospital into Chicopee Centre to meet the regular line on Front Street and form a direct line to the Falls. The majority of the directors of the railroad company are said to favor the idea.

THE directors are also considering the advisability of raising their car house on Bond Street in order that it may be used for storing electric cars. The building is of brick, three stories high. Two or three new cars are also to be added to the Maple Street and other lines.

Terre Haute, Ind.—The street railway company have petitioned for right of way to extend their line on Thirteenth Street.

Toledo, O.—An ordinance has been passed granting the Consolidated Street Railway Co. the right of way for a single track extension on Central Avenue from Cherry Street to the westerly city limits. The line must be in operation by September 1.

Washington, D. C.—Mr. Sawyer, in the Senate, has introduced a bill providing for the extension of the line of the Columbian Railway.

Wheeling, W. Va.—New friction clutches, a new generator and new engine will be added to the power station of the electric railway here.

Wilmington, N. C.—The street railway here has been purchased by a Northern syndicate who will put in an electric plant. John H. Barnard formerly connected with the Edison General Electric Co. is interested in the new organization.

Zanesville, O.—The street railway company propose to make a number of extensions in the spring.

New Roads.

Alexandria, Va.—The City Council on January 12, voted to extend ninety days, the date at which the Alexandria & Fairfax Passenger Railway Co. are obliged by ordinance to commence the building of their railway.

Atlanta, Ga.—The Georgia Electric Light Co. have been granted the right to build an electric railway.

Anoka, Minn.—There is talk of connecting this place with Minneapolis by a motor line. The distance is fifteen miles.

Aurora, Ill.—An electric railway company known as the Aurora & Chicago Inter-Urban Railway Co. have been incorporated, with a capital stock of $1,000,000. The first board of directors are: Wm. M. Van Northwick, Batavia; Henry H. Evans, Aurora; Wm. J. Manning, Warrenville; W. B. Miller, Aurora; J. W. Eddy, Aurora; John Meredith, Aurora; John J. Luck, Aurora. The railway will run from Aurora to Chicago, by way of Warrenville, with branches to Batavia and other points, and will connect with the Northern Pacific entering the city over their lines.

Austin, Tex.—John W. Hoyt and others have asked for right of way for a dummy line connecting Austin with South Austin.

Beaver, Pa.—It is rumored that New Brighton capitalists are contemplating building an electric road from New Brighton to Rochester.

Canisteo, N. Y.—A company with $20,000 capital is being organized to build an electric street railroad. The name of the company is the Canisteo Valley Electric Railway Co.

Cape May.—Arrangements have practically been completed for the construction of an electric railway along the beach front, extending a distance of seven miles. The right of way in the city has been requested. The road will cost between $150,000 and $200,000, and will be controlled by Philadelphia and New York capitalists. It is expected that work will be begun about February 15. J. Henry Edmunds is interested.

Chambersburgh, Pa.—An application for right of way for an electric railway has been presented by Alfred E. Hay, of Philadelphia, to the City Council. Mr. Hay has agreed, if the franchise be granted in time and the ground be in condition, to begin work by April 1 and complete the road by May 15.

Chicago, Ill.—Members of the Seventy-fifth Street Improvement Club are endeavoring to secure the construction of a street railway line on Seventy-fifth Street and are raising a bonus with that object in view.

AN ordinance has been presented to the City Council, and favorably referred, for an elevated railroad over Sixty-seventh Street. It was accompanied by a petition signed by a majority of the property owners. The line is to begin at Stony Island Avenue and Sixty-seventh Street running west in Sixty-seventh to the west line of State Street, and the company will extend their lines westward, northward and southward as fast as practicable. Two miles of the road are to be constructed before May, 1893, and a guarantee deposit of $25,000 is provided for.

BY a vote of forty-one to eighteen the City Council have passed the Calumet Electric Railway ordinance. It is one of the most extensive franchises ever granted by the City Council. Miles of territory are covered by the franchise, and it brings into close connection the suburban towns of Pullman, Grand Crossing and South Chicago. The Cottage Grove Avenue, Michigan Avenue, Madison Avenue and South

Chicago Avenue lines are to be completed and in operation one year from date. Two years are given for the building and operating of the remaining tracks. Single tracks are all the franchise calls for. The usual provisions for the protection of the city are embodied, and the company are directed to file a $25,000 bond with the city comptroller.

Columbus, Miss.—The Columbus Street Railway & Power Co. have let the contract to grade and equip their street railway, work to commence February 1, 1892. N. M. Brandon of Meridian, Miss., will have immediate charge of the construction. The line will be used for both freight and passenger traffic.

Connellsville, Pa.—The Connellsville Electric Railway Co. have been organized. Capital $100,000.

Creston, Ia.—Articles of incorporation have been filed by the Creston Street Railway Co. The capital is $50,000. The work on the city's first line of street railroad will commence in the spring.

Fort Howard, Wis.—An ordinance has been introduced before the Council to grant a franchise to Charles H. Holmes and L. G. McNair to build a street railway in this city. The road will commence at the intersection of Broadway and Dousman Street, and run east across the lower bridge to Green Bay; also from same intersection of streets to run south on Broadway to intersection of Third Avenue and Second Street, thence east on Second Street to and across the south side bridge to Green Bay.

Fort Worth, Tex.—The Fort Worth & Dallas Rapid Transit Co. have been organized. The incorporators include several New York capitalists as well as the following residents of Fort Worth: A. M. Carter, L. D. Hall, Max Elser, L. J. Boaz. The charter provides for the construction of a standard gauge, sixty pound steel rail tracked railroad between the cities of Fort Worth and Dallas, a distance of about thirty-two miles. Electricity may be used.

Fredericksburg, Va.—The Chamber of Commerce is mooting the subject of a street railway here and have appointed a committee to report on the subject. H. von Schon is interested.

Galion, O.—The Suburban Electric Railway Co. have made application to the Common Council for permission to construct and operate a street railway on Main and South Market Streets. The franchise is asked for twenty years.

Green Bay, Wis.—Two applications for electric street railway franchises were presented to the Green Bay City Council last month by C. H. Higgins, who owns the street railway, gas works and electric light plant at Marinette, and by Holmes and McNair, of St. Louis.

Hamilton, Ont.—The Hamilton, Beamville & Grimsby Electric Railway Co. have applied to the townships of Barton, Saltfleet and Grimsby for the privilege of running on the stone road. If this is granted, and the County Council shows itself favorable to the scheme, the line will be commenced in the spring.

Harrisburgh, Pa.—The Citizen's Electric Passenger Railway Co. being organized, have sent in a special request to the Borough Council asking permission to put down tracks on Chambers, Second Pine and Harrisburgh Streets, in the borough. Outside the borough the tracks will be laid on Harrisburgh, Berryhill, Cameron, Paxton, Market and other streets. The capital stock of the company will be $125,000. The residents of Oberlin alone have taken $20,000 worth of stock, which will nearly construct that part of the new line.

Hornellsville, N. Y.—The Hornellsville Electric Street Railway Co., Francis G. Babcock, president; capital $50,000, has been organized.

Janesville, Wis.—Everything has been satisfactorily arranged for the building of the new electric street car line. Haines Bros. have filed a bond of $2,000 as a guarantee that the road will be in operation on or before July 1, 1892.

Jersey City, N. J.—The proposed plan for connecting Newark with this city by means of an electric railway is being rapidly put into operation. The Plank Road Co. of Jersey City, of which C. B. Thurston is president, are undertaking the construction of the line as far as their property extends. When they have completed the road to the city lines of Newark and Jersey City they will form an alliance with the Newark Passenger Co. on one end and with the Jersey City & Bergen Railroad Co. on the other end. The negotiations have been so far completed, it is reported, as to render it absolutely certain that the Plank road line will become part of the system of the Newark Passenger Co. The overhead system will be used throughout. The Pennsylvania Railroad Co. it is reported, will make the electric road act as a relief for their regular line, and when the electric railway is completed cease running trains through Newark, and will only use the tracks through the city for local trains. The through trains will be run on the short line across the meadows by means of the new branch known as the Passaic & Waverly Railroad.

Kankakee, Ill.—Kankakee, Waldron & Momence Street Railway Co. have been incorporated with a capital stock of $175,000, by W. R. Hunter, W. W. Hatch and John Lanfesty.

Kansas City, Mo.—Mr. J. L. Brown of the Eureka Transportation Co. is authority for the statement that the Citizens' Electric Railway Co., recently organized, will build a road over the old Thayer-Enright franchise, connecting Kansas City and Riverside. The road will be built in the coming spring.

Kingston, Can.—B. W. Folger states that if an electric street railway would not cost more than $75,000 he will have one in the city next year.

Lancaster, Pa.—A charter has been granted to the Lancaster & New Holland Electric Railway Co. The capital stock of the company is $300,000 and the directors are: C. A. Fon Dersmith, president; B. Frank Eshleman, John Hertzler, J. P. Shirk, David Bair Shenk and Thomas C. Wiley. It is the intention of the company to commence operations on the road at as early a date as possible, in order to have the road in running order by next summer. The route will be along the Lancaster and New Holland turnpike, and the length of the proposed road will be thirteen miles.

Little Rock, Ark.—The petition of the Little Rock & Argenta Street Railway Co. for franchises on a number of streets has been granted.

Macon, Ga.—The route of the proposed Macon & Indian Springs Electrical Railroad is being surveyed, T. J. Carling is interested in the road.

Massillon, O.—The franchise for the proposed electric road has not yet been awarded by the City Council, but will probably be given out before February 1. According to the conditions advertised, each bid for the franchise must be accompanied by a bond in the sum of $5,000, conditioned that if the bid is accepted the said street railroad will be in operation on or before July 1, 1892.

New Holland, Pa.—Arrangements are about being made for an electric road from Joanna station on the W. & N. R. R. to Morgantown, thence to Goodville and New Holland in Lancaster County. Should the road end at New Holland the distance will be about fifteen or twenty miles. President H. A. Dupont of the W. & N. R. R. is interested.

New Orleans, La.—On March 28, 1892, the city will sell at auction to the highest responsible bidder, the right of way for twenty-five years for street railway purposes over a number of streets including Canal, Carondelet, Clio, Constance, Camp, Henry Clay, Coliseum, Laurel and Louisiana Avenue, including right of way over part of the tracks of the Canal & Claiborne and Crescent City street railway companies.

Newton, Mass.—The petition of the Newton & Boston Street Railway Co. for a location on Walnut and Homer Streets to Newton Centre has been granted by the Board of Aldermen. The cars must be in operation within nine months. The overhead system is to be used.

Norfolk, Va.—The Rapid Transit Co. of Norfolk and the Port Norfolk Street Railway Co. have recently been incorporated. S. M. Cooper, of Cincinnati, O., is president of the latter company, and M. W. Mason is secretary.

Norwalk, O.—Esbon Blackmar of Toledo has accepted the conditions proposed by the Common Council of Norwalk, governing an electric street railway franchise, and the road will probably soon be built. The franchise provides for the commencement of work within six months and its completion within two years.

Olympia, Wash.—The Everett Street Railway Co., with a capital of $50,000, have been organized.

Ottawa, Ill.—Articles of incorporation have been issued to the Ottawa, Starved Rock & Western Electric Railway & Power Co. The principal stockholders are: Ferdinand Walther, Harris W. Huell, Chicago, W. L. Phillips, Chas. F. Wilson and Charles S. Cullen, Ottawa. The capital stock is $150,000. The railway will run west on Madison Street to the Egan farm and Starved Rock. A branch will be run over to Twin Bluffs and another to Utica.

Paris, Tex.—The Paris Electric Light & Railway Co., with a capital of $800,000, have been incorporated. J. J. Walsh, S. J. Wright and John Martin are interested.

Peterboro, Ont.—The Town Council has passed a by-law granting the franchise of the streets of Peterboro for twenty years for an electric street railway to the Edison syndicate, composed of John Kreusi, H. M. Francis, John Langton and M. D. Barr.

THE Edison Electric Co. have secured a franchise for an electric railway here.

Philadelphia, Pa.—The Board of Surveyors last month approved an ordinance authorizing the Holmesburg, Tacony & Frankford Electric Railway Co. to lay tracks in the Twenty-third and Thirty-fifth Wards. No cars are to be run by overhead wires unless specific provision be granted. The laying of tracks is to be commenced within one year and completed within two years. The incorporators are William Miller, H. A. Mullen, Percival E. Bell, David Martin and John K. Andre.

Pittsburgh, Pa.—The Grandview Traction Co. have been organized with a capital of $15,000. The directors are: W. B. Lufton, Charles H. Humbert, J. A. McCormick, Samuel McCombe and Thomas S. Kerr, of Pittsburgh.

Poland, O.—The construction of an electric line from Youngstown to this place is under consideration. The building of the line is said to be probable.

Port Huron, Mich.—A local syndicate have stated the terms on which they will agree to construct an electric railway line from the end of the existing Fort Gratiot line to the depot at the new tunnel. The proposed route is along Griswold Street, from the corner of Military and down Tenth and Bancroft.

Raleigh, N. C.—The Street Railway Co. will build a line to the new depot which will be opened about April 1.

St. Louis, Mo.—The St. Louis & Kirkwood Rapid Transit Co. have a franchise for an electric railway between St. Louis, Benton and Kirkwood by way of Webster Groves upon certain conditions which include one that the company will commence the construction within two years from date of receiving the franchise, complete and run cars

upon one track within three years and lay a double track within ten years.

San Francisco, Cal.—Articles of incorporation have been filed for a new company to construct the second section of the San Francisco & San Mateo electric railway from Baden to Redwood City. The railway company of which Behrend Joost is president and J. W. Hartzell is secretary and general manager have the franchise over the entire line, but the new corporation which is now being organized will attend to the work of construction. It will be a sort of offshot, however, of the main company. General Manager Hartzell says that by February 15 cars will be running from the city terminus of the road at Market and Steuart Streets to Holy Cross Cemetery.

Shelbyville, Ind.—George M. Ray has filed articles of incorporation of the Shelbyville Electric Street Railway Co. The capital stock is placed at $100,000, and the line will be six to seven miles long. It is to be completed by August 1.

Sioux City, Ia.—Work has been begun on the electric road of the Sioux City & Leeds Electric Railway Co.

Steelton, Pa.—Another street railway company are asking permission to occupy the streets of this borough. The Citizens' Passenger Railway Co. propose to lay track on Second, Pine, Harrisburgh and other streets. It is claimed that over $20,000 has already been subscribed.

Stockton, Cal.—The articles of incorporation of the Stockton Electric Railway Co. were filed last month by Hon. S. D. Woods, one of the directors of the new company. The officers are: I. S. Bostwick, president; Joseph Fyfe, vice-president and secretary; E. R. Hedges, treasurer. The capital stock is $500,000. The estimated length of the railroads for which franchises have been granted is eight miles.

Toledo, O.—It looks as if the long agitated scheme to build a street railway between this city and the villages of Perrysburg and Maumee would be accomplished soon. An ordinance has passed the Perrysburg Council giving a franchise to John W. Barton to build a street railroad on Front Street, Perrysburg. The cars are to be propelled by electricity, compressed air or any other power except horse power, The ordinance provides that the construction of the road shall be begun "on or before the first day of July, 1892, and the same be completed within two years from the date of the passage of this ordinance." The franchise is granted for twenty-five years from the passage of the ordinance.

Waltham, Mass.—Francis Buttrick, Thomas P. Smith and other local capitalists are considering the construction of a road from this city to Watertown.

Washington, D. C.—A bill has been introduced in the House to incorporate the Zoo Street Railway Co., with John Joy Edson, E. L. McClelland, A. A. Bigelow, Henry H. Smith and Lawrence Gardner as incorporators. The route is to be from Fifteenth and B Streets northwest, along several streets to the boundary of the "Zoo," and through the park to the principal animal house. The capital stock is to be $100,000 and may be increased to $300,000. The line is to be completed within one year after the approval of the act or the charter is to be forfeited.

THE Washington & Brookland Street Railway Co. seek incorporation. Among those interested are: Harry Barton, T. C. Daniel, Jere Johnson and Charles H. Stanley. A double track railway beginning at the corner of Pennsylvania Avenue and Sixth Street and extending to Brookland is proposed. In lieu of personal tax the company are required to pay a tax of four per cent. on their net earnings from all sources. The bill requires work on the construction of the road to begin within one year, and to be opened for traffic within two years from the passage of the act. The capital stock is not to exceed $1,000,000.

THE Washington, Fairfax & Alexandria Railroad have been incorporated, with M. B. Harlon, Frank Hume and N. Dumont among the incorporators.

INCORPORATION has also been asked for the Washington Northeastern Street Railway Co., with the following among the incorporators: G. P. Davis, L. C. Loomis and Ira J. Baker.

SENATOR STOCKBRIDGE has introduced a bill in the United States Senate, incorporating the Cross Town Railroad, of the District of Columbia. The bill names among the incorporators: H. D. Cooke, D.R. McKee, Harry L. Earle and C. P. Janney and provides that the motor power of the cars shall be any mechanical power but steam that may be approved by the District Commissioners. The railway is to be commenced within six months and be opened within two years of the passage of the act. The capital of this company shall not exceed $1,000,000.

IN the House a bill has been introduced by Representative Belmont, of Arkansas, incorporating the Washington & Bladensburg Street Railway Co., with John H. Oberley, Clif D. Maxwell and Robert L. Miller among incorporators. The motive power is to be electricity or any other system approved by the District Commissioners. The capital stock is not to be less than $200,000 nor more than $500,000, in shares of fifty dollars each.

Waterloo, Ia.—A proposition to connect Waterloo and Cedar Falls by electric cars is being agitated by D. B. Lyons and other Des Moines capitalists.

Wellsville, O.—A. L. Johnson, of Cleveland, proposes to construct an electric railway from this city to New Lisbon. The distance is fifteen miles.

Worcester, Mass.—Civil engineers engaged by the North End Street Railway Co. have begun preliminary surveys for the proposed electric railway between this city and Clinton. The route being surveyed is from the terminus of the present north end tracks, through West Boylston and East Clinton to Clinton.

Annual Report of Chicago Street Railways.

WEST CHICAGO STREET RAILROAD CO.

The annual meeting of the West Chicago Street Railroad Co. was held on January 12. In the annual report of President Charles T. Yerkes the following reference to the year's business was made:

"It is with pleasure that I review the business of the last year, showing, as it does, most satisfactory results. We have not only increased our receipts, but we have greatly increased our facilities for transacting business. While the percentage of operating expenses is still somewhat larger than it will, in all probability, be the coming year, yet we have the satisfaction of knowing that the money has been well spent in our endeavor to accommodate the public.

"The large increase in the number of cars, together with the increase of the mileage, shows that, notwithstanding the fact that there are still complaints, we have removed a great many causes. It is a fact that a street railway company can never entirely suit the people, but it can give such transportation facilities as will satisfy ordinary citizens. This, in my opinion, the West Chicago Street Railway does.

"The management has been experimenting quite extensively with motors and has given the subject a great deal of attention. We now think we have arrived at a point where we can say we are nearing the time when the proper motor will be obtained, such a one as we feel we can adopt. It is only a question of time when horse cars will be a thing of the past."

The annual report of the treasurer presented these figures:

		Increase.
Gross receipts	$4,169,200	$505,819
Operating expenses	2,468,179	265,411
Net receipts	$1,701,021	$240,408
Fixed charges, leased roads, interest, taxes	$832,341	$76,592
Balance applicable to dividends	$868,680	$163,816
Dividends paid	600,000	
Balance to surplus	$268,680	

The operating expenses were 59.20 per cent. of the gross receipts. The number of trips were 1,774,235; the number of miles run, 14,638,414; the number of passengers carried, 85,613,004. The number of passengers carried in 1890 was 75,152,694. Other details were as follows:

Gross receipts, horse railways	$2,464,759
Gross receipts, cable railway	1,704,441
Operating expenses, horse railroad	1,742,119
Operating expenses, cable railway	726,059
Miles run by horses	8,785,242
Miles run by cable	5,853,172
Number of horses on hand	5,709
Average number of miles per horse per day	12.98

The gross receipts showed an increase over 1890 of 13.81 per cent. The increase of 1890 over 1889 was almost exactly the same, being 13.82 per cent. The average number of cars was 614; maximum number passing through the tunnel per hour 171, the minimum 113; the maximum number passing over the bridges per hour 239, minimum 130. The increase in the cars has been about 25 per cent., while the increase in the passengers has been about 14 per cent.

The directors were elected as follows: Charles T. Yerkes, Norman D. Frazer, John B. Parsons, William L. Elkins, and R. C. Crawford.

NORTH CHICAGO RAILROAD CO.

The meeting of the North Chicago Railroad Co. was held on the same day. In the absence of President Yerkes, his annual report was read by Vice-President Furbeck.

The report showed that the road last year carried 44,345,905 passengers. The operating expenses have increased, owing to the fact that many more cars have been put on the road. The year's operations resulted as follows:

Gross earnings	$2,217,440
Operating expenses	1,221,408
Net	$996,332

The operating expenses were 55 per cent. of the gross earnings, which are said to be the lowest average of any year. Operating expenses in 1890 were 55.9. The average number of passengers to every mile a car traveled was 5.71, which is much less than when the road was running horse cars. Then the average was about seven passengers to a car each mile, showing that passengers are not crowded as much now as when horse cars were run.

Fifty new cars and 250 new horses had been added to the equipment, and a new paint shop had been constructed at a cost of $50,000.

The report entered into the system of life insurance for the employes. Sick men received one-third of their wages when off duty. Two hundred and forty had received such benefit during the year, and the amount so expended was $9,141.

The profits for the year were equal to 12¼ per cent., as follows:

Profits	$ 613,450
Balance carried to income January 1, 1891	416,406
Total	$1,029,856
Dividends	400,000
Balance carried to income account January 1, 1892	$ 628,856

Out of this there has already been paid the January 15 dividend amounting to $225,000, leaving the balance in the income account $404,864.

The following directors were re-elected: Charles T. Yerkes, Charles Henrotin, Charles A. Spring, Jr., William L. Elkins and W. D. Meeker.

CHICAGO CITY RAILWAY CO.

The meeting of the Chicago City Railway Co. was held January 15. The treasurer's report showed the following figures:

RECEIPTS.

Cash on hand Jan. 1, 1891	$ 438,776
Increase of stock	1,001,700
Sale of bonds in 1891	120,000
Earnings	3,873,198
Increase in liabilities	458,662
Total	$5,892,336

EXPENSES.

Operating expenses 1891	$2,534,315
Interest paid	216,585
Dividends paid	750,000
Maintenance of track	31,475
Maintenance of cable machinery	11,617
Increase in assets	2,155,042
Cash on hand Dec. 31, 1891	193,302
Total	$5,892,336

The net earniugs were, from cable $1,246,914 and from horses $91,968, a total of $1,338,882. Interest, dividends maintenance of track and cable cost $1,009,677, leaving a surplus of $329,205. The net earnings applicable to the stock were $1,079,205, equal to 17.27 per cent. on the capital stock.

The principal items in President Wheeler's report are as follows:

Receipts	$3,436,748
Operating expenses	2,297,651
Net	$1,139,097
Dividends	600,000
Interest	220,270
Maintenance track	.....
Maintenance cable	.....
	$820,270
Surplus	318,827
Net earnings, per cent	18.37
Passengers, No	68,734,969
Miles run	17,599,680
Average earnings per day	$9,415

The revenue from the cable lines was $2,591,996, and from the horse lines $1,281,202. The comparative unprofitableness of the horse lines is shown by the fact that the net receipts from the cable were $1,246,914, while from the horse lines they were only $91,968.

The cost of operating per mile per car was as follows:

	1890.	1891.
Cable	9.650 cents	9.369 cents
Horse	21.985 cents	23.334 cents
All lines	.....	13.055 cents
Per cent expenses to earnings	68.55 per ct.	65.43 per ct.

The expenses per passenger on the cable were 2.60 cents, on the horse lines 4.64 cents, and the average on all was 3.35 cents. The engine service has been increased, so there is now from 1,700 to 1,900 H. P. in service and the same amount in reserve. A new engine room was built at Thirty-ninth street and Wallace Avenue, another on Archer Avenue, and a new office on State Street. The company built 100 open cars at $724 each, 100 grip cars at $661 each, and 25 box cars at $1,251 each, a total expenditure of $169,775.

The equipment of the road now consists of 1,474 cars, with a seating capacity of 51,474. Of these 322 are grip cars, with a seating capacity of 6,440. Twenty-five new box cars and 100 open cars are now being built. The company has on hand 2,549 horses against 2,508 a year ago. Three hundred and twenty-five were purchased at an average cost of $125, 193 were sold at $40.75 each, and 112 died. It cost fifty-five cents a day to feed the horses. The feed cost $84,097 more than the year before.

The only new track constructed was three-fourths of a mile on Thirty-ninth Street, between Wentworth Avenue and Halsted. Damages amounted to $57,156, an increase over the previous year of $26,346.

Personal.

Mr. P. M. Kling, general manager of the St. Louis Car Co., has been in the East for some time.

Mr. J. H. Shay, of the Charles Munson Belting Co., Chicago, called at the JOURNAL office recently.

Mr. William Sutton, president of the American Car Co., of St. Louis, recently came to New York on a business trip.

Mr. George E. Kimball, one of the directors of the Reliable Manufacturing Co., of Boston, Mass., died from pneumonia last month.

Mr. Elmer P. Morris, of the supply department of the Thomson-Houston Electric Co., of Boston, paid us a visit last month. He reported a large call for the electric railway supplies manufactured by his company.

Mr. Robert Gillham, C. E., of Kansas City, has recently completed seven miles of cable line for the Denver City Cable Railway Co., making thirty-three miles of cable line operated from one central power station.

Mr. W. T. Robinson, of the Electric Truck & Supply Co., of Boston, called on us a few days ago and spoke encouragingly of the future of the radial truck and stated that the demand for them was constantly increasing.

Mr. Frank B. Rae, formerly of the Detroit Electrical Works, has opened an office in Detroit, as a consulting electrical engineer. His patents on electric railway and other work have been assigned to the Detroit Electrical Works.

Mr. C. W. Cushing has been appointed general superintendent of the American Steel Wheel Co., *vice* Mr. W. G. Richards. Mr. J. W. Rampe was appointed acting superintendent of the works of the same company at South Boston.

Mr. Merle J. Wightman, of the Wightman Electric Manufacturing Co., of Scranton, Pa., while in the city recently called at our office. He reports his company as doing a very thriving business, taxing to the utmost the force employed.

Mr. R. G. Brown, a gentleman well known in electrical circles and connected with the Interior Conduit & Insulation Co., of this city, was married on Tuesday, December 29, 1891, to Dr. Lucy M. Hall, of Brooklyn, N Y. The marriage took place in Washington.

Mr. L. E. Myers, formerly of the Edison General Electric Co., has been appointed Chicago agent for the Detroit Electrical Works, with office at 83 Kinzie Street. Mr. F. J. Stone has been appointed agent for the company for Tennessee, Georgia, Alabama and Mississippi, with headquarters at Chattanooga.

Mr. E. Saxton, cable railway contractor, has been spending some time recently in New York, inspecting the cable constructions on Broadway and Third Avenue, and while in the city spent some time in our office. He reports his work on the cable lines of the Washington & Georgetown company as now nearly completed.

Mr. S. Ashton Hand, who has been connected with the Equitable Engineering & Construction Co., of Philadelphia, has accepted the position of superintendent of the Detroit Electrical Works. Mr. Hand has had a comprehensive experience which well qualifies him to discharge, satisfactorily, the responsible duties of his new post.

Mr. E. J. Lawless, manager of the Paterson Railway Co., of Paterson, N. J., called at our office recently. Mr. Lawless is enthusiastic over the success being had with electricity on the Paterson lines. Although heretofore prominently identified with the cable railway interests, he is a firm believer in the future of electric traction where the conditions are favorable.

Mr. Charles J. Van Depoele, one of the most successful pioneers in the history of electric railways, has been very sick during the month of January, and for some time his condition was regarded as critical. At the time of our going to press he was considerably better. His wide circle of friends sympathize with him in his sickness and hope that it will not be long before his complete recovery will be announced.

Mr. M. W. Conway, street railway contractor of Brooklyn, sailed last month for St. Augustine, Fla., where he will spend some weeks, in company with contractors A. J. Hutchinson and Wm. P. Craig. These parties own a franchise, and will build three miles of street railway in St. Augustine during the present winter. The line is to be operated for the present with animal power, but the rails will be wired with a view of equipping with electric power in the near future.

Mr. John A. Beeler, construction engineer of the Denver Tramway Co., Denver, Colo., is spending some weeks with friends in the East, and while in New York recently called at the JOURNAL office. Mr. Beeler gave us many interesting facts in regard to the early history of cable roads in Denver and of the marvelous development of street railway interests in that new city. The development of rapid transit, both by electricity and cable, continues with unabated interest.

Mr. David W. Guernsey, president of the St. Louis Power Co., called at our office during January. Mr. Guernsey was formerly agent for the Sprague Electric Railway & Motor Co., in Missouri, and was largely instrumental in installing the extensive electric railway systems in St. Joseph and other cities in Missouri. He was also the founder of one of the first electric stations operated exclusively for power purposes and from this station on Lucas Ave., St. Louis, is distributed at present electric current to 128 stationary electric motors, operating a large variety of industries.

Mr. George Beadle, proprietor of the Petersburg (Va.) Street Railway, is spending some time in New York, and in conversation with him we learn that steps are being taken to change the street car line of Petersburg from mule power to electricity. The present line, which is three and a half miles, will be extended, and a dummy line will also be equipped with electric power. The line is now operated with forty mules, and Mr. Beadle states that during the eight years he has owned the franchise he has lost only four mules by death, although upon an average the animals make nineteen miles a day. The mules are re-

quired to work two hours at a time, when they are allowed to rest four hours. To this alternating of work and rest Mr. Beadle attributes the long life of the animals.

Mr. M. H. Bronsdon, superintendent of the Providence Cable Tramway Co., while in our office recently, stated that they were now operating their line with one of the long lay ropes manufactured by Thomas & William Smith, of Newcastle-on-Tyne, England; that the rope does not show much wear after four months' service, and that it will apparently outlast any rope previously tried on this line. Some difficulty, however, has been experienced with the splice, as the strands in the forward end of the tuck have a tendency to pull out. This type of rope has given excellent satisfaction on roads in Australia and other foreign lines, and we expect to see equally good results from their use in this country.

New Publications.

"Edisonia, a Survey of the Edison Light and Power Industries," by T. C. Martin. This is a beautiful brochure, handsomely illustrated and printed and tastefully bound. One can learn thoroughly of the magnitude of the Edison interests by glancing at the volume. It is an artistic little publication, which all interested in electrical work will be glad to preserve.

Catalogue No. 2 of the Weir Frog Co., Cincinnati, O. In their catalogue for 1892, which has been received during the past month, the Weir Frog Co. of Cincinnati, O., present a large number of illustrations of the various crossings, switches, frogs and other appliances manufactured by them. In glancing over this very comprehensive list of track devices we find that a large part of the extensive business carried on by this company is in devices especially applicable to street railways, and that in this line their patterns are of the latest and most approved forms. In the latter part of the catalogue are included some simple rules for laying out turnouts, etc., as well as a number of useful construction tables. The catalogue contains 190 pages.

The Minneapolis Tribune, Annual Number for 1892. This twelve page issue of the *Tribune* has a handsome cover printed in three colors. On the front cover the city of Minneapolis is represented as a handsome woman standing on the continent of North America, holding in one hand several blades of cereals and the other a banner on which are inscribed the claims of Minneapolis for pre-eminence. A glance over the statistics of the city shows that with a population of 177,083, Minneapolis has 117 miles of electric road, more than any other city in the world and that the number of passengers carried by the street railway cars during 1891 was 26,500,000. Altogether the record is one of which a citizen of that city may well be proud and shows a prosperous and rapidly growing city.

The Woodbury High Speed Steam Engine; issued by the Stearns Manufacturing Co. of Erie, Pa. The special claims made for their engine by the Stearns Manufacturing Co. are economy, durability, superior regulation and cool running. The steam valve, owing to the method of construction, is balanced and adjustable, insuring the maintenance of steam tightness and reducing the necessary wear to a minimum. The governor is of that class in which the point of cut-off, or valve closure, is effected by moving the eccentric across the shaft. The movement of the eccentric is operated by centrifugal weights on the flywheel, the centripetal force being furnished by a single spiral spring, the outer end of which is secured to the rim of the wheel in such a manner as to permit of its lateral adjustment along the latter. These and other important points in the construction of the machine are fully described and illustrated in the pamphlet, which also contains a number of sample indicator diagrams. These engines are built in sizes of from fifteen to 200 H. P., and designs for larger sizes are being prepared.

The Third Annual Report of the Inter-state Commerce Commission on the "Statistics of Railways in the United States."—This report gives comprehensive statistics covering the operations of railways for the year ending June 30, 1890, and a statement of earnings from passenger and freight service, together with operating expenses and fixed charges, for the nine months ending March 31, 1891. The railway mileage in the United States on June 30, 1890, was 163,597.05 miles. The number of railway corporations at that time was 1,797. Forty railway corporations operate 77,872.63 miles of line, or 47.51 per cent. of total mileage. The average length of line for these forty roads is nearly 2,000 miles. The total number of locomotives in the United States is 29,928, of which 8.384 are passenger locomotives and 16,140 are freight locomotives. This shows ten freight locomotives and five passenger locomotives for each 100 miles of operated line. The number of cars used on the railways of the United States is 1,164,188, of which 26,511 are in the passenger service. The total number of men employed is 749,301, being an increase of 44,558 over 1889. The average number of men employed per 100 miles of line on all roads is 479. The 156,404.06 miles of line, which is made the basis of statistics in this report, is represented by railway capital to the amount of $9,437,353,372, which is equivalent to $60,340 per mile of line. Assuming that the remaining mileage is capitalized at the same rate, the total capitalization of railway property in the United States would be $9,871,378,389. The number of passengers carried during the year was 492,430,865. The number of tons of freight carried during the year was 636,541,617; the number of tons carried one mile was 76,207,047,298. Freight train mileage was 435,170,812 showing the average number of tons per train to have been 175.12. The revenue per passenger per mile of line for all the railways was 2.167 cents; the average cost of carrying one passenger one mile was 1.917 cents. The revenue for carrying a ton of freight one mile was .914 cent, the cost of carrying a ton of freight one mile was .604 cent. The total number of persons reported by railways as killed during the year was 6,334, and the total number reported as injured was 29,025. Of the total number killed 2,451 were employes, 286 passengers, and 3,597 were classed as "Other persons." In this latter figure are included the large number of suicides.

The Patent on Rail Bonds.

Judge Blodgett, of Chicago, delivered a decision on January 4, 1892, in the case of Charles A. Lieb *vs.* The Electric Merchandise Co., *et al.*, in which the complainant sued the defendants for an alleged infringement of patent No. 434,087, covering a type of rail bond used in electric railway construction for electrically connecting adjoining rails. Briefly, the patent claimed the right to a bond or connector consisting of a rod or wire each end of which is passed through the head of a bolt or rivet, the latter to be inserted in holes drilled into the rails to be connected. The chief claim made in defense was that the device was old, and a number of earlier patents on wire connectors were produced in evidence.

In his decision, which was in favor of the defendants, Judge Blodgett says: "I think the proof shows that the complainant's form of construction for a rail connector when one is used, is more simple and less expensive than any of the previous forms shown, unless it be that shown by Westinghouse. But the changes which the complainant made are only mechanical changes and do not introduce any new principles. After Gassett and Fisher [earlier inventors] had shown their device for making a connector from rail to rail by means of wire wound round the head of the stud driven into holes drilled in the rail, they would have undoubtedly had the right in practice to have fastened their connecting wire to the stud, by inserting it into holes made in the head of stud, as an equivalent for their coil, because the hole through the head of the stud was but another mode of fastening the wire and the stud in close metallic contact. And the coil which passed around the head of the stud, was in all respects, the same as the hole made in the head of the stud into which the coil was inserted, so far as the principle of operation was concerned."

Success of Liability Insurance.

We learn from Mr. John G. Dorrance, representing the Guarantee & Accident Lloyds, of this city, that this company are issuing a large number of policies to street railway companies, insuring them against liability arising from accidents to persons or property. The company hav recently settled claims with the Metropolitan Street Railway Co., Portland, Ore.; Denver Cable Railway Co.; Cleveland City Railway Co.; Union Railway of Providence, R. I.; Metropolitan Crosstown and the Houston & West Street Railway companies of New York. Over forty-five companies are now holding policies written by this company. Mr. Dorrance has recently returned from a trip to Portland, Ore., where he has been in the interests of the company, and reports that a large number of roads in the Northwest have taken advantage of the offers made by his company. The following letters, which have been received without solicitation, indicate in a striking manner the esteem in which the insurance company is held by their patrons:

OFFICE OF
THE DENVER CITY CABLE RAILWAY COMPANY.

DENVER, COLO., Jan. 2, 1892.

JOHN G. DORRANCE, ESQ.,
Guarantee & Accident Lloyds, New York City.

Dear Sir:—Very nearly a year has now passed since you insured us against accidents to the public.

The manner in which you have conducted the business, the promptness with which you have settled proper claims, and your liberality in all matters connected with the policy have been very gratifying.

Wishing you success in the coming year, I am yours truly,

GEORGE E. RANDOLPH, General Manager.

METROPOLITAN RAILWAY COMPANY.

PORTLAND, ORE., Dec. 12th, 1891.

JOHN G. DORRANCE, ESQ.,
Guarantee & Accident Lloyds, New York City.

Dear Sir:—Please allow me to return you our most sincere thanks for the prompt and satisfactory manner you have settled all reasonable demands for injuries received by passengers that were on Car No. 20 at the time of the deplorable accident on our road on the 16th of October.

We commend your company to the favorable consideration of all desiring insurance of the kind you furnish. If you need any reference in this part of the country, you may use our name with pleasure.

Yours, very truly,

G. A. STEEL, President.

A New Home.

The new building recently erected on Walworth Street, Brooklyn, for the use of the Lewis & Fowler Manufacturing Co., and the Lewis & Fowler Girder Rail Co., is now occupied and affords considerable additional space, made imperative by the constant increase in the already extensive business of these leading concerns. The building on the west side of Walworth Street, which was temporarily occupied by the offices of these companies, is now utilized as a pattern shop.

The lower floor of the new building is fitted up as a machine shop and is filled with lathes, planers and other accompaniments of a room devoted to that purpose. The offices are on the second floor and are roomy, light and attractive. On the right of the entrance are the accountants' and bookkeepers' departments, separated from the rest of the room by the usual railing and lattices. On the left is the general reception room, upon each side of which are the private offices of the president, Mr. John W. Fowler, and the secretary, Mr. A. H. Dollard. From the windows of this room can be seen the extensive building devoted to car construction, which extends the length of an entire block, the foundry and other portions of the Lewis & Fowler works. The upper stories of the new building are devoted to the extensive register and stove departments of the Lewis & Fowler Manufacturing Co. While not entirely settled in their new quarters yet, the officials appear quite comfortable, and, as heretofore, have always a hearty welcome ready for any visiting member of the street railway fraternity.

The Robinson Radial Truck.

The following extract from a circular recently published by the Robinson Electric Truck & Supply Co., of Boston, gives a comparison between the earning capacity of a Robinson radial open car and an ordinary eight-wheeled open car:

The cars used for this comparison were one of a number of Robinson radial open cars in operation on the Union Street Railway, Dover, N. H.. and one of the largest open electric cars, having two ordinary four-wheeled swiveling trucks, in service on the West End Street Railway, Boston. Both cars have similar boxes and gear, and both are equipped with two 15 H. P. Thomson-Houston motors. The weight of the eight-wheeled car is 18,650 lbs.. and it seats fifty passengers. The weight of the Robinson radial is 17,650 lbs., and its seating capacity is seventy passengers. That is, the radial, weighing 1,000 lbs. less, seats forty per cent. more passengers than the eight wheeled car. The dead weight in the Robinson per passenger seated is 252 lbs ; that of the eight-wheeled car 373 lbs.

If we equalize the weights of the two cars by allowing 1,000 lbs. additional weight to the radial, this at 250 lbs., the dead weight to the passenger, will give the radial an additional seating capacity of four more passengers, or eight per cent. more. That is, the radial seats forty-eight per cent. more passengers than the eight-wheeled car, weight for weight.

To get at the average comparative earning capacity, assume that each car makes six round trips per day, taking one full load of seated passengers each straight trip, but not changing passengers *en route*, and running 365 days in the year—as a full equipment of cars will keep up this average—and it is found that, the weights of the cars being equalized, the Robinson earns more than $5,000 per annum in excess of the other. Furthermore, it has been shown on various occasions that the average power required to propel the radial is scarcely two-thirds of that required to propel an eight-wheeled car of the same weight, so that the grand total gain of the radial over the eight-wheeled car on straight track is eighty-one per cent. This is equivalent to an excess in earnings per annum of $5,256, not taking into account the saving in power effected.

The mammoth radial used in the above comparison seats seventy passengers, but has carried 210 people at one time.

Proposed Thomson-Houston Factory at Pullman, Ill.

The announcement made a few weeks ago that the Thomson-Houston Electric Co. proposed to establish a factory at Pullman, Ill., was at first received with incredulity. So many of such projects have been reported and the rumors have so uniformly proved without foundation that the last report was assumed to belong to the same class. Investigation shows that the announcement was generally correct though details have not been settled fully. This statement is authorized by B. E. Sunny, Chicago manager of the company. It is stated very emphatically by Mr. Sunny that his company will have no relations with the Pullman company beyond buying a site of the latter corporation.

The primary idea in building a factory near Chicago is to save freight in shipping goods to Western points. The new plant will probably be devoted to the manufacture of electric railway supplies, lights, motors, stationary engines, and other kinds of electrical goods manufactured by the company. The Pullman plant is designed to relieve the Eastern factories of their surplus work and was made necessary by the large amount of Western business being performed by the company.

Equipment Notes.

The Robinson Electric Truck & Supply Co., of Boston, have ready for delivery twelve Robinson radial trucks for the Metropolitan Street Railway, of San Francisco.

V. H. Blackington & Co., of Attleboro Falls, Mass., manufacturers of number badges, handle a large line of goods in their specialties and include many prominent railroad companies among their customers.

The Perfection Oil Purifier Co., 136 Liberty Street, New York, will ship to responsible persons their oil-purifying device for free trial in order that the latter may test it thoroughly and ascertain if the claims made for it are reliable.

The Newburyport Car Manufacturing Co., of Newburyport, Mass., advise us that their works are very busy at present, and that they are employing more men than ever before. The calls on this company are constantly increasing.

Haines Bros., of Kinderhook, N Y., inform us that they were the contractors for the Owosso & Corunna (Mich.) Street Railway, four and a half miles in length. This same firm have bought the Janesville (Wis.) Street Railway and will equip this with the Short electric system.

Clay, Pepper & Register of Philadelphia, manufacturing and contracting electrical engineers, dissolved January 15 by mutual consent, Mr. Clay retiring from the firm. The business will be carried on as heretofore by the remaining partners, under the firm name of Pepper & Register.

The Purity Oil Filter Manufacturing Co. of Pittsburgh, report a large number of recent orders, and among others, from the following companies: Vacuum Oil Co., New York; Monongahela Electric Light Co., Homestead, Pa.; Edison Electric Illuminating Co., Cincinnati, O.; Central Traction Railway Co., Pittsburgh, Pa.

Queen & Co., of Philadelphia, have recently moved into their new quarters at 1,010 Chestnut Street, and are very comfortably situated. They have recently brought out a number of new electric appliances to which they call the attention of engineers to whom they extend a cordial invitation to visit their new home.

Alfred F. Moore, manufacturer of insulated electric wire and cables, No. 200 N. 3d Street, Philadelphia, has withdrawn his agency in Chicago, lately controlled by Mr. G. A. Harmount, Monitor Electric Co., 149 Wabash Avenue. Until further notice all communications or orders should be addressed direct to the head office.

The Pennsylvania Iron Works Co., of Philadelphia, were the successful bidders and have received the contract for the complete power house, including engines, boilers and machinery, erecting and placing in operation for the West Chicago Street Railway Co., at the corner of Twelfth Street and Blue Island Avenue, Chicago.

Mr. James F. Shaw, of Boston, representing the Newburyport Car Manufacturing Co., has recently equipped the Union Railway, of Providence, and the Lynn & Boston Railway, of Lynn, Mass., with Dorner & Dutton scrapers. He has also taken an order from the Lynn Belt Line and the Merrimac Valley Railway Co. for a number of Reliable sand boxes.

The Benedict & Burnham Manufacturing Co. of Waterbury, Conn., have recently placed on the market their new weather proof wire named the "Benedict," for which high insulation is claimed. The manufacturers state that a number of severe tests have been made of the insulation of this wire with most successful results, and that wherever the wire has been introduced it has given the best of satisfaction.

The Lieb Machine Works, of New York, are getting out a new line of overhead appliances for electric railways, combining a number of important improvements. They also report a large call for their new trolley pole, and state that they have appealed from the recent decision of Judge Blodgett, of Chicago, in a patent case covering rail bonds, in which they were plaintiffs and in which judgment was given to the defendants.

W. R. Fleming & Co., of New York, have installed during the last month two 55 H. P. Ideal self-oiling automatic engines in the handsome private hotel building known as the "St. Lawrence," near Madison Avenue, New York. The absolutely smooth and noiseless running of these engines commended them for this work. There are now about twenty of these engines running in New York City, and all are among concerns of the highest standing in the community.

The Eddy Electric Manufacturing Co., of Windsor, Conn., report a large business in their electric apparatus. They have recently installed a power plant of 385 H. P. in the factory of the Encaustic Tiling Co., Zanesville O. They have also installed a 50 H. P. generator and seven motors for driving the Blackman ventilating fans in the New York State Capitol, Albany, N. Y., and a central power station at Kalamazoo, Mich., consisting of 60 H. P. generators and 80 H. P. motors.

The Field Engineering Co., of New York, who take charge of the entire equipment of power stations, supervising all details of the entire installing, are planning a number of stations on designs which embody changes calculated to increase the economical operation. Central station owners and railway companies having power stations in contemplation this season, or thinking of overhauling or making changes in old plants, would find it to their advantage to communicate with the Field Engineering Co.

Alexander, Barney & Chapin, of New York, have sent to their numerous friends and customers a new year's greeting in the form of a four page folder printed in two colors. On the front and back pages are handsome designs bearing the initial letters of the firm, A B C, and representing gnomes and other figures. The interior pages contain

the wish to their friends (and they are many) of "health, happiness and prosperity" and to their enemies (and they are few) of "enlightenment, liberality and magnanimity" which should be sufficient to turn them into friends.

The Reliable Manufacturing Co. of Boston, Mass., have just shipped to the Thomson-Houston Electric Co., San Francisco, several sets of sand boxes, to be put on the new cars this company are equipping for several street railway companies in California. The Norwich Street Railway Co. have adopted the Reliable sand box, and are applying the same to their cars. The Lynn & Boston Street Railway Co. have also given an order to this company to equip their entire road with the Reliable sand boxes. This order was given after the road had thoroughly tested the use of these boxes on some of their cars during the past year.

The Stearns Manufacturing Co., of Erie, Pa., propose to make the Woodbury engines in sizes to meet the demands of all companies. Their facilities for manufacturing are among the best. Their commodious shops give ample room in the galleries for the construction of engines, and the company have recently installed $18,000 worth of new machinery for engine building. The first 100 H. P. engine will soon be ready and will be operated in the company's shops, so that it may be thoroughly tested. Engines will be constructed up to 500 H. P. The company propose to construct a building for testing engines, which, they think, will be the most complete plant of its kind in the country.

The Berlin Iron Bridge Co. of East Berlin, Conn., are just completing a new machine shop for the Bridgeport Machine Tool Co., at Bridgeport, Conn. The building is made entirely of brick and iron, divided into two parts, each forty feet wide, the total length being ninety-six feet. One portion is two stories high, the roof and floor being designed for light work, while the opposite half of the building is of the same height, but the second floor is omitted, so that it may be used as an erecting shop. The erecting shop is controlled by a traveling crane. The building, when completed, will, it is claimed, be one of the most perfect and best designed machine shops in the New England States.

The Ball Engine Co., of Erie, Pa., are now preparing to put on the market some new sizes of engines which will interest street railway men. Their new shops are splendidly equipped and they are making engines of a very high grade. Inquiries are being received from all points where electrical plants are to be put in. Their engines are well appreciated where they are known. They have received an order for a 400 H. P. compound condensing engine from the Erie Electric Motor Co., who operate the local electrtc railway. They will furnish the Braddock Street Railway a 200 H. P. single cylinder engine. The company expect a large demand for engines for street railway work in the spring.

The Boston Bridge Works, of Boston, Mass., are constructing the roof of a large power station in Lynn, Mass., for the Lynn & Boston Railway, of which the trusses and purlins are of iron. The building is about seventy feet wide by 250 ft. long. They are also building the roof for a boiler house for J. P. Squire's packing and provision company, in East Cambridge, Mass. The trusses of this roof are of iron and the covering is of corrugated iron, resting directly upon the rafters. There is a ventilator running the entire length of the building, which is also made entirely of iron. Besides this they have under construction the roof trusses for a machine room for the Otis Falls Pulp Co., at Livermore Falls, Me., and other buildings.

H. Ward Leonard & Co., electrical engineers, New York, write us that among the prominent buildings in which they are at present installing electric plants as contractors are the following: Graham Hotel, Fifth Avenue Theatre, Mr. John H. Inman's residence, *Mail and Express* building, Catherine Bradley building, Germania Insurance building, and F. O. Du Lous building, all of New York; the Franklin Trust building, and Columbia Theatre, Brooklyn. Among the leading concerns for whom they are acting as consulting engineers are the following: Otis Elevator Co., New York City; Wm. Sellers & Co., Philadelphia; Ingersoll-Sergeant Drill Co., New York City; Eastern Electric Co., Limited, St. Johns, N. B.; Providence Journal Co., Providence, R. I.; and Rock Hill Electric Light Co., Rock Hill, S. C.

The Thomson-Houston Electric Co. advise us that their supply department are doing a large business and have received a number of letters from their customers complimenting them upon the quick delivery of goods. This department have secured during the past month some very large orders for their various patented articles and find that the railway companies regard their supplies with great favor. The high quality, good workmanship, and low prices of these goods are the essential points which commend them. The Pittsburgh office of the Thomson-Houston Electric Co., is about to be moved into commodious quarters in the building 414 Wood Street, where a large stock of electric light and railway supplies will be carried. E. G. Waters will be in charge of the lighting department, and Howard Wheeler will be in charge of the railway department.

The Edison General Electric Co. have enlarged the scope of their wideawake *Monthly Record*, which is in charge of C. W. Dever, of the contracting department, and will publish therein items in regard to all the departments of the Edison company. The Southern district of the Edison company has been abolished, the portion of the country in charge of this district being divided between the Eastern and Central districts. A slight change has also been made in the territory covered by the New England and Eastern districts. The Edison General Electric Co. have established a supply depot in Pittsburgh, Pa., made necessary by the many calls for general supplies which they have received from the region in the neighborhood of that city. The extensive business of the company is constantly growing, new orders being taken in all sections of the country.

The Robinson Machine Co., with general offices at Altoona, and Works at Bellwood, Pa. have been most successful in placing on the market a truck often wished for by street railway companies, *i. e.*, one that combines durability, lightness and simplicity with completeness, as their many orders and testimonials prove. Apparently with a view to strengthening their company, we note that they have elected their former general agent to the presidency. This will certainly have a very beneficial effect, for Mr. Hay, during the many years devoted by him to the railway business, has acquired a reputation for ability, energy and courtesy. We are advised that after passing successfully the trying ordeal of a close criticism and inspection by Pennsylvania Railroad experts, Robinson Machine Co were given the order for the additional trucks required by the Altoona railway.

The Jewell Belting Co., of Hartford, Conn., have recently installed in the Boyd Street station of the Newark Passenger Railway Co., a very handsome sixty inch double belt, which is mentioned in another part of this issue. The company have also entered on their books during the past month orders for eighteen belts, double and three-ply, a large proportion of which are destined for electric light and power work. Among these orders are the following: 100 ft. belt, fourty-two inch, double; 190 ft. belt, thirty-two inch, double; sixty-nine foot belt, thirty inch, double; seventy-nine foot belt, thirty inch, double; 115 ft. belt, thity inch, double, and a 103 ft. belt, fourty-eight inch, three-ply. The Jewell belting has achieved an excellent reputation in the past, and the company are now better equipped than ever to turn out the best of work in the shortest possible space of time.

The Ball Engine Co. of Erie, Pa., have sent us a list of their recent orders, which include the following: Thomson-Houston Co., Boston, Mass, one 100 H. P. and one eighty H. P. single engine; Newark Electric Light Co. Newark, N. J., one 300 H. P. cross compound engine; Kittanning Electric Light, Heat & Power Co., Kittanning, Pa., one 150 H. P. cross compound engine; Columbia Electric Light Co., Philadelphia, Pa., one 200 H. P. cross compound engine; Osage Electric Light Co., Osage, Ia., one fifty H. P. cross compound engine; Edison Light & Power Co., Minneapolis, Minn., one 300 H. P. cross compound engine; Central District Telegraph & Telephone Co., Bldg., Pittsburgh, Pa., two fifty H. P. cross compound engines; Industrial Improvement Co., Brockton, Mass., one 300 H. P. and one 200 H. P. cross compound engine; Electric Improvement Co., San Francisco, Cal., one 100 H. P. tandem compound engine; Edison General Electric Co., Portland, Ore., three 150 H. P. tandem compound engines.

The John Stephenson Co. Ltd., of New York, are turning out a large number of cars from their shops on Twenty-eighth Street, New York City. Among the recent companies from whom they have received orders for cars are the New York & Harlem Railway, New York City, for twenty cars, the Salt Lake City Rapid Transit Co., of Salt Lake City and the New Haven & Centreville Street Railway Co., New Haven. In their shops are several handsome grip cars which immediately attract the attention of a visitor and which are destined, as already mentioned, for the Washington & Georgetown road of Washington, D. C. These cars have monitor roofs with quartered oak ceilings and impress the observer with their general substantial and handsome appearance. This company have recently received a letter from Mr. James D. Callery, President of the Second Avenue Passenger Railway Co., of Pittsburgh, Pa., in which he refers to some recent cars manufactured by the Stephenson company for that line, in the following terms: "We are much pleased with these cars and claim them to be the finest in the city."

J. W. Parker & Co., of Philadelphia, are agents for the Ball engine, and do a large business in installing complete steam plants for electric light and electric railway uses. They write us that they are building at present a number of engines for street railway service, among which they include one 250 H. P. cross compound railway engine for the Rock Creek Railroad, of Washington, D. C.; this engine is to be delivered as soon as the railway power station can be completed. They are also building a similar engine for the Industrial Improvement Co., of Boston, Mass., for use at Brockton, Mass., and delivered a single cylinder 150 H. P. engine to the Lynchburg Street Railway, of Lynchburg, Va., this being the third Ball engine to be put in use by this railway company. Messrs. Parker & Co. express as their opinion that 1892 will be an important year in street railway improvement, and the extent of their own business seems to justify this prediction. They say that they have never had a greater number of inquiries for engines than at present for street railway service, and this in spite of the general complaint of dullness in other business lines.

The Burton Electric Co., of Richmond, Va., are now doing a prosperous business. Electric heating is meeting with favor among street railway companies. It is stated that at the present time there are 100 street railways using Burton electric heaters. Beyond all question a great many other companies would adopt the system at once were it not for the reason that they fear the cost of current will be too great. Mr. W. R. Mason, President of the Burton Electric Co., recently furnished the STREET RAILWAY JOURNAL a statement which shows that the cost of operation is not great. He estimates that in all ordinary cases the cost of the current required for heating a car will not be over fifteen cents per day. This, he thinks, is a fair estimate; but it is considerably less than that furnished by street railways, which has in some cases been as high as seventy-five cents and one dollar. The current required per set of 4 heaters, 2 H. P.; coal, per H. P. 4 lbs.; coal, 18 hour car day 144 lbs; 1 lb. coal worth .00087 cent; 144 lbs. coal worth 12¾ cents. The figure of 12¾ cents was determined by a recent test made on a large railway which uses the Burton heater.

The Lamokin Car Works, of Philadelphia, have recently delivered to the Williamsport Passenger Railway Co., of Williamsport, Pa.,

two palace finish vestibule car bodies. These cars are finished in solid mahogany, with mahogany ceilings, the seats and backs are covered with Wilton carpet and the equipment includes solid bronze trimmings, safety gates, radial bars and ratchet brakes. A novel feature about the cars is the observation skylight in the roof of the vestibule, which affords a view of the trolley and enables the motor man to readjust the trolley without leaning out of the front window. This order makes a total of ten cars delivered to this railway company. The Lamokin Works have at their factory in course of construction two palace vestibule cars for the Altoona City Passenger Railway Co., Altoona, Pa. These bodies are to be mounted upon the Robinson electric motor truck, which are manufactured by the Robinson Machine Co., Altoona, Pa. They also have an order for six double truck cars, from the Rock Creek Railway Co., of Washington, D. C., and six open cars for the same road upon which they expect immediately to start work.

The Electric Mutual Insurance Co., of Boston, have issued a circular letter to policy holders and others, stating that an arrangement has been made between that company and the Home Insurance Co., of New York, whereby the entire liabilities under outstanding policies of the former company have been assumed by the latter company. The reasons for making this arrangement are given in the circular, and are, principally, the severe losses sustained by the insurance company during the past year and the feeling on the part of the Electric Mutual Insurance Co. that the interests of their policy holders would be best subserved by a transfer of the risks to a company having a larger paid up cash capital than their own. Mr. S. E. Barton will have charge of the electric insurance department of the Home Insurance Co. For the time being business will be conducted at the present office of the Electric Mutual, but in the near future it will doubtless be found advisable to locate the office in New York City. The present status of the Electric Mutual will remain unchanged until all of its policies have expired, and any indorsements, consents or other required changes will be promptly made as heretofore by communicating with the company.

The Engineering Equipment Co., of New York, have made a large number of sales recently of the Underwood cotton leather belting in various widths, ranging chiefly between two inches and twenty-four inches, and this department forms an important branch of their business. The Edison central stations, of New York and Brooklyn, have adopted the Underwood cotton leather belts, having tried them two years with satisfactory results. Two twenty-one inch and three fifteen inch Underwood cotton leather belts have recently been put in at the Edison Twenty-sixth Street station. At the Brooklyn station there are now running eighteen of the Underwood cotton leather belts, each sixteen inches wide. The Edison company, Paterson, N. J., have recently added five sixteen inch cotton leather belts to their plant. In Buffalo the Buffalo Street Railway Co. have added two of these belts, each twenty-four inches wide. The Rochester Electric Light Co., United States system, have added about 200 ft. of twenty-one inch cotton leather belting and People's Electric Light Co. (Thomson-Houston system), Oswego, about 100 ft. of thirty inch cotton leather. All of these belts are running finely. This looks well for cotton leather, despite the assertions of those who claim, for business purposes, that the Underwood belting is not what it is. There are enough of witnesses to show that it is true that the cotton leather belting, made solely by the Underwood Manufacturing Co., is steadily, and in some directions rapidly, growing in favor with the users of belting. The present product of the Underwood factory is all that could be desired in point of excellence of material and manufacture. The significant sales given indicate the value of this belting and suggest its use to those who have not tried it recently.

WESTERN NOTES.

The Shultz Belting Co., of St. Louis, have issued a handsome colored calendar for 1892, which they are sending to their many customers.

The American Car Co., of St. Louis has sold to the West Chicago Railroad Co. 150 street cars, and fifty cars to the North Chicago Railroad Co.

Dorner & Dutton, of Cleveland, O., report that they are kept busy in supplying the demand for their motor trucks. Several excellent orders have lately been received.

Ramsay & Kenyon, of St. Paul, Minn., have been appointed Northwestern agents for the Morden Frog & Crossing Works of Chicago, Ill., the Tudor Iron Works, of St. Louis, Mo., and the Belleville Steel Co., of St. Louis, Mo. Their headquarters are at 109 Endicott Arcade.

The Indianapolis Frog & Switch Co., of Indianapolis, Ind., have recently closed a contract with the Baltimore City Passenger Railway Co. for all the crossings for the new cable road being built by that railway company. The appliances of this company are meeting with well merited favor throughout the country.

The Central Electric Co., of Chicago, have just taken the agency for Illinois, Missouri, Nebraska and Indiana, for the Interior Conduit & Insulation Co., of New York, and will carry in stock at Chicago, St. Louis, Kansas City and Omaha, a large supply of tubing. This company also report a large increase in their lamp orders, and the extensive supply of these goods which are kept on hand insures the filling of orders of this kind.

The Pond Engineering Co., from their Chicago office have recently installed at the Chicago Arc Light & Power Station, a 250 H. P. Armington & Sims engine. It is an interesting fact in connection with this order, as showing the facilities this company have for supplying orders promptly, that the engine was shipped complete from St. Louis within a day after it was received, and the Power company received it in Chicago six days afterwards, and within three days from that time the engine was ready for operation in the plant of the company.

Mark & Sterling, of Cleveland, manufacturers of rail joints, rail chairs, etc., used in street railway construction, write us that the call for their appliances has been so great that they expect to enlarge their business considerably during the next few months and wish to establish a few good agencies. Correspondence on this subject should be addressed to the office of the firm at Society for Savings Building, Cleveland, O. They also write that they have had remarkable success in their business so far and have a good outlook for the coming spring trade. Their rail joint which was described in a recent issue of this paper is attracting special attention.

The Western Electric Co., of Chicago, have purchased the grounds and buildings at 261 to 277 South Clinton Street for $320,000. The ground adjoins the present factory of the company and the purchase is made presumably for an extensive addition to the company's large factory. Possession is not to be given for some time yet. It will be remembered that the company already control quite an expanse of frontage on Clinton Street, on which they erected, about six years ago, a magnificent six-story building, which at that time and for some time after was considered equal to the company's business, but it was only a short time till they found that more space was needed and a large addition was built as well as additional stories put on the first structure which they erected.

Alfred G. Hathaway, of the Case Building, Cleveland, finds an active demand for his specialties. He has recently sold a twenty-four foot transfer table to the Pittsburgh, Allegheny & Manchester Traction Co. of Allegheny, Pa. The Washington & Georgetown company, of Washington, D. C., have given Mr. Hathaway an order to equip all their car houses with transfer tables. The main car house will have six tables, four on the main floor and two on the second floor. The tables are now made so shallow, that when put in position it is not necessary to cut into the joists. An order was recently received for two ten foot tables from the Buffalo Railway Co., who have already sent several orders to Mr. Hathaway. The outlook for the spring is very promising, as Mr. Hathaway has received orders for equipping some of the largest car houses in the country.

The Crossley Friction Brake Co., of Cleveland, O., have applied a numbnr of their brakes to cars of the Broadway & Newburgh Street Railway Co., which are giving entire satisfaction. The motormen are greatly pleased with them and state that they can control their cars with great nicety by means of this appliance. The brake is of the momentum type. By the use of a lever or an ordinary crank, a rope is tightened around a spool on the axle. The stop is effected as quickly as may be desired. An inch and a quarter rope is used and it might be thought that wear would soon destroy its usefulness. This does not seem to be the case. The rope wears for months and then may be replaced at the cost of twenty-five cents. Horace E. Andrews of the Broadway road, has written a letter to the company in which he speaks of the brake in the highest terms. The great points argued in behalf of the brake are its extreme simplicity and its cheapness.

The Brownell Car Co, of St. Louis, write us that the car "Accelerator" which attracted so much attention at the late Pittsburgh Convention, will soon be in New York City, where it will be inspected by the managers of the Broadway cable road. It has been in service in Chicago for a considerable time and has proved so satisfactory in that city that the right to use the patent has been purchased by the North Chicago Railway Co. and also the West Chicago Railway Co. Mr. Yerkes, president of these lines, is quoted as speaking in the highest terms of the car, and especially of its efficiency in carrying large loads with comfort to passengers. In view of the agitation in many cities of the rapid transit question, any device which tends to facilitate the receipt and discharge of passengers, and so shorten the time required for stops is of great importance, and this car seems to accomplish these important results.

The Electric Merchandise Co. of Chicago, with characteristic enterprise have arranged recently to handle the entire produc of certain large mica mines. The mica of excellent quality and is prepared in all desired sizes. The terms of the arrnagement make it possible for the company to quote attractive prices. Already large sales have been made and great satisfaction expressed by consumers. The winter weather bring in orders for the well-known Burton electric heaters, and Brand's steel wire track brooms with Wardwell's adjustable track broom holder. The diploma for efficiency has lately been awarded the Burton electric heater by the committee of judges of the Canadian Electrical Exposition, at Ottawa, Can., where the heaters were thoroughly tested. A change has occurred in the office of secretary and treasurer of this company, Mr. W. L. Adams, of Chicago, having been appointed to that place to succeed Mr. A. L. England, resigned. This company have recently received an order for 3,000 lbs. of their black tape. The frequency of similar orders speaks well for the goods manufactured by this company.

The Electrical Supply Co., of Chicago, moved a few months ago into new quarters at the corner of Michigan Avenue and Randolph Street. Here they have over 3,500 sq. ft. of floor space, but already find themselves crowded for want of room to such an extent that outside storage had recently to be arranged for, since this company carry a large amount of Shield Brand "moisture proof" and Habirshaw rubber covered wires in stock. Business at this season of the year, they report, has never been better than now, and the outlook for Spring is extremely encouraging. This is especially true of their extensive and growing railway department. They are fortunately situated in respect to the larger amount of specialties in this work. Making them in their own factory, they are enabled to closely govern the

quality of material entering into the composition of the goods. This, in connection with their rigid inspection of the finished article, has been an important factor in establishing their reputation in this field. The magnet wires which they manufacture and which they have been careful to have perfectly uniform in gauge and insulation, are extensively used by all electric roads in the repairs of motor and generator coils and armatures. Another article for which they are finding a rapidly increasing sale is their rawhide pinions. The company evidently believe in the maxim that "whatever is worth doing, is worth doing well," and certainly the nicety of workmanship observed with these and all their other supplies would seem to corroborate this view. Divided into many departments, each under the care of an experienced and capable head, the business goes forward with the unity and harmony of a well constructed mechanism.

The Detroit Electrical Works have sent us a copy of a letter recently received by them from J. T. Voss, general manager of the Athens Railway Co., of Athens, Ga., who have recently installed the Standard Electric Railway system of the Detroit company. Mr. Voss' letter describes the success attained with the Standard system, and is in part given herewith: "We have had (in Athens) very little trouble or expense with the bevel gear supplied by you; in fact there is no trouble with it when the friction collars are kept well adjusted, which is very easily done. And as to the dynamo, it has not caused us one minute delay or one cent of expense. As to the whole equipment, we find it to be the simplest and easiest to keep in repair of any of the systems that I have ever inspected. I have a son, nineteen years old, who has charge of all the cars and motors, and he keeps them in thorough repair; we have never lost as much as a day's service with any one motor, and all the experience he has ever had in electrical work was with your men while here setting up our machinery, while with other systems it is considered by many necessary to keep a high salaried expert to keep the machinery in order. I claim that we have the best equipped road anywhere to my knowledge. Our cars make less noise and run smoother than those of any other system that I have ever inspected. I have been in the street railway business for some twelve years, and last year, before we began to make any change in our line here, I made a tour of inspection of the different systems and became utterly dissatisfied with two motors to one car, especially in the item of repairs. The single motor geared direct to each axle cannot be beaten anywhere, and that is what we have. We would be glad at any time to show anyone our system here." This company have lately sold five additional thirty H. P. equipments to the People's Electric Street Railway Co., of Springfield, Ill. Three motors of the same capacity have been sold to the Jacksonville Railway Co., of Jacksonville, Ill. This company are changing from horses to electricity, and the road will be ready for operation with the new power March 1. The Detroit company have received an order for five equipments for the City Street Railway Co. of Kokomo, Ind.

The Fulton Foundry Co., of Cleveland, O., have improved their electric truck, and have facilities for manufacturing these in as large quantities as may be desired. Orders can be filled with dispatch. The truck, which has been illustrated in the STREET RAILWAY JOURNAL, is built in the main of wood; for this reason the bolts do not become easily loosened from the constant vibration. Great rigidity and strength are claimed for it, while, owing to the wooden construction, it is very light. It has a brake of a new design which admits of a tremendous leverage. When the brakes are off they are entirely free from the wheels, and it is never necessary to change the turnbuckles, it is stated, whether the brakes are new or nearly worn out. The company have furnished twenty-two of the trucks to the East Cleveland Street Railway Co. They have not cost the latter anything for repairs, although the first one was put into service fifteen months ago. Trucks are being furnished to many of the electric railway companies, and they are giving great satisfaction. One point has been particularly remarked: The wheels and axle always keep in line, so that the wear is even. The company have designed a new chilled cast wheel for electric railway service, embodying a new feature which will, it is thought, double and, perhaps, treble, the life of the wheel. The new principle is very simple, but it is thought its introduction will greatly interest street railway men. The company will now answer any inquiries which are sent to them regarding it. The company's steel tired wheels are gaining favor with street railway companies and large numbers of them are selling. The drawbars for electric cars have been found to give entire satisfaction. The East Cleveland company have adopted them on all their cars—225 in number. The device makes possible a tight coupling so that there is always tension on the rear car. The strain is much less, therefore, on the gears and pinions than when link and pin are used. As there is no slack in the connection, there is an absence of noise. The transfer tables constructed by the company are made for four, six, or eight wheel cars of any wheel base. They are made very substantial and are so constructed that one man can handle a car on it. Large numbers of these tables have been sold throughout the country. The company's turntables are well known throughout the country. These are made on short notice, though the sizes usually desired are kept on hand. Large numbers of railroad crossings, which are giving entire satisfaction, are being sold by the company.

WM. WHARTON, JR., of Philadelphia, calls our attention to an error which crept into the description of the Missouri Railway Co., of St. Louis, in our last issue. The manufacture of the rails used on the Tower Grove Park division and the Forest Park division from Fourth Street to Tower Park should have been credited to Messrs. Wharton & Co., the weights of rails used being fifty-seven pounds on the Tower Grove Park division, and a seventy-eight pound rail on the Forest Park division. The mistake was due to erroneous information given to our correspondent.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, DECEMBER 29, 1891, TO JANUARY 19, 1892, INCLUSIVE.

DECEMBER 29.

Electric Railway, Julius Emmer, Jr., Washington, D. C. 465,844
Electric Railway, Henry S. Pruyn, Hoosick Falls, N. Y. 465,886
Railroad Fish Plate, Moses G. Hubbard, Chicago, Ill. 465,985
Motor Car, Thomas C. Oakman, Aurora, Ill. 466,009
Rail Joint, Clark Fisher, Trenton, N. J. 466,095
Electric Railway Switch, Max Kerstein, Boston, Mass. 466,101
Safety Guard for Cars, Andrew J. Brown, Chicago, Ill. 466,115
Indicator for Railways, Edward G. Rowen, Boston, Mass. 466,141
Electrically Driven Locomotive, Everard H. Morgan, Dover, Eng. 466,180
Electric Railway Trolley and Support, Wilbur A. Stevens, Kansas City, Mo. 466,196
Electric Car Brake, La Motte C. Atwood, St. Louis, Mo. 466,212
Railway Tie and Chair, Theodore S. Brooks, Garrison's, N. Y. 466,218
Car Seat, Fred. H. Henry, Wakefield, Mass. 466,302

JANUARY 5.

Self Acting Safety Brake, David Mathias Gerhard, Minneapolis, Minn. 466,339
Cable Car, Augustin Martinez, Philadelphia, Pa. 466 355
Electric Railway Crossing, William Osner, Chicago, Ill. 466,362
Elevated Street Railway Car and Truck, Howe Paige, Minneapolis, Minn., 466,364
System of Electric Distribution, for railways, Nelson W. Perry, Cincinnati, O. 466,367
System of Electric Distribution for moving Translating Devices, Nelson W. Perry, Cincinnati, O. 466,368
Propulsion of Street, Tramway, or other Railway Cars or Carriages, John Hughes, Chester, England 466,415
Extensible Electrical Conductor, Benton C. Rowell, Boston, Mass. 466,427
Underground Conduit for Electric Railways, Charles P. Tatro, Spokane, Wash 466,471
Car Truck for Electric Railway Cars, Peter M. Kling, St. Louis, Mo. 466 539
Car Truck, John H. Bickford, Salem, Mass. 466,595
Means for Operating the Switches of Street Railways, William H. Farmer and Thomas White, Saginaw, Mich. 466,302
Hydraulic Variable Speed Gear, Louis Duncan, Baltimore, Md. 466 660
Hydraulic Variable Speed Gear, Louis Duncan, Baltimore, Md. 466,661
Hydraulic Variable Speed Gear, Louis Duncan, Baltimore, Md. 666,662
Lubricator for Trolleys, Edwin M. Doig, Denver, Colo. 466,737

JANUARY 12.

Fare Box, Henry C. McEnery, New Orleans, La. 466,797
Wire Support for Electric Railways, William Q. Prewitt, Lexington, Ky. 466,800
Electric Trolley, Elmer A. Sperry, Chicago, Ill. 4 6,807
Truck for Vehicles, Elmer A. Sperry, Chicago, Ill. 466,808
Clip for Rope Tramways, Andrew S. Hallidie, San Francisco, Cal. 466,880
Railway Electric Motor, Charles F. Winkler, Troy, N. Y. 466,914
Bracket for Trolley Wire Supports, Edward P. Russell, Newburyport, Mass. 466 956
Trolley for Electric Railways, John Kuehnle, Detroit, Mich. 466,981
Cable Tramway, William E Wilby and William M. Wilby, Birmingham, Eng. 466,987
Car Wheel, James T. Bridges, Hagerstown, Md. 466,988
Electric Motor, John H. Palmer, Boston, Mass. 467,048
Electrically Controlled Car Switch, Burt I. Potter, Boston, Mass. 467,050

JANUARY 19.

Air Circulating Mechanism for Railway Cars, Geo. R. Perry and William H. Perry, Concord, N. H. 467,195
Electro Magnetic Brake, Henry E. Walter, London, England, ... 467,243
Trolley for Electric Railways, Edwin R. Harding, Winthrop, Mass. 467,250
Car Brake, James McArthur, Rochester, N. Y. 467,257
Electric Railway Brake, Edmond Verstraete, St. Louis, Mo. 467,259
Street Car, George W. Baumhoff and August H. Hagemeier, St. Louis, Mo., 467,392
Metallic Railway Support, James M. Price, Philadelphia, Pa. 467,432
Electric Railway, Charles J. Van Depoele, Chicago, Ill. 467,448
Transferring Cable Cars from one line to a crossing line, James E. Morris, Chester, Pa. 467,457
Electric Railway Signal William F. Z. Desant, New York, N. Y. 467,476
Pull Gong for Street or other Cars, Ezra W. Vanduzen, Newport, Ky. 467,488

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

The Roundhay Electric Tramway.

146 ROUNDHAY ROAD, LEEDS, ENGLAND.

JANUARY 16, 1892.

MESSRS. CHAS. A. SCHIEREN & CO., 47 Ferry St., New York, U. S. A.:

GENTLEMEN—We are ordering to-day from you a supply of your electric belt stuffing, also a supply of your belt cement.

Will you kindly send us full instructions for splicing your perforated belts? It may interest you to know that the two belts furnished by you for this plant are giving every satisfaction, and have elicited considerable admiration from English engineers.

Yours truly, THE ROUNDHAY ELECTRIC TRAMWAY,
J. E. WINSLOW, Manager.

QUOTATIONS OF STREET RAILWAY STOCKS.

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 7 Exchange Place, Members of Boston Stock Exchange. Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	84½	85
West End Com'n	50	$7,150,000	J. & J.	5	1890-1891	72	72½

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co	100	$270,000	New.	...	Oct., 1887	94	95
Union R. R. Co., Prov	100	2,000,000	Q.—J.	2	1862-1863	185	190
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co	100	$300,000	J. & J.	4		200	225
Holyoke Street R. R	100	150,000	J. & J.	3		170	175
Northampton Street R. R	100	50,000		...		25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	3			65
Enterprise Ry. Co	25	250,000		...			8

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co		100,000	J. & J.	6	1915		
Enterprise Ry. Co		50,000	J. & J.	5	1906		

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE-SASSIER, 174 Common Street, New Orleans, La., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co	100	800,000	Quart.	1½	1867	118	122
Crescent City R. Co	100	1,150,000	"	1¾	1866	87	87½
Canal & Claiborne R. R. Co..	40	240,000			1888	22½	25
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	127	130
Orleans R. R. Co	50	185,000	"	2	1868	70	75
St. Charles Street R. R. Co ..	50	600,000	"	1½	1866	86	89

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	100½	
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93-'99		
do do new	1886	40,000	M & N	6	1896		
N. O. City R. R. Co	1879	495,200	J & D	6	1903	118	
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92-'06	113½	
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89-'01		

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4		140	
State Street Horse R. R. Co....	25	23,000	J. & J.	3		100	
New Haven & W. Haven R. R. Co	25			...		20	
New Haven & Centville H. R. Co.				...			
Whitney Ave. Ry. Co	50	25,000		...		7	
Bridgeport Horse R. R. Co	100	140,000		...			
Hartford & Westfield Horse R. R. Co	100	200,000	J. & J.	3		125	

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	22,000	J. & J.	7	Jan., 1894	105	
New Haven & W. Haven R. R. Co	1889	50,000	J. & J.	5	July, 1899	100	
Bridgeport Horse R. R. Co		50,000		6			
Hartford & Wethersfield Horse R. R. Co., Deb. Series A	1888	100,000	M. & S.	5	Sept., 1908		
Hartford & Wethersfield Horse R. R. Co., Deb. Series B	1890	100,000	M. & N.	5	May, 1910		
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued)		100,000	M. & N.	5	May, 1910		

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co	50	1,250,000	Q.—J.	1½		104	106
Broadway R. R. Co	100	525,000	Q.—F.	2		185	
Brooklyn City R. R. Co	10	6,000,000	Q.—J.	2		170	
Coney Island & Brooklyn R. R. Co	100	500,000		...		120	

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort		140,500	M. & N.	7	May, 1894	104	
Atlantic Ave. R. R. Co. Cons.		900,000	A. & O.	5	Oct., 1909		106
Broadway R. R. Co		350,000	J. & J.	5	6 m. notice	100	
Coney Island & Brooklyn R. R. Co., 1st bonds		300 000	J. & J.	5	Jan., 1909		103
Coney Island & Brooklyn R. R. Co., certificates		300,000	J. & J.	6	July, 1894	100	
South Brooklyn Central R. R. Co., 1st		125,000	F. & A.	7	Aug. 1897	107	
South Brooklyn Central R. R. Co., 2d		150,000	F. & A.	6	July, 1941	103	
Brooklyn City R. R. Co., 1st		3,000,000	J. & J.	5	July, 1916	104	106

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Aug.	1½	1890	107	108
Watervleit Turnpike & R. R. Co	100	240,000		...	1863	10	15

BONDS.*	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	103	
" " " 2d Mort	1873	20,000	M. & N.	7	1893	102	
" " " 3d Mort	1875	28,500	J. & J.	7	1895	105	
" " " 4th Mort	1880	11,500	M. & S.	6	1905	103	
" " " 5th Mort	1888	50,000	M. & S.	5	1913	105	
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103	104
" " " Debenture	1891	200,000	M. & N.	6	1901	109	111
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	95	98
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919		70

*In bonds buyer pays accrued interest.

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾		25	27
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2		205	205
Brooklyn City	10	2,000,000	Q.—F.	2		165	170
Brooklyn Crosstown	100	500,000	A. & O.	4			
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2		104	108
Christopher & Tenth	100	650,000	F. & A.	1¾		115	116
Central Crosstown	100	600,000	Q.—F.	1¾		125	130
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2		125	135
42d & Grand St. Ferry	100	748,000	Q.—F.	3		230	240
42d St., Manhat. & St. Nich. Av.	100	2,500,000				37	40
Eighth Avenue	100	1,600,000	Q.—J.	2		105	110
Houston, W. St. & Pav. Ferry. Leased to B'way & 7 ave	100	1,000,000	Q—F.	2		160	
Second Avenue	100	1,862,000	J. & J.	5		95	100
Sixth Avenue	100	1,500,000	M. & S.	3		130	150
Third Avenue	100	2,000,000	M. & N.	4		290	305
23d St	100	600,000	Q.—F.	2½		220	230
Ninth Avenue	100	800,000		3		90	95

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry		700,000	J. & J.	7	July, 1900	110	
B'way & 7th Ave., 1st mort		1,500,000	J. & D.	5	June, 1904	105	107
2d mort		500,000	J. & J.	5	July, 1914	105	106
Broadway Surface Guaranteed		1,500,000	J. & J.	6	July, 1924	106	107
Additional		1,000,000	J. & J.	5	July, 1905	93	95
Brooklyn City		200.000	J. & J.	5	Jan., 1902	105½	107½
Brooklyn Crosstown		200,000		5	1902	107	109
Cen'l Park, North & East River		1,200,000	J. & D.	7	Dec., 1902	114	116
Christopher & Tenth		250,000	A. & O.	7	Oct., 1898	112	114
Central Crosstown		250,000	M. & N.	6	Nov., 1922	118	120
Dry Dock, E. B'way & Battery. 1st mort		840,000	J. & D.	7	June, 1893	104	106
Scrip		1,200,000	F. & A.	6	Aug. 1914	98	100
42d & Grand St. Ferry		236,000	A. & O.	7	April, 1893	110	112
42d St. Manhat. & St. Nich. Av 1st mort		1,200,000	M & S.	6	Sept., 1910	112	114
2d mort		1,200,000	J. & J.	6	1915	38	39
Eighth Ave., Scrip		1,000,000	F. & A.	6	Aug., 1914	105	110
Houston, W. St. & Pav. Ferry.		250,000	J. & J.	7	July, 1894	109	111
Second Avenue		1,600,000	M. & N.	5	Nov., 1909	102	103
Third Avenue		5,000,000	J. & J.	5	Jan., 1937	110	115
23d St		250,000	M. & N.	7	May, 1893	108	110

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$600,000	M. & N.	4	May, '91.	186	190
Ditto new shares (100% paid	50	300,000	.....	...	.....	185½	190
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	68	70
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	18	19
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	94	95
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	112	113
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	112	113
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City.....	100	$7,000,000	Q.—J.	3	.....	310	315
Chicago Passenger.....	100	1,000,000	A. & O.	2½	.....	....	96
North Chicago City.....	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street.....	100	5,000,000	J. & J.	4	.....	177	177½
West Division City.....	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street.....	100	10,000,000	Q.—F.	1½	.....	133	133¼
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City.....	.....	4,000,000	J. & J.	4½	.....	97½	98½
Chicago Passenger.....	1883	400,000	F. & A.	6	1903	105	109
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,640,000	M. & N.	4½	1927	93¾	94
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	.....	99
West Division Railway.....	.....	3,790,000	J. & J.	5	.....	101	101½
" " " Ext....	.....	250,000	J. & D.	6	.....	100	100¼
West Chicago Street.....	.....	4,160,000	M. & N.	5	.....	101	101½
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	98

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co ...	50	1,500,000	.....	..	.....	24	24¾
Citizens' Traction R. R. Co..	50	3,000,000	J. & J.	3	.....	61⅜	62
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	18⅜	18½
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	....	50
Federal St. & Pleasant Valley	50	1,300,000	J. & J.	3	.....	22¾	23
Pittsburgh, Allegheny & Man	50	3,000,000	....	...	.....	36	37
West End R. R. Co.....	50	200,000	J. & J.	...	.....	70	.....
Second Avenue R. R. Co.....	50	300,000	J. & J.	3	.....	48	52½
Penn Incline Plane Co.....	50	250,000	.....	.....	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	....	20
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	40	.....
Pittsburgh Incline Co.....	100	150,000	.....	...	.....	115	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co ..	1887	1,250,000	A. & O	5	1927	107	108
Pitts. & Birmingham Traction Co.....	1889	1,500,000	M. & N.	5	1929	95	95½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	.. .	104
Pleasant Valley R. R. Co.....	1891	300,000	J. & J.	5	1919	.....	.....
P., A. & M. R. R. Co.....	1891	1,500 000	J. & J.	5	1931	102	109½
Duquesne Traction Co.....	1890	1,500,000	J. & J.	5	1930	.....	98
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.....	1889	375,000	J. & J.	5	1919	.....	.....
Pleasant Valley R. R. Co.....	1873	75,000	J. & J.	6	1903	.....	.....
Union R. R. Co.....	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.....	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.. ...	6	1901	....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.....	1883	125,000	.....	6	1903	.....	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	....	.....
Monongahela Inc'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.....	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.....	100	1,000,000	Monthly	5	....	115½	118
Central R. R. Co.....	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R.R. Co	100	1,000,000	.....	1	.....	90	110
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	45½	53
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	37	40
Omnibus Cable Co.....	100	2,000,000	Monthly	4	.....	65	70
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	20	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House.....	.....	650,000	M. & S.	6	1914	102	104
Market Street R. R.....	.....	3,000,000	J. & J.	6	1913	119½	120¼
Omnibus R. R.....	.....	2,000,000	A. & O.	6	1918	114	114¾
Powell Street R. R.....	.....	700.000	M. & S.	6	1912	111½	115
Park & Ocean R. R.....	.....	250,000	J. & J.	6	1914	110	115
Park & Cliff House R. R.....	.....	350,000	J. & J.	6	.....	93½	97½
Cal. St. Bds. R. R.....	.....	.....	.....	.....	.....	101⅜	102

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Jan. 18.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.....	100	$324,000	Q.—J.	3	1864	100	.....
Cass Ave. & Fair Grounds.....	50	300,000	.....	...	1876	44	50
Citizens'	100	1,500,000	A. & O.	1¼	1887	100	105
Jefferson Avenue.....	100	112,000	.....	..	1885	200	300
Lindell.....	100	2,500,000	Q.—J.	...	1890	56	60
Missouri.....	100	2,000,000	Q.—J.	2	1891	225	250
Mound City.....	100	1,000,000	.....	..	1890	190	200
Northern Central.....	100	200,000	.....	...	1884	100	105
People's.....	50	1,000,000	M. & S.	6	1889	40	45
St. Louis.....	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal.....	50	150,000	Jan.	.50	1872	15	25
Union.....	50	600,000	.....	...	1870	20	25
Union Depot.....	100	1,200,000	.....	...	1790	200	250
St. Louis & Suburban.....	100	1,000,000	... .	...	1891	10	15
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine.....	1880	$500,000	F. & A.	6	1900	102	102½
Cass Avenue.....	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable.....	1887	1,500,000	J. & J.	6	1907	106	107
Lindell.....	1890	1,500,000	J. & J.	5	1895-1910	99	100
Mound City.....	1890	525,000	A. & O.	6	1900-1910	104	105
Missouri Cable.....	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort.....	1882	125,000	J. & D.	6	1902	102	105
" 2d mort.....	1886	75,000	M. & N.	7	1902	104	105
People's Cable.....	1889	800,000	J. & J.	6	1889-1914	97½	100
Northern Central.....	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable.....	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union.....	1885	150,000	M. & N.	6	1895-1915	102	103
Union Depot.....	1890	1,600,000	A. & O.	6	1900-1910	104	105

PHILADELPHIA STOCKS AND BONDS.—Corrected by ROBERT GLENDINNING & Co., 143 So. Fourth st. (Bullitt Building), Philadelphia, Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'.....	50	$500,000	Q.—J.	4	1858	250	.....
Continental.....	50	1,000,000	J.—J.	6	1873	120	122
Frankford & Southwark.....	50	1,250,000	Q.—J.	6	1854	196	200
Germantown.....	50	1,500,000	Q.—J.	...	1858	97½	98
Green & Coates...	50	500,000	Q.—J.	3	1858	118	120
Hestonville...	50	2,050,000	.....	...	1859	30	34
Lombard & South.....	25	500,000	A.—O.	8	1861	60	62
People's Common.....	25	1,500,000	M.—S.	2½	1873	42	43
" Preferred.....	25	750,000	M.—S.	2½	.....	43	.....
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	145	146
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	67	.....
Philadelphia Traction.....	50	5,000,000	M.—N.	3	1883	56	58
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	200	205
Second & Third.....	50	1,060,200	Q.—J.	4½	1853	145	150
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	190	192
Union.....	50	1,250,000	J.—J.	9½	1864	170	171
West Philadelphia.....	50	750,000	J.—J.	10	1857	175	176
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	84	84½
Baltimore Traction.....	25	5,000,000	.....	...	1889	19	19¼
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	25	30
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	15	20
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	106½	.....
" " Imp.	1892	1,250,000	M.—S.	6	1901	102½	.....
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort..... ...	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-standing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co	1889	2,500,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & CO., Bankers and Brokers, 26 West Third Street, Cincinnati, Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	108¾	109
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	109	109½
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	120	123½
Mt. Auburn Cable	100	300,000	.....	...	.....	47½	50
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	52	55
" " " Pref.	100	100,000	.....	6	.....	90	92½
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	102	.....
" "	.....	50,000	J. & J.	7	July, 1894	104	.....
" "	.....	50,000	J. & J.	7	July, 1895	.....	110
" "	.....	50,000	J. & J.	7	July, 1896	108	112
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	103½	.....
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	.....
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	107½	115
" " " "	.....	300,000	J. & J.	6	Jan. 1914	104	105
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	100	103
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & CO., Bankers, 9 South Street, Baltimore, Md., Jan. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	60	65
Union Pass. Ry. Co	50	750,000	.....	...	.....	.....	.....
Highlandtown & Point Breeze Ry. Co	50	189 000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	19	19½
North Balto. Pass. Ry	25	600,000	Sem an	3	.....	31	32
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry	1882	250,000	J. & J.	6	1912	110	112
Union Ry. Co. 1st mort	.....	50,000	M. & N.	6	.....	105	.....
" " cons. mort	.....	1,500,000	.....	5	.....	93	100
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	106	106½
City Pass. R. R. Co	1891	2,000,000	"	5	1911	107½	108

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & CO., Bankers, 1344 F Street, N.W., Washington, D. C., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	235	250
Metropolitan R. R.	50	750,000	Q. J.	...	1864	95	104
Columbia R. R.	50	400,000	Q. M.	...	1870	63	70
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	41	42¼
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	31	40
Georgetown & Tenallytown	50	200,000	.....	...	.....	48¾	52
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	101½	104
do. do. convert.	'83-'91	2.000,000	J. & J.	6	1899-1929	149	155
Eckington & Soldiers' Home.	.....	100,000	J. & D.	6	1896-1911	93	.....
Capitol & North O St. R. R.	1891	250,000	J. & J.	5	1921	108¾	114
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	115	117

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	170	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	75	78
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

The Street Railway Stock Market.

While there are four of our City street railway stocks, and one Brooklyn street railway stock, besides the Manhattan Elevated Road, listed on the New York Stock Exchange, with the exception of the Manhattan securities, which are always active, no quotations upon the others have been made on the floor of the Stock Exchange for a long time; so long, in fact, that one of the largest dealers in street railway securities recently said he could not recall a sale in the Exchange for several years.

This state of affairs shows that, up to date, street railway stocks are a class of securities to be dealt in privately, and in each case when a sale is attempted, by indvidual explanations not well understood by the investing public generally; which means, that this class of stocks and bonds costs more labor and talk to sell them than those of the steam railways most active on the Exchange. Such a condition of things tends to keep street railway stock values lower than would be the case if all investors were fully acquainted with them.

Because of this keeping in the background, which may be due to the horse car system as a slower means of street railway communication, the general state of the street railway stock market is almost wholly dependent upon the condition of the general market for all securities, as is shown in the purchases and sales upon all of the exchanges in the country. That is, up to date, street railway securities are more or less regulated by outside active values than by their intrinsic merit. Now, this, in view of the rapid changes taking place in all parts of the country through the introduction of the electric and cable systems, and the necessity to obtain with greater facility the large sums of money required for their establishment, may at an early day alter the prevailing condition of things through the adoption of stock exchange methods to make such securities better known, to the end that street railway shares may be bought and sold for what they are worth, regardless of the relation of other securities.

But as it is now our business to record matters as they are rather than what they ought to be or may become, it is interesting to note that the general state of the stock market during the last month has been on the whole firm, to rising. And it is safe to forecast a continuance of this state of affairs, provided no unforeseen catastrophe occurs, such as a large failure or series of small ones, or some stoppage arises to the prevailing tendency towards larger purchases of all good securities. Of course these "provideds" are numerous enough, as they cover all misfortunes sufficiently large to affect the general market, but we can safely say that the present is the best time we have had for nearly two years to float new street railway companies, securities. The greatest argument in favor of a bull market we have had since our last issue is, the dispatches from France that that country is becoming an active buyer of our securities. This information is of momentous consequence; so large in fact that few people, if any, are able to calculate the large benefits our commercial prosperity is likely to get out of it. We have no space here to explain the details of this significant movement, but feel safe in saying that if the French are not defrauded by some of our wildcat affairs before they learn of the solid merit of our good securities, that Nation alone is competent to offset many another ill, which without its aid might prove most disastrous.

Our steam railway earnings—gross—for December,

went ahead of any figures for the year, or about eight per cent. in excess of the same month in 1890; this large matter added to the increased purchases of our stocks in England, the heavy crop transportation movement from the interior to our seaboard, the fair condition of trade throughout the country, and the recent increased demand for bonds on our Exchange, puts an altogether promising outlook upon all stock transactions. Gross railway earnings for January show a slight falling off in the rate of increase shown in the December figures, which is as much due to snow blockades and severe winter weather as any other cause, for there yet remains more grain to be hauled than the railways can take care of; at the same time January's figures are somewhat larger than a year ago. Money has been decidedly easier during the past month, and to such an extent that the savings banks and big insurance companies have been obliged to buy railway securities in order to keep their money moving. This fact is likely to affect the general market in a favorable way, as all additional buyers tend to put up prices.

It is an open question with some financiers whether the prevailing quotations of stocks have not already risen during the past year as much as the increased railway earnings and other favorable conditions warrant; for such advance is shown to be an average of twenty per cent. among the more active stocks, while the increase in actual dividends would warrant only about a seven per cent. rise. At the same time the abnormally low prices at January 1, 1891, must be taken into the calculation. J. M. B.

Financial.

THE Georgetown (Ky.) Street Railway Co. have declared a semi-annual dividend of four per cent.

$ $ $

THE Springfield (Ill.) Electric Railway Co. have certified to an increase of capital stock from $50,000 to $100,000.

$ $ $

THE directors of the Jersey City (N. J.) & Bergen Railroad have declared a semi-annual dividend of five per cent.

$ $ $

THE Union Street Railroad Co. of New Bedford, Mass., declared a quarterly dividend of two per cent. on January 14.

$ $ $

THE Murphysboro (Mo.) Street Railway Co. have filed a certificate of decrease of capital stock from $25,000 to $11,000.

$ $ $

THE stockholders of the Erie (Pa.) Motor Co. have voted to increase the bonded indebtedness of the company $150,000.

$ $ $

THE City Passenger Railway Co., of Wilmington, Del., have declared a semi-annual dividend of two and a half per cent.

$ $ $

THE stockholders of the Redlands (Cal.) Street Railway Co. propose to increase the capital stock of that company from $50,000 to $75,000.

$ $ $

THE West End Street Railway Co. of Rockford, Ill., have filed a certificate of the increase of their capital stock from $30,000 to $75,000.

$ $ $

THE earnings of the Atlanta (Ga.) Consolidated Street Railway Co. for November were $28,400, as against $24,290 for the corresponding period last year.

$ $ $

AT the annual meeting of the Johnstown (N. Y,) Gloversville & Kingsboro Street Railroad Co. a dividend of three per cent. on the capital stock was declared.

$ $ $

THE gross earnings of the Galveston (Tex.) City Railway Co. for 1891 reached $156,000, which represents 3,120,000 passengers carried, or an increase in earnings of about $23,000 over last year.

$ $ $

THE United Electric Railway Co., of Nashville, Tenn., will issue $200,000 of second mortgage income bonds. The Nashville Trust Co. are trustees. The coupons are payable in cash or in tickets.

$ $ $

STOCKHOLDERS of the Green Lake Electric Railway Co. of Seattle, Wash., have bonded the road for $50,000. The bonds will be of $500 denomination, running twenty years and drawing six per cent. interest.

$ $ $

THE Metropolitan Street Railway Co., of Springfield, O., have voted to increase their stocks from $500,000 to $600,000 and to issue $50,000 more in bonds. The money to be thus obtained is to be used in extensions.

THE Lynn Belt Line Street Railway Co., for 1891, show cash and cash assets of $10,450.64, a surplus of $9,357.84. This income was $62,432.90, including $6,368.01 balance from last year. The passenger earnings were $54,139.40. The cost of construction was $185,200.

$ $ $

THE Newton (Mass.) Street Railway Co. have received authority from the State Railroad Commissioners to increase their capital stock from $100,000 to $135,000. The proceeds of the new stock will be used for improving the road's equipment, and probably also for the extension of the line to Auburndale.

$ $ $

NOAH HARDING, of the Fort Worth National Bank, was appointed last month by Judge Beckman as receiver of the North Side Street Railway Co. A bond of $50,000 was executed. with K. M. Van Zandt J. B. Ellison and J. J. Jarvis as sureties. The receiver was appointed at the request of Thomas Worthington.

$ $ $

THE annual report of the Concord (N. H.) Street Railway Co. showed the number of passengers carried from February 1 to December 31, 1891, 331,386; earnings for same time, $26,179.14; number of miles run, 95,822; addition to buildings and steam plant, $7,964,65; addition to rolling stock and cars, $9,374.87.

$ $ $

THE Metropolitan Street Railway Co., of Springfield, Mo., have voted to increase their capital stock from $500,000 to $600,000 and their bonded debt from $500,000 to $550,000, and to issue an entirely new series of bonds of the amount of $550.000, bearing five per cent. interest per annum, payable semi-annually in gold.

$ $ $

THE Lowell (Mass.) & Suburban Street Railway Co. have filed a mortgage of their property for $1,000,000 to the American Loan & Trust Co., of Boston. The bonds are to be $1,000 each, running twenty years at five per cent. The money will be used for extensions and for equipping the road with electric power.

$ $ $

THE Portland (Me.) Street Railroad Co. show as their gross passenger earnings of the year, $148,555.67; total earnings, $149,399.13; operating expenses, $127,880.09; taxes, $2,821.30; net income, $15,295.96; present surplus, $3,295.96. The total number of passengers carried during the year was 2,976,225, an increase over the previous year of 193,439.

$ $ $

"THE West End Street Railway's Stock," says the Boston *Advertiser*, "at seventy two and a fourth looks cheap, and we have no doubt that investors will soon begin to look at it in that way. Cambridge people seem very much enamored over the double deck cars that have been put on that line. They are said to run perfectly and be practically noiseless, producing no grinding or whistling sound."

$ $ $

THE Dubuque (Ia.) Electric Railway Light & Power Co. have filed with the county recorder a mortgage to Joe R. Lane of Davenport, trustee, to secure $200,000 of six per cent. bonds of $500 each, running until 1897. $50,000 of the proceeds of the sale of these bonds is to be applied to the redemption of the former issue, and $150,000 to the extension of the plant. The mortgage is not a first mortgage.

$ $ $

THE last annual report of the Reading, (Pa.,) City passenger Co. showed that the total receipts last year were $289,435.04. The operating expenses were $120,518.90. There was expended for new construction $45,897.04, and for increased equipment $10,300, making total expenditures of $281,424.66, leaving an actual cash balance of $8,010.38. The capital stock was increased from $300,000 to $400,000. The company carried 3,527,920 passengers.

$ $ $

THE report of the North Chicago Railroad Co. for the year 1891, was presented to the stockholders on Jan 11 by President Yerkes. During the year the receipts from passengers were $2,217,440. Operating expenses were $1,221,408, leaving a gross profit of $696,032, an increase of $245,267. There were 44,343,905 passengers carried, and 7,762,366 miles of road covered. The net profit is $613,458, which gives a dividend of 12¼ per cent. on the capital stock.

$ $ $

BROOKLYN (N. Y.) City & Newtown Railway Co. have made the following report for the last quarter of 1891: Gross earnings, $107,685; operating expenses, $78,642; fixed charges, $18,461; net income, $10,581; profit and loss, surplus, $55,070. Van Brunt Street & Erie Basin Railway Co. have made the following report for the same period: Gross earnings, $9,512; operating expenses, $6,544: fixed charges, $615; net income, $2,352; profit and loss, surplus, $25,138.

$ $ $

THE annual reports of the East Reading Electric and Reading & Southwestern Street Railway companies, operating suburban lines, also showed them to be in a flourishing condition. The latter company, in existence only four months, declared last month a dividend of two and a half per cent. They have five and a half miles of road, and the total cost of construction and equipment amounted to $124,581.63. The road has been earning money every day since it was opened to travel, and was built free of bonded indebtedness.

$ $ $

THE annual report of the Newark, (O.) & Granville Electric Railway Co. for the last fiscal year showed receipts for the year as follows: Cash car fare, $13,374.65; tickets collected $5,801.85; freight, $924,-

87; U. S. Express, 414.07; U. S. Mail, $357.29; total, $20,872.73; total expenditures, $20,039.86; balance $832.87. The increase in business over last year was $10,612.22, or more than double. Although no dividends as yet have been paid to the stockholders, the prospects are that they will realize from their investments in the near future.

$ $ $

THE Harvey (Ill.) Transit Co. have given to the Atlantic Trust Co., of New York, a mortgage to secure payment on an issue of $150,000 bonds running twenty years at six per cent., the interest payable semi-annually. The bonds are divided into 115 bonds in denomination of $1,000 and seventy bonds of $500 each. Of these $35,000 are to be held in trust to be delivered to the company upon the extension of the works to the amount of at least 100 per cent. of the bonds to be issued and that the income from these extensions amounts to at least six per cent. upon the bonds to be thus issued.

$ $ $

THE People's Passenger Railway Co. of Philadelphia, Pa., held their annual meeting January 12, The annual report stated that the past year had been a most prosperous one, notwithstanding that grain and all other commodities have been unusually high. The increased cost of grain alone was $35,000. The total number of passengers carried was 34,210,823; total income, $1,233,939; cost of operation, $757,750; net income, $476.239. Of this $259,884 has been paid in interest and fixed charges, and two dividends at $1.25 per share on 83,000 shares, amounting to $207.500 were paid, leaving a net surplus of $8,555.54.

$ $ $

DURING December the receipts on the Brooklyn Bridge from the carriage way were $7,145.67, and from the railway $98,472.90, a total of $105,618.57. The expenditures were $295,748.34. At the end of the month the cash in bank and on hand amounted to $163,180.32. The number of passengers carried on the railway during the month was 3,590,640, a daily average of 115,827 as compared with a daily average for November of 114,323. The cash fares very nearly equal the number of tickets sold in bunches, and, according to the directors, are increasing more rapidly than the sale of tickets in bunches.

$ $ $

DURING the last week of December a sharp rise took place in Chicago City Railway stock, the price going from 280 to 300. The demand was occasioned by a rumor that a large block of Alley elevated stock was to be divided among the city railway stockholders in the shape of an extra dividend. A pro rata division of the elevated stock held by the City Railway would, it is said, give to every holder of 100 shares of the City Railway stock nearly thirty-six shares of elevated railway stock. The capital stock of the elevated road is $7,500,000 and its mortgage authorizes an issue of an equal amount of bonds.

$ $ $

THE Financial statement of the West End Street Railway Co. of Boston for the quarter ending Dec. 31, 1891, the first quarter of the fiscal year, shows in comparison with the corresponding period for the preceding year as follows: Oct 1 to Dec. 31, 1891, $1,549,496; 1890. $1,493,584; increase, $55,913. Expenses and charges—1891, $1,270,249; 1890, $1.330,526; decrease, $60,276. Balance, 1891, $279,147; 1890, $163,058; increase $116,189. As will be seen, the road did not maintain its average gross increase of $1,000 per day, but the savings from operations and charges made the net gain $1,262 per day, including Sundays.

$ $ $

A DISAGREEMENT occurred last month between the governing committee of the Baltimore Stock Exchange and the Baltimore City Passenger Railway Co. in regard to the transfer of certain certificates of the latter company, and upon the refusal of the management of the company to comply with the demands of the Exchange committee, the latter caused the stock to be stricken from the Exchange list. Their action created considerable talk and unfavorable comment in financial circles. The stock will probably be listed again, but the approval of the Board of Governors of the Exchange will be required, and a deposit of twenty-five cents a share, besides the commission on the sales, demanded by the by-laws. No agreement has yet been reached.

$ $ $

IN regard to the stocks and bonds of the Chicago street railway companies generally the financial writer of the *Times* says in his review of the year: "All of the street railway companies are making money rapidly, and it is no wonder that their stocks and bonds find such great favor with the investing and speculating public. They have always had a monopoly in carrying passengers, and even when the elevated railways are in operation they will still have all they can attend to, for the city is growing wonderfully. Already they have reached the point where they are unable to do the vast work required of them promptly. The cable lines have proved to be inadequate to meet the heavy demands made on them, and their managers are lying awake nights trying to devise some means for prompt transit, without the constant breakdowns and delays that now annoy passengers. The coming World's Fair will involve the carrying of vast numbers of people, and after the necessary expenditures are made for cars and other equipment the companies will be in a position to make money at a rate never known before. Higher dividends will be paid and shares of all the lines will doubtless sell during this and next year above all former records.

The Syracuse Poles.

Those who expect to buy metal poles for electric railway construction, will be interested to know that the Syracuse Tube Works have, during January, doubled the capacity of their metal pole department. This company have also just made a contract with the Engineering Equipment Co., of 143 Liberty Street, New York, for the exclusive sale of the Syracuse pole in the Atlantic seaboard states. Already some large orders have been taken by the Engineering Equipment Co. and satisfactorily filled by the Syracuse Works. A very large number of the most approved patterns of tubular poles can be turned out weekly, so that contracts will be taken for the delivery of any given number of poles at a certain date under guarantee as to shipments. In this number of the JOURNAL will be found an illuminated advertisement of the poles. The manner of swaging the joints and strengthening the tubes is peculiar to this pole, and the tests under strain for deflections, have proven eminently satisfactory. The poles can be seen, erected, along some of the largest electric railway lines in the East, among them being, for instance, the Paterson and Trenton street railways.

What the Papers Say About It.

This road has long been noted for the beauty of its scenery, the elegance and comfort of its equipment, and as the greatest through car line on the American continent.

The main line is 450 miles in length and connects the cities of Chicago and Buffalo, with branch lines to the oil regions of Pennsylvania, Fort Wayne, Ind., and to the flourishing cities of Detroit, Jackson, Lansing, Kalamazoo, and Grand Rapids in Michigan. The main line passes through such important cities as Dunkirk, N. Y., Erie, Pa., Cleveland, Sandusky and Toledo, O., Adrian, Hillsdale, Mich.; and Goshen, Elkhart, South Bend and La Porte, Ind.

The roadbed is unsurpassed by any line in the country, and under the great improvements made during the past two years in the way of reducing curves and grades, the Lake Shore is to-day a line practically without a grade or a curve, a thoroughly constructed double-track railway, facts which give increased popularity and which have made it the favorite passenger line between the East and West, standing in the front rank among the great transportation companies of the world, a shining example of the careful, considerate, and progressive policy of its management, the double tracks permitting of a high rate of speed with entire safety, the perfect roadway giving ease and comfort to its patrons.

The equipment of its trains is, indeed, of a very high order of excellence. The sleeping, drawing-room and dining cars are of Wagner build, and nothing which the ingenuity of man could suggest for the comfort and welfare of passengers is omitted in their make-up.

The Lake Shore enjoys the distinction of being the line selected by the United States Government as the route of the fast mail trains—three daily trains being devoted almost exclusively to this branch of business—and forms in connection with the New York Central & Hudson River Railroad the greatest through mail line in the world, the line between New York and Chicago. No higher compliment could be paid to its management, and the road certainly merits the trademark it has adopted—the mail pouch.

The country traversed by it represents the richest portion of the Middle States. Its connections with other railways being made in almost every case in Union passenger stations of necessity calls to its line the people from a large territory tributary to its own immediate neighborhood. Its universally recognized excellent through train service between the cities of New York, Boston and Chicago, which has recently been increased by the addition of two new trains making thirteen through trains between the cities mentioned, ten of which are daily, has attracted the attention of people throughout the Eastern country and in Europe.

The magnificent passenger station on Van Buren Street, occupies a central position in the city of Chicago, convenient to all hotels, banks, postoffice and street railway lines, and secures to travelers immunity from the annoyance of of a long transfer across the city.

Another cause of the Lake Shore's popularity is the fact that it is the only line conveying passengers over the four track New York Central into the City of New York without a ferry transfer.

WE PURCHASE

Total Issues of Street Railway Bonds.

CORRESPONDENCE INVITED.

N. W. HARRIS & CO.,

BANKERS,

163 Dearborn Street Chicago,

15 Wall St., New York. 70 State St., Boston.

SPECIAL NOTICES.

FOR SALE.

FOR SALE.—38 lb. girder steel rails (side bearing) for relaying. S. P. S. Ellis, Penn Building, Pittsburgh, Pa.

FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

FOR SALE.—11 standard gauge, very light, double end Street Cars, seating 12, repaired and repainted by us in excellent manner. Very suitable for trail cars. Payment cash or on car trust. HUMPHREYS & SAYCE, 10 Wall Street, New York. 1t

FOR SALE—STREET CARS.—On account of increase of business calling for larger cars, we have for sale 9 twelve-foot double-end, box cars, with fare box in each end. Gauge 4 feet 8½ inches. Apply to UNION STREET RAILWAY Co., New Bedford, Mass.

HELP WANTED.

WANTED.—A thoroughly experienced superintendent to take charge of a street (horse) railway. No attention paid to applications unless name, salary expected, and other full particulars are given. Address "RICHARDSON," care of STREET RAILWAY JOURNAL. 1t

POSITIONS WANTED.

WANTED.—Position as trackmaster, 25 years' experience, 11 years with last company. Address "TRACK," care of STREET RAILWAY JOURNAL. 1t

WANTED.—A young practical railroad man, of twelve years' experience, desires the management of a road. Address "K," care of STREET RAILWAY JOURNAL. 1t

WANTED.—An active, practical young man, 12 years' railroad experience, desires to purchase an interest in a property which he can manage. Address "BUYER," care of STREET RAILWAY JOURNAL 1t

WANTED.—S. P. S. Ellis, Penn Building, Pittsburgh, Pa., representing Johnson Company of Johnstown, Pa., invites correspondence with manufacturers desiring to be represented in Pittsburgh and vicinity.

WANTED.—A first class cable road ropeman, capable of making the inlaid splice and doing all work connected with cables. Must come well recommended for steadiness and sobriety. Address, stating experience and salary expected, "SPLICER," care of STREET RAILWAY JOURNAL, New York. 1t

WANTED.—A man with over 10 years' experience, desires a position to take charge of the inspection and detective department of a street railway company in any part of the country. Can furnish the best of references regarding ability, etc. Address "W. F. G.," care of STREET RAILWAY JOURNAL. 4t

WANTED.—By a thoroughly practical mechanical and electrical engineer a position as superintendent or manager of an electric road. To any company about changing from horse to electric power, I will guarantee a great saving. Am competent to purchase and install both steam or electric plants of the best for the least money. Can furnish 15 years' references, which will include my record as an occasional manager and a reliable man whose whole time is given to the interests of any company by whom I am employed. Address "ECONOMICAL MANAGER," care of STREET RAILWAY JOURNAL. 3

WANTED RAILS.

We are in the market for 40 tons of either T or tram rails of not more than 25 lbs. nor less than 20 lbs. per yard. Purchase to be made in February. Parties having rails of the above description will please let us hear from them stating terms, condition of rails, etc. Address CENTRALIA AND CENTRAL CITY ST. RY. CO. S. N. PIERCE, President, Centralia, Ills. 1t

WITHDRAWAL OF AGENCY.

Until further notice we have withdrawn our agency in Chicago, lately controlled by Mr. G. A. Harmount, Monitor Electric Company, No. 149 Wabash Avenue.

All communications or orders to be addressed direct to Alfred F. Moore, Manufacturer of Insulated Electric Wire and Cables, Office and Works, No. 200 N. 3d Street, Philadelphia, Pa.

FOR SALE.

125 tons second-hand 38 lb steel tram rails, in excellent condition.
100 tons second-hand 25 lb steel T rails, but little used.

D. E. GARRISON & CO., - - 219 N. 4th St. Louis, Mo.

FOR SALE CHEAP.
FARE BOXES.

G. I. M. Slawson Fare Boxes, 4 Wales Manufacturing Co,
Fare Boxes Will be Sold Very Cheap by the

OSWEGO STREET RAILWAY CO.,
OSWEGO, N. Y.

CAR AND CARRIAGE MANUFACTURERS

Should write for

SAMPLE BOX OF NATURAL RUBBING STONE.

SENT FREE OF CHARGE. CHARGES PREPAID.

Does not scratch or clog on the surface, and cuts rapidly. Sold on positive guarantee to give satisfaction.

A. L. SIMMONS, - Geneseo, N. Y.

FOR SALE.

350 Tons 48 lb. Chicago Pattern Slot Rail,
2 Walker U Frames with 12 ft. Staggered Arm Sheaves,
4 Walker U Frames with 10 ft. Staggered Arm Sheaves,
1 Set Double Cable Driving Machinery with Four Ring Walker Differential Drums,
1 Hazelton Tripod Boiler, 150 H. P.,
1 " " 300 "

All the above but little used and in excellent condition.

CONSOLIDATED STREET RAILWAY CO.,
GRAND RAPIDS, MICH.

FOR SALE.

Electric Cars,

BOTH OPEN AND CLOSED.

QUICK DELIVERY AND AT LOWEST PRICES AND ON LONG TIME. THEY ARE REAL BARGAINS.

For Particulars write to

NEW YORK EQUIPMENT CO.,
15 Wall Street, NEW YORK.

STEEL RAILS.

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Street Rail and Tram Roads.

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Humphreys & Sayce,
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C. E. LOSS & CO.,

RAILWAY CONTRACTORS,

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Contract for Road-bed Construction and all Materials, also for Entire Equipment.

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OF THE HIGHEST TYPE AND in ALL SIZES, ARE MADE BY

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THE STREET RAILWAY JOURNAL

Vol. VIII. *NEW YORK & CHICAGO, MARCH.* *No. 3.*

Cincinnati Street Railways.

Our readers are already familiar in a general way with the transit facilities of this progressive city. All the leading systems of traction are employed, including electric traction by the single and double trolley, with motors of all the leading types; cable traction, both by the grip and incline plane systems, animal traction, for which both horses and mules are employed. Electricity, however, is taking the lead, and soon the horse and mule will retire from the street railway field. Not only is rapid progress being made in the development of transit facilities, but it is interesting to note that nearly all the work on various lines is being done by home talent and labor.

In our January, 1891, issue we gave a brief description of the Hunt Street power station, then being built. We now take pleasure in illustrating the same, and describing its equipment. The engraving (Fig. 1) on this page presents a very good idea of the exterior of the station. Fig. 2 on the following page is a view of the interior of the engine and generator room, while Fig. 3 shows to the reader the appearance of the boiler room.

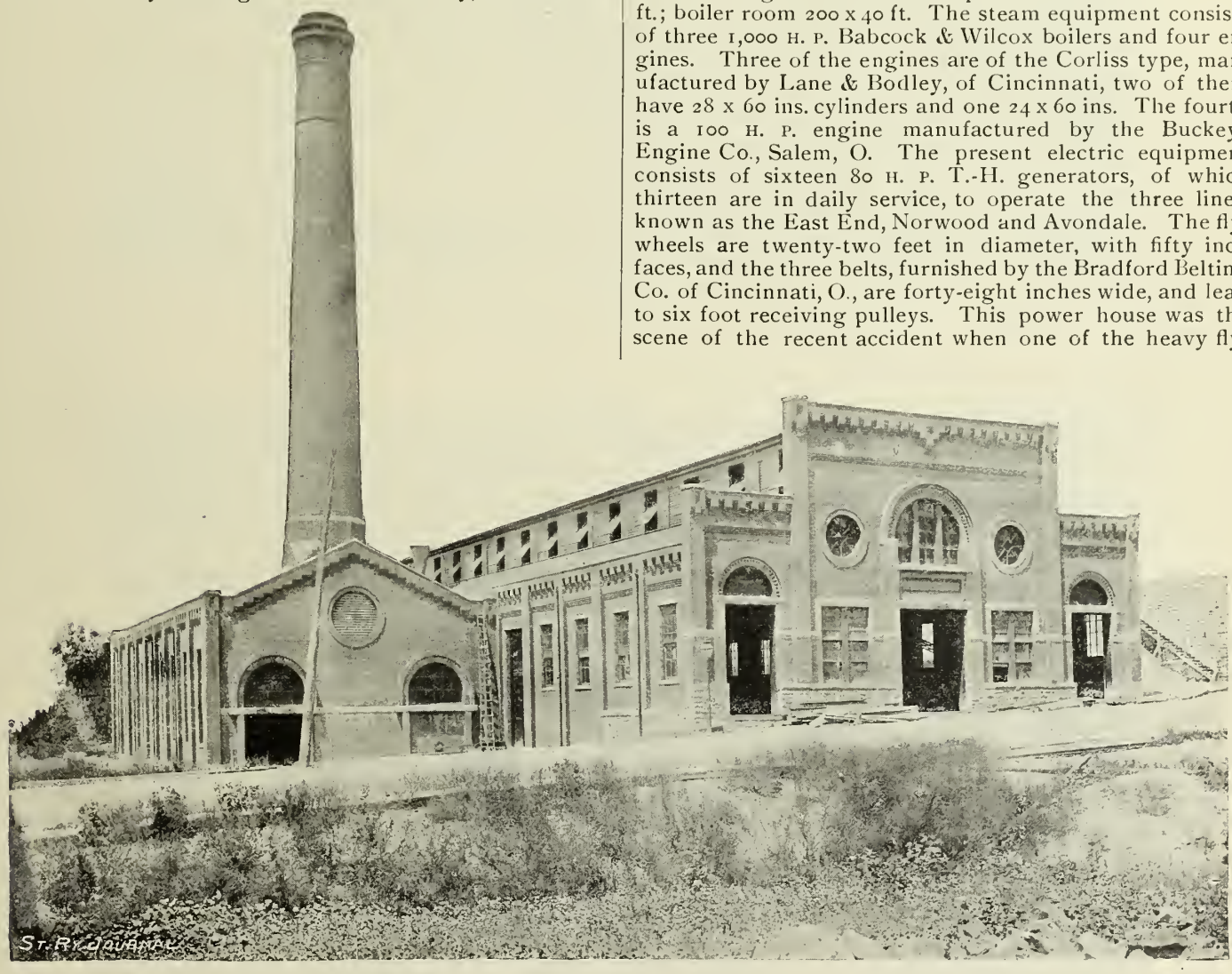


FIG. 1.—EXTERIOR OF HUNT STREET STATION—CINCINNATI STREET RAILWAY CO.

The engine room of the power station is 200 x 60 ft.; boiler room 200 x 40 ft. The steam equipment consists of three 1,000 H. P. Babcock & Wilcox boilers and four engines. Three of the engines are of the Corliss type, manufactured by Lane & Bodley, of Cincinnati, two of them have 28 x 60 ins. cylinders and one 24 x 60 ins. The fourth is a 100 H. P. engine manufactured by the Buckeye Engine Co., Salem, O. The present electric equipment consists of sixteen 80 H. P. T.-H. generators, of which thirteen are in daily service, to operate the three lines, known as the East End, Norwood and Avondale. The fly-wheels are twenty-two feet in diameter, with fifty inch faces, and the three belts, furnished by the Bradford Belting Co. of Cincinnati, O., are forty-eight inches wide, and lead to six foot receiving pulleys. This power house was the scene of the recent accident when one of the heavy fly-wheels burst, doing great damage to the building. This has since been repaired and a new fly-wheel manufactured by the Walker Manufacturing Co. of Cleveland, O., substituted. The Hoppes feed water heater is used.

One of the most interesting sections of the city to a street railway manager is the corner at Fifth and Walnut Streets, near Fountain Square, shown in Fig. 4. Here 300 cars per hour pass, including the cars of the Walnut Hills and Vine Street cable lines; East End, Avondale, Colerain Avenue, and Norwood and Eden Park electric lines, double trolley T.-H. system; Main Street electric, single trolley, Edison system; Cincinnati and

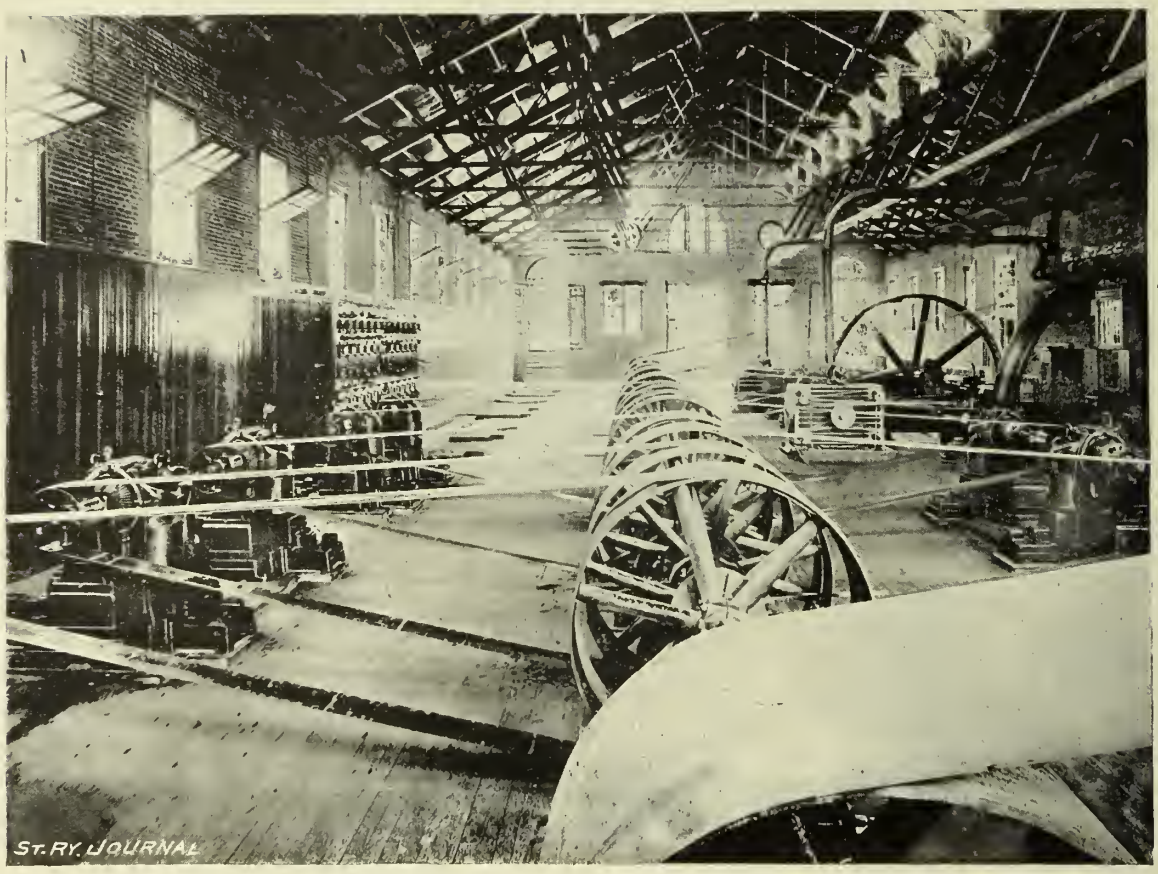


FIG. 2.—INTERIOR OF STATION—CINCINNATI STREET RAILWAY.

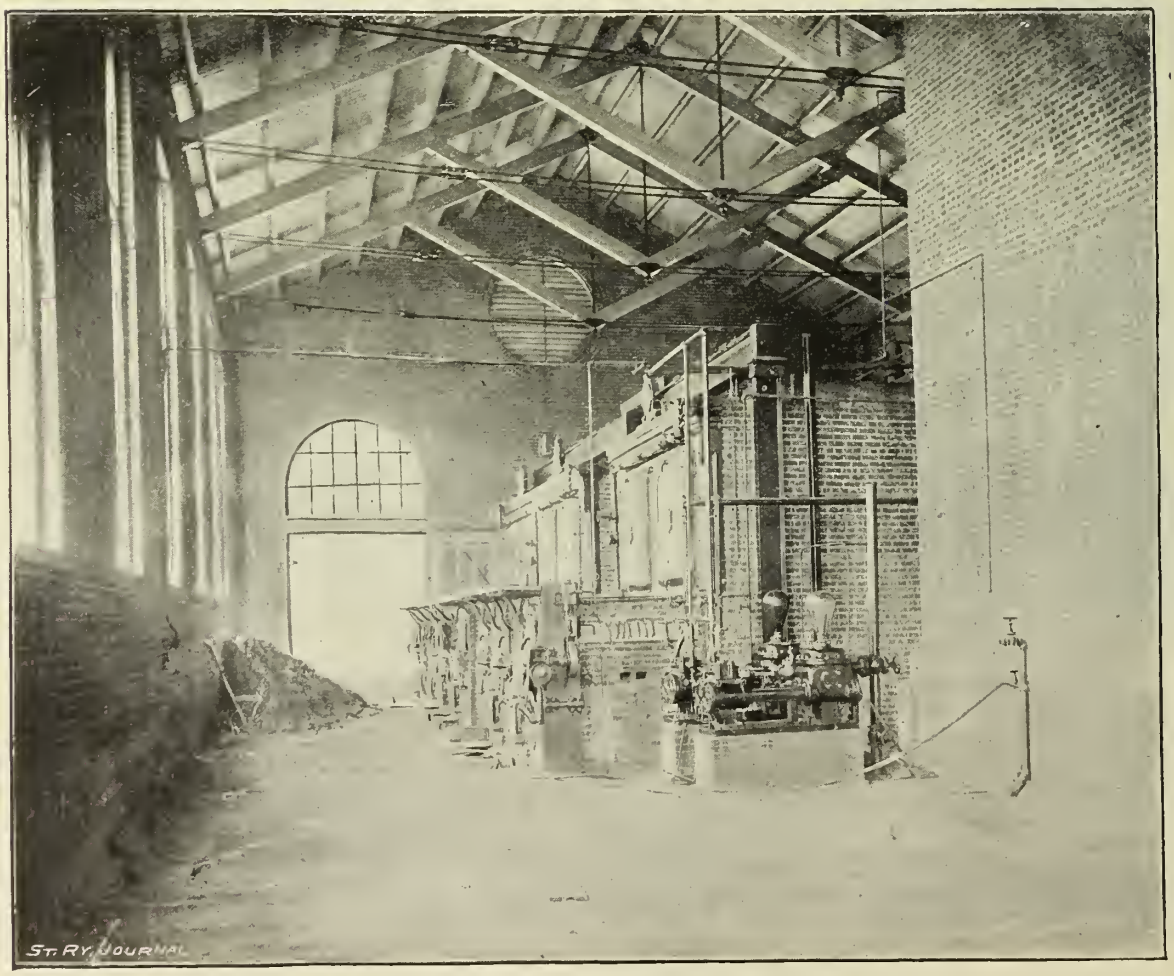


FIG. 3.—INTERIOR OF BOILER ROOM—CINCINNATI STREET RAILWAY.

South Covington electric double trolley, Short system, and the horse cars of the John Street, Fifth, Sixth and Seventh Streets, Clark Street, Farmount and Newport divisions.

That portion of single track on Walnut Street in front of the Apollo Building, where the offices of the Cincinnati Street Railway Co. are located, as shown in the engraving, probably does service to as diversified a traffic as can be found anywhere. It is constructed for a cable line, but, in addition to the cable cars, over it pass the cars of three horse lines and two electrical lines, one operated by the single trolley and the other by a double trolley. For these two lines the wires are arranged so that the single conductor is placed between the other two.

Fig. 5 illustrates a double trolley electric car ascending the Mt. Adams & Eden Park Incline, on board the platform of one of the incline cars. By this means the electric cars operate over different sections of track located in the business portions of the city and on the heights.

Fig. 6 illustrates the foot of the Cincinnati Incline Plane, and shows an electric car just boarding the incline platform. An interesting fact in connection with this arrangement is, that the approach of the electric line to the foot of the incline is upon a grade, for a short distance, of thirteen per cent. A full description of the different Cincinnati inclines having been given in previous numbers of the STREET RAILWAY JOURNAL, we omit further notes in this connection.

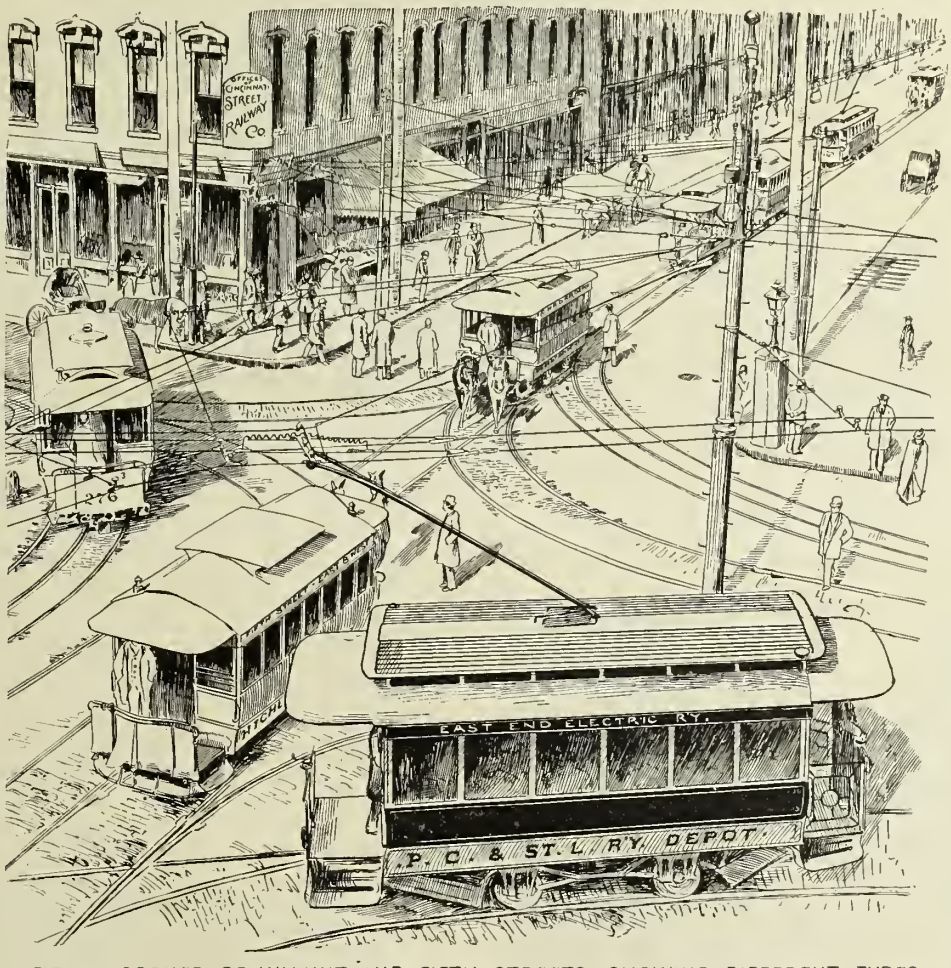


FIG. 4.—CORNER OF WALNUT AND FIFTH STREETS, SHOWING DIFFERENT TYPES OF STREET CARS.

A FOUR wheel wagon for hauling street railway cable reels has been built for the Cleveland City Cable Ry. Co., of Clevelaud, O. The weight of the wagon empty is 9,000 lbs., and its guaranteed carrying capacity is 100,000 lbs. or fifty tons. The length of the bed between axles is thirteen and a half feet and is composed of four ten inch "I" beams hung under the axles. The side beams are drawn in at the front so that the front wheels can have room to cut in when the front axle is turned. The bed is five feet two inches wide, covered with four inch oak plank.

The axles are five by six inches in diameter, of steel, and the two weigh 1,360 lbs. The wheels are forty-four inches in diameter, with nine inch tread, tire being one and one quarter inches thick. The front axle is shorter than the hind one, so that the wheels do not run in the same track, the object of which is to distribute the weight more evenly over the surface of the street to avoid cutting through pavements. The wagon can be hauled by team, traction engine or capstan, as may be desired. This wagon, which is considered to be the heaviest one ever built was supplied by the Miller-Knobeck Wagon Co., of South Bend, Ind.

The New Broadway Cable Cars.

The John Stephenson Co., Ltd., report that the Broadway, New York, cable cars will have a length of body of twenty-one feet, and length over all of thirty feet. A four wheel truck, having a nine foot wheel base, will be used. All will be box cars, and the seats will run lengthwise of the car, and will be covered with Wilton carpet. The interior will be finished in white ash, and the ceilings will have panels of birdseye maple. There will be nine high windows on each side. The cars will probably be painted with body of cadmium.

Rope Driving for Cable Roads.

Rope driving has been in use for years for the transmission of power, but until a comparatively recent date it had not been brought into use to take the place of gear driving. The system, we believe, was revived by Comb, Barber & Comb, eminent machine makers of Belfast, Ireland. Several small installations were put down by that firm in the northern part of Ireland not many years ago. From there it was introduced into Dundee by William Bamber, cotton spinner. It was soon afterwards adopted by other firms, and quickly became a very popular system for the transmission of power in England, and for the last ten years, it is said, hardly any other method has been applied for use in English cotton mills. Not only is this the case, but an extra number of conversions from gear driving have taken place. One of the largest rope drives in England, at Darwen, in the India Mills, furnishes a striking example of such a conversion. These mills containing 85,000 spindles, are run by an engine of 2,000 indicated H.P. A thirty foot fly-wheel carrying thirty Lambeth cotton ropes one and three-fourths inches in diameter, with a rope speed of 5,100 per minute, transmits the power noted. The weight of the fly-wheel is upwards of sixty-five tons.

Until within a very few years in the power stations of the cable roads in the United States the power was transmitted from the engine to the large drum by spur gears, and on the large drum shaft was the initial drum, carrying the steel cable, but the continual noise and vibration even with the adoption of wooden teeth, made a power station in a thickly settled part of a city not a very desirable neighbor.

Belts could not be introduced to advantage on account of the low speed and small driving wheels, and would be extremely expensive ; the width of belt required to transmit the desired power, traveling at the slow rate

that is necessary under these circumstances, would be out of all reason, and doubtless would be a cause of more or less uncertainty. For these reasons cotton ropes have been introduced very extensively to take the place of gear driving. In the new systems of cable roads, by the introduction of rope driving, we find on the crank shaft of the engine a small balance wheel, where, under the old system of spur gearing, a very heavy one was necessary, and the saving in this item and gears alone almost pays for the ropes, while the latter give practically as positive a drive as the gears. Another point in the favor of ropes is that they furnish an elastic medium between the driver and the cable shaft drum, and take easily any sudden changes of loads. Again, while with gearing there is no warning before a complete stoppage takes place, with rope driving there is a warning by the fraying of the rope. Never, it is said, in the history of rope driving, in what is called the English system, has any accident happened where one of these ropes broke and became entangled in the others.

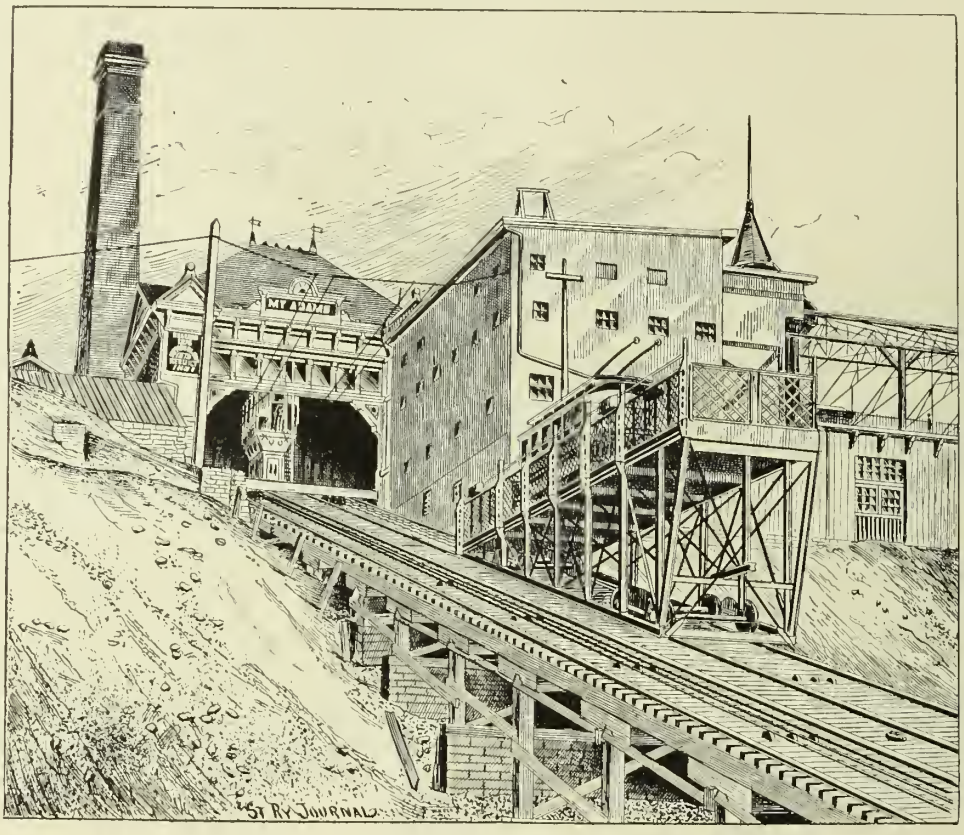
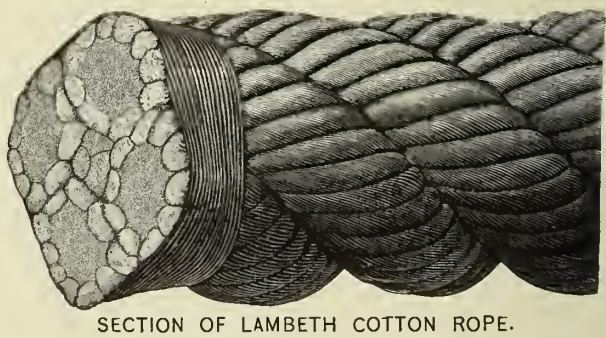


FIG. 5.—CAR ON INCLINE—MT. ADAMS & EDEN PARK RAILWAY.

Although each rope runs independently it is not necessary that all the ropes on one pulley should have just the same tension, but it is of great importance that the slack side should be on top, and that the ropes should be short enough not to bring the slack side in contact with the tight. The durability of ropes when properly stretched and spliced has not yet been ascertained, but, judging from power transmitted by ropes in some of the largest textile mills in Europe and this country, taking into consideration the speed and power transmitted, there is no reason why cotton ropes for the main driving of a cable road should not last many years. The ropes should be looked after and carefully treated, as one would treat leather belts under similar conditions.

A section of the Lambeth cotton rope is well illustrated in the accompanying cut. This rope is designed upon strict scientific principles, with due regard to the requirements of the purpose for which it is intended. These purposes demand tensional strength, elasticity and flexibility, the combination insuring durability. From some recent tests made with this rope, it was shown that a rope one and a half inches in diameter broke clear of its fastenings with a weight of 9,722 lbs. A rope of the same diameter, with a strain of 2,000 lbs., stretched five and a half per cent.



SECTION OF LAMBETH COTTON ROPE.

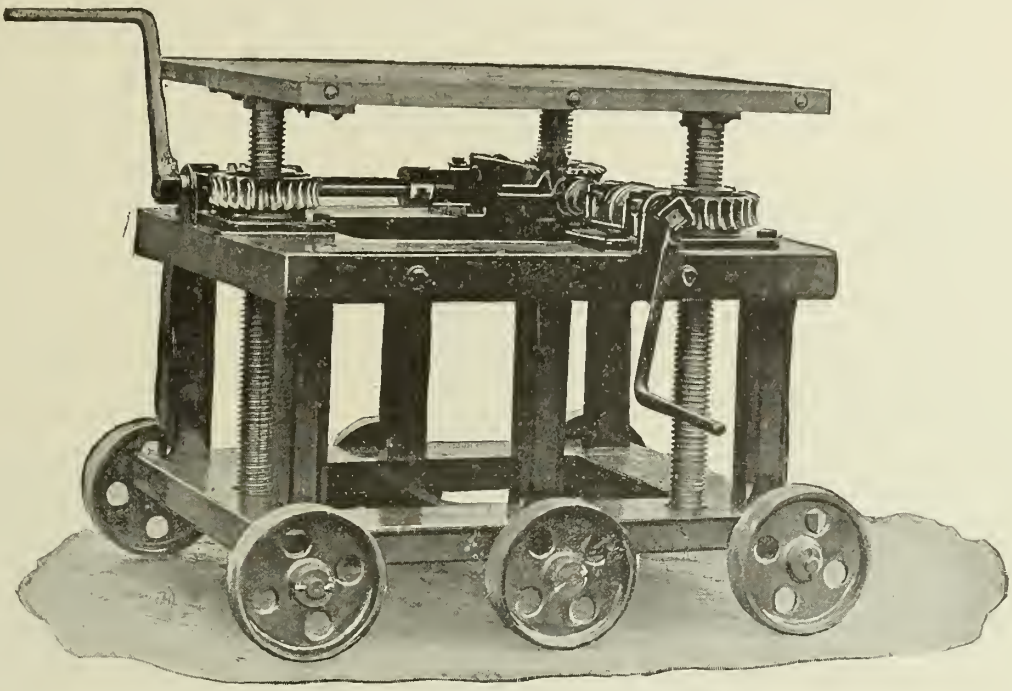
and when this load was removed the rope returned to its original length, showing an element of elasticity of great advantage in rope transmission. This rope, in practice, at a speed of 4,000 ft. per minute, transmits twenty-two H. P. and has a strain upon it, which can be easily figured, of only 182 lbs. With this margin of safety no appreciable stretch can take place. This particular rope is used in many of the cable plants in this country, among the number being those at Providence, Third Avenue of New York, Baltimore, West Chicago, Denver and Salt Lake City. Arthur A. Bingham, 186 Devonshire Street, Boston, Mass., is the sole agent in this country for the Lambeth cotton ropes and to him we are indebted for some of the foregoing facts.



FIG. 6.—CAR AT FOOT OF INCLINE—CINCINNATI INCLINE PLANE.

Motor Dismounting Table.

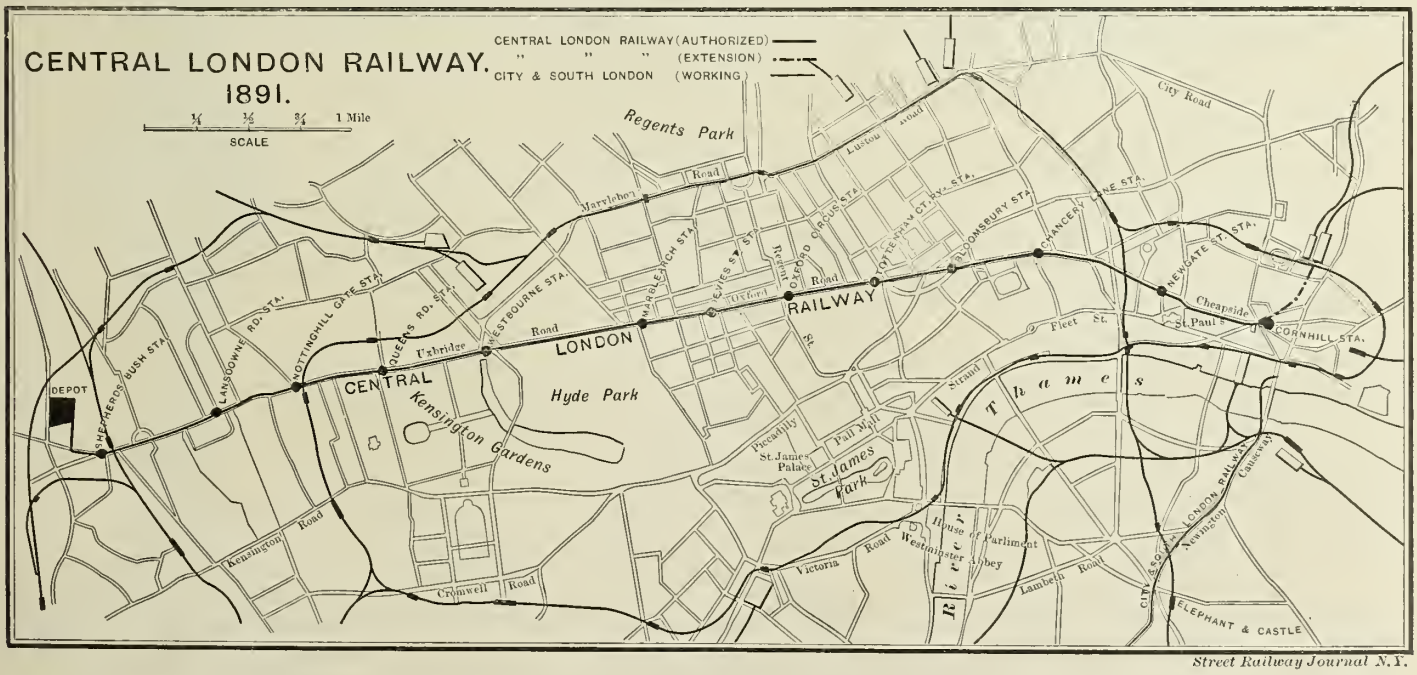
A new labor saving machine for the use of street railways in mounting and dismounting railway motors is being manufactured by the Edison General Electric Co. The device, which is illustrated on this page consists of a table and strong frame mounted on wheels. The table can be raised or lowered by means of worm and wheel gear, which is arranged underneath it and is operated from crank handles, that can be placed on three sides of the frame. The table is put into the car pit and run below the car and is then raised by means of the crank handles, until it takes the weight of the motor. The fittings are then unshipped and the table and motor lowered clear of the wheels, when it can be run under a crane and the motor removed, or a second table carrying a new motor can be run in position for remounting on the truck. Two men can in this manner handle motors with ease, and, furthermore, the method of removing the motors from underneath is much quicker than removing the car body from the truck. Tables can be made of any widths to suit special car pits, and, if desired, can be arranged to run upon rails. The following are the particulars of tables already constructed: Wheel base, 4×4 ft.; size of table, 36×42 ins.; least height of table from floor, three feet two inches; greatest height of table from floor, six feet two inches; weight of frame and table complete, 1,270 lbs.



EDISON MOTOR DISMOUNTING TABLE.

Underground Electric Railways for London.

The operation of the City & South London Electric Railway in London has been in many respects so successful that several new projects, similar in character, have been formed. The Londoners have great faith in underground roads, especially when electricity is employed as motive power. At the next session Parliament will be called upon to legisiate on four underground electric railway schemes. They are: 1. A railway to be called the Great Northern & City Electric Railway, which is intended to commence by a junction with the Finsbury Park and Canonbury branch of the Great Northern, passing underground and terminating in Finsbury Pavement. 2. A railway to be named the Waterloo & City Electric Railway, running underground and passing beneath the bed of the Thames from Waterloo station to the Mansion House. 3. An underground railway commencing in the vicinity of New Street, Upper Baker Street, and passing via Langham Place, the Quadrant, by the County Fire Office in Regent Street to Waterloo. 4. An extension of the City & South London Railway from the City Road to Islington.



Street Railway Journal N.Y.

The accompanying map, taken from one issued by the Exposition Committee, will show the magnitude of the lines installed or for which permission has been granted, and the district covered by them.

The traffic on the City & South London Railway has for some months shown a steady increase over the corre-

sponding periods twelve months ago. In view of providing for a further increase, the directors of the company have instructed Messrs. Mather & Platt to design and construct another locomotive of considerably greater power and speed than the present locomotives. Owing to the exigencies of the traffic and the rolling stock being in consequence considerably heavier than was originally anticipated, and for which the present locomotives were not designed, they have been required to do far more work than that for which the makers constructed them, although some of them have run over 20,000 miles with the unexpected load without repairs of any nature whatever being required. Many of the delays which have occurred from time to time, may be attributed to the overloading of the locomotives.



SCENE ON OTTAWA STREET RAILWAY.

At the general meeting of the company, held February 2, the chairman stated that the great fault of the line was the want of traffic and of sufficient receipts. The present receipts per train mile are 2s. 1½d., and expenses per train mile have been only 1s. 7¾d. The success of the motive power can be determined from the fact that the last figure is 1s. 1¼d. less than the expense of an ordinary English steam railway.

Snow Fighting in Ottawa, Ont.

The problem of keeping a railway in operation during snow storms is one of especial interest to managers of electric roads, in places where a heavy fall of snow is likely to occur at almost any time during the winter season.

The arrangements and facilities of the Ottawa Electric Railway Co., for battling with and removing the heavy snow falls are of the most complete character, and one of the most satisfactory features of the company's system consists in the fact that the streets are left in excellent condition. Sleighing is better than upon the other streets of the city. This continued success in the face of frequent and long continued snow storms has been most carefully watched by other Canadian cities in about the same latitude.

The snow is swept from the tracks by an electric sweeper supplied by the Lewis & Fowler Manufacturing Co., of Brooklyn, N.Y. Two Walkaway snow plows drawn by horses follow the sweeper and remove the snow bodily to the curb; a third Walkaway shoves the snow between the double tracks to the unswept track which is immediately traversed by the electric sweeper and in turn is followed by the Walkaways. In this manner snow falls of nine to twelve inches have been handled in half a night throughout the whole length of the line. The snow is then shoveled into large boxes mounted on double runners and drawn away. A second Lewis & Fowler sweeper will be in readiness in a few days. Preparations for winter were commenced as early as August, and all the ordinary platform cars were in turn neatly, though temporarily, vestibuled to make them comfortable for the motormen who are suitably clad and provided with fur caps. Conductors are very neatly uniformed with special provision for the severe northern weather. Heavy duck canvas is fixed all around the trucks and almost reaches the rails. This prevents snow from reaching the motors and contributes to the comfort of the car. Special track sweepers and brooms are used on each car. The successful and profitable operation of a winter electric railway service has been so convincingly demonstrated that the influence upon other Canadian cities will, no doubt, be immediately felt Much of the success of the road, especially under the severe conditions of the present winter, is due to the efforts of the superintendent, Mr. J. E. Hutcheson, a former employe of the Canadian Pacific Railway. The excellent construction of the Westinghouse motors has contributed to no small extent to the regularity and success of the service.

Multiple Distributing Station Electric Railway.

At the Coney Island end of the Brooklyn & Coney Island Electric Railway a half mile of track has been equipped to test the electric railway system of the American Engineering Co. of New York. This system is introduced with the idea of obviating the necessity of overhead wires and the trolley. A test of the system was recently made, and the trial was extremely successful. Whether the multiplication of electro-magnets rendered necessary by the construction will interfere with the continued operation is a question which can be answered only when a considerable length of road is in operation. The characteristic features are shown in the accompanying illustrations.

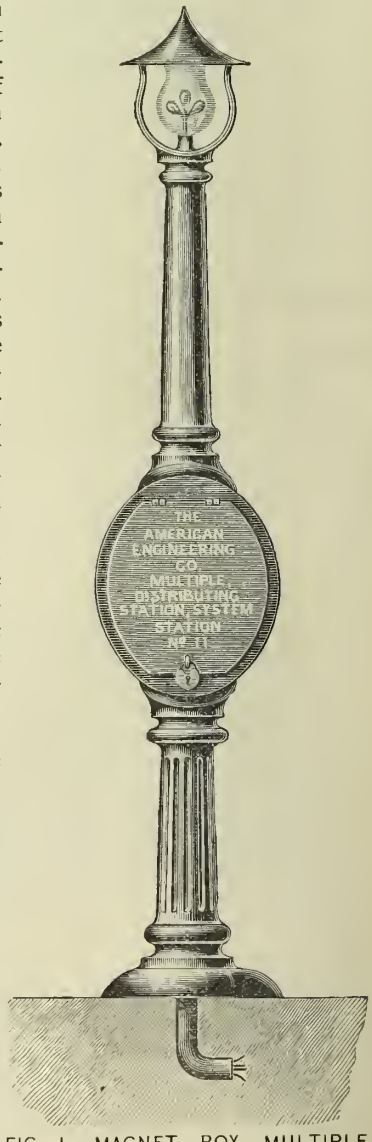


FIG. 1.—MAGNET BOX, MULTIPLE DISTRIBUTING ELECTRIC SYSTEM.

In this system a wooden trench for receiving the transmitting main is located in the centre of the track. On the cappings are located every twelve feet iron blocks, of very solid construction, which serve as contact plates or terminal heads. These latter project above the pavement about three-quarters of an inch, the edges being beveled. Under the car, as Fig. 2 shows, is located a metallic brush long enough to extend from one plate to another. Each head is connected to a wire running to its own automatic switch in a distributing station, located in the centre of each block. The car is started by throwing the

current by means of a switch operated by hand into one or more of the heads. The connection is then so arranged that each head is automatically connected with the main as the car is passing over it, and the only portion of the line alive is the head directly under the car at any time. The distributing boxes which are located about every 400 ft., may be arranged in the hollow part of a lamp-post, making such a construction as shown in Fig. 2. All feeders and mains are carried in the trench with the wires that are laid from the heads. At each junction box or elbow, where the wires from the heads go to the distributing station a tap is taken from the main feeder and run to a binding post on each switch. An armature, part of each cut-out or switch, by an up and down movement cuts in and out the main line with the head connected to that armature by being actuated by a magnet.

It is absolutely impossible, it is claimed, that the main line should be thrown into any of the heads without the magnet of the cut-out being first made active and drawing up the armature. In order to draw up this armature it is necessary to send down through the magnet from the head a current which will be sufficient to draw up the armature and throw it into contact with the main line. By no other means can this armature be drawn up.

Should the car be derailed the car can be started again after it is on the track, by the motorman who can go to the distributing box and raise the armature of the electro-magnet corresponding to the head on which the car is located.

The operation of the car on the experimental line at Coney Island is a severe test, inasmuch as the road has six curves, one of forty foot radius, several grades, switches and crossovers. The officers of the road are C. C. Bowen, president, Henry Keim, vice-president, J. S. Zerbe, manager and Joseph Sachs, electrician.

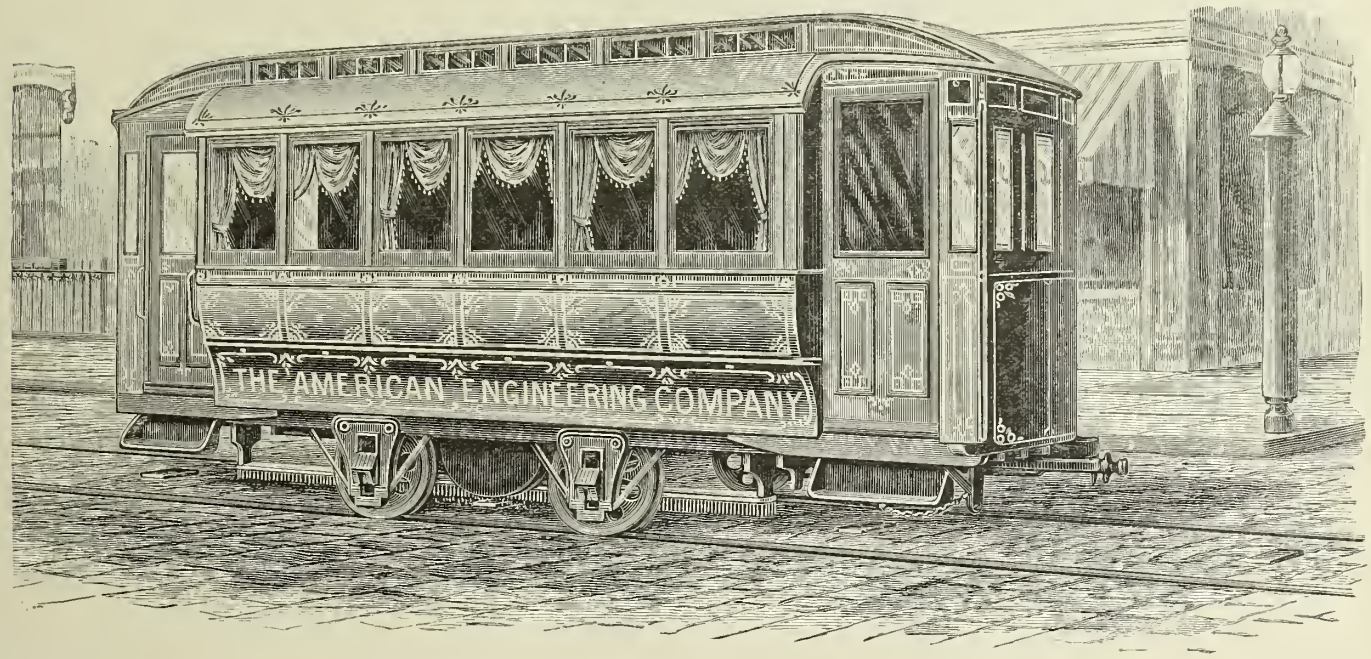


FIG. 2.—CAR OF MULTIPLE DISTRIBUTING RAILWAY SYSTEM.

A DIRECTOR of the Chicago City Railway Co. recently said: "The Illinois Central is asked to raise its tracks at Jackson Park so as to admit street car and other traffic into the grounds. The railroad company is asked to contribute $150,000 toward the expense of raising the tracks. As we have little to gain by this move we thought $150,000 too much, and three weeks ago I proposed and secured the passage of a resolution offering $50,000. The majority of directors were not in favor at first of offering anything at all, because they did not see how it could benefit our company, but I persuaded them to offer the $50,000. I do not know whether the Illinois Central people will accept this or not. As far as I know they have not as yet taken any action upon it."

Passenger Elevator and Viaduct at Weehawken.

An extensive elevator and viaduct designed for passenger traffic has recently been built by Otis Bros. & Co., of New York, at Weehawken, N. J. While not yet entirely completed, the structure is nearly finished and a very good idea can be obtained of its general arrangement and appearance. It will be ready for traffic by April next.

The viaduct is 873 ft. 6 ins. long from centre of east bend of the east tower to centre of end pin on west abutment and one end rests against the well known Palisades. Transportation from one end of the viaduct to the other will be by steam, and the structure is designed to carry in addition to its own weight a train consisting of a seventy-two ton Mogul locomotive followed by 2,000 lbs. per lineal foot on each track. In addition, sidewalks are provided for foot passengers and designed for a maximum live load of eighty pounds per square foot.

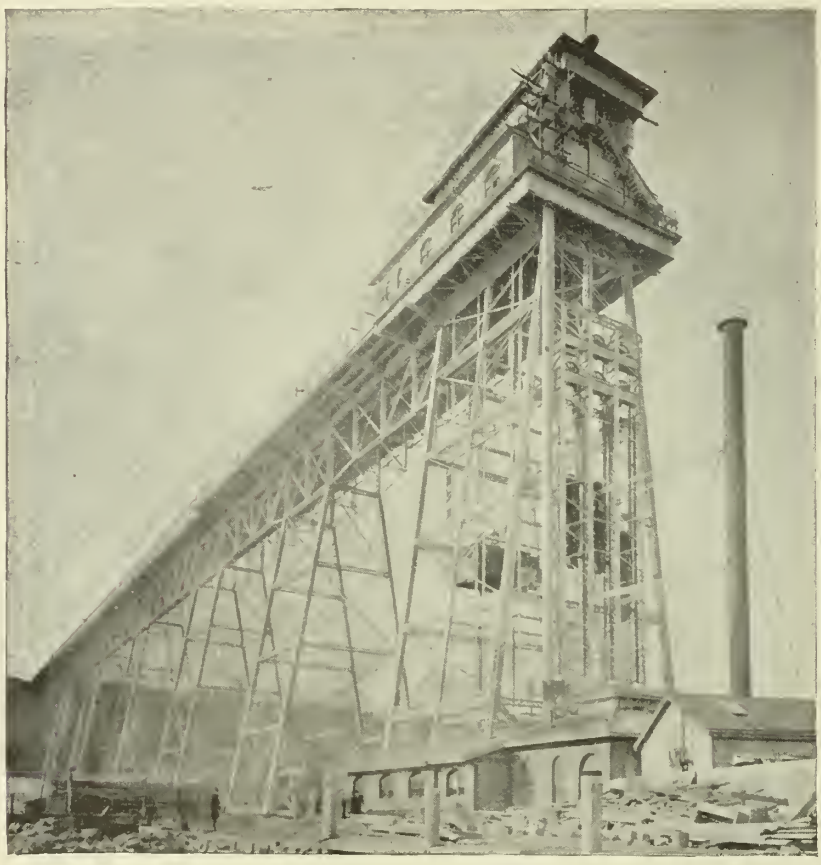
The base of the tower is near the ferry houses of the West Shore railroad where ferry boats connect with West Forty-second Street and Jay Street, New York City.

The tower is sixty feet in width at the base, and twenty-four feet at the level of the railroad; its extreme height from the top of the foundation to the ridge of the station roof on the top of the tower is 194 ft. 2 ins. Passengers are lifted a vertical height of 148 ft. Three elevator cars are provided, each 21 ft. 6 ins. × 12 ft. 6 ins., and each having a capacity for 130 persons standing. The elevators are designed for a speed of 400 ft. per minute, but it is not expected that their working speed will exceed one-half the above. At this rate the time of passage for the 148 ft. is forty-five seconds, and as the elevator cars are provided with wide doors at each end so that passengers can enter at one door while others are leaving by the other door, it is estimated that thirty seconds only will be required at either top or bottom for transferring passengers. The cars run independently of each other and all can ascend at the same time. The total weight for each car loaded is 34,000 lbs.

Hydraulic power is employed for operating the elevators. The hydraulic cylinders have an internal diameter of thirty-eight inches and an external diameter of forty-two inches, are thirty-five feet long, and are built in four sections. The water pressure employed is 185 lbs. per square inch. Water is delivered through a fifteen inch cast iron pipe from a pressure tank at the top of the tower, which has a capacity of 10,000 gals.

The element of safety is carefully attended to. Each car is provided with two governors of the usual pattern for controlling the speed. Each is automatically connected with grips which act on the sides of the hard

wood guides in which the car runs, and in case the speed increases above a certain amount will hold the car. Either governor will set the grips, and two are provided in case of the failure of one of them to act. The hoisting



VIEW LOOKING TOWARD PALISADES—WEEHAWKEN VIADUCT.

cables, of which there are six to each car, are connected with equalizing levers which force the grips into action in case of the breakage of any one of the cables. At a special test made at the shop of Otis Bros. & Co., a car was loaded with 34,000 lbs., equipped with the actual grips used on these elevators and was then cut loose from the ropes. The car passed a distance of only three and three-fourths inches before coming to rest. The power station, situated directly at the base of the tower, contains two Worthington compound condensing pumps, with eighteen inch stroke and sixteen and thirty inch diameter steam cylinders and twelve inch diameter water cylinders. The discharge tank at the base of the tower has a capacity for 10,000 gals.

The viaduct towers have a width of nineteen feet at the top and sixty feet at the bottom. The foot of each column rests upon a steel pedestal casting which in turn rests upon a wrought iron base plate two and one-fourth inches in thickness. One corner of each tower is anchored against moving while the other three are free to move both transversely and longitudinally upon the sliding surfaces between the cast pedestal and the wrought iron base, but are secured against lifting. Trusses for the span are placed nineteen feet between centres, and are twenty feet deep between centres of chords.

The piers for all the towers rest upon bed rock, with the exception of the two easterly towers. The foundations for the latter were secured by piles driven in the bed rock. The metal superstructure was manufactured and erected by the Passaic Rolling Mill Co. of Paterson, N. J. The designs for the structure were supplied by the engineer for Otis Bros. & Co., Mr. Thomas E. Brown, Jr, who designed the elevators for the Eiffel tower.

The Rochester Railways.

Improvements are being made on these lines so fast that one needs to visit the city two or three times a year to keep track of them. About forty-seven miles are now being operated by electric traction (Short system) and thirteen miles by horse power. The present car equipment consists of 100 vestibule motor cars, manufactured by the Gilbert Car Co., and sixty horse cars of Stephenson and Pullman make. The cars are mounted on the Bemis and Peckham trucks, and recently a truck equipped with the Peckham radial box has been added. The company are now building a private car, which will be equipped with the Short motors and a Dorner & Dutton brake. At the last monthly meeting of the executive committee of the Rochester Railway Co. it was decided to equip the remaining horse car lines for electric traction, and for this purpose the tracks will be relaid with fifty-two pound Johnson girder rails, on stone foundation with stone ballast, the same construction practically as was adopted on the other electric lines which have now been in service since October, 1890, and are standing up well under the traffic.

Thirty sixteen foot open platform cars will be ordered for the new electric lines, and some of the horse cars will be employed for trailers. The vestibule type of cars are not in high favor with the management, owing to their



VIEW FROM RIVER—WEEHAWKEN VIADUCT.

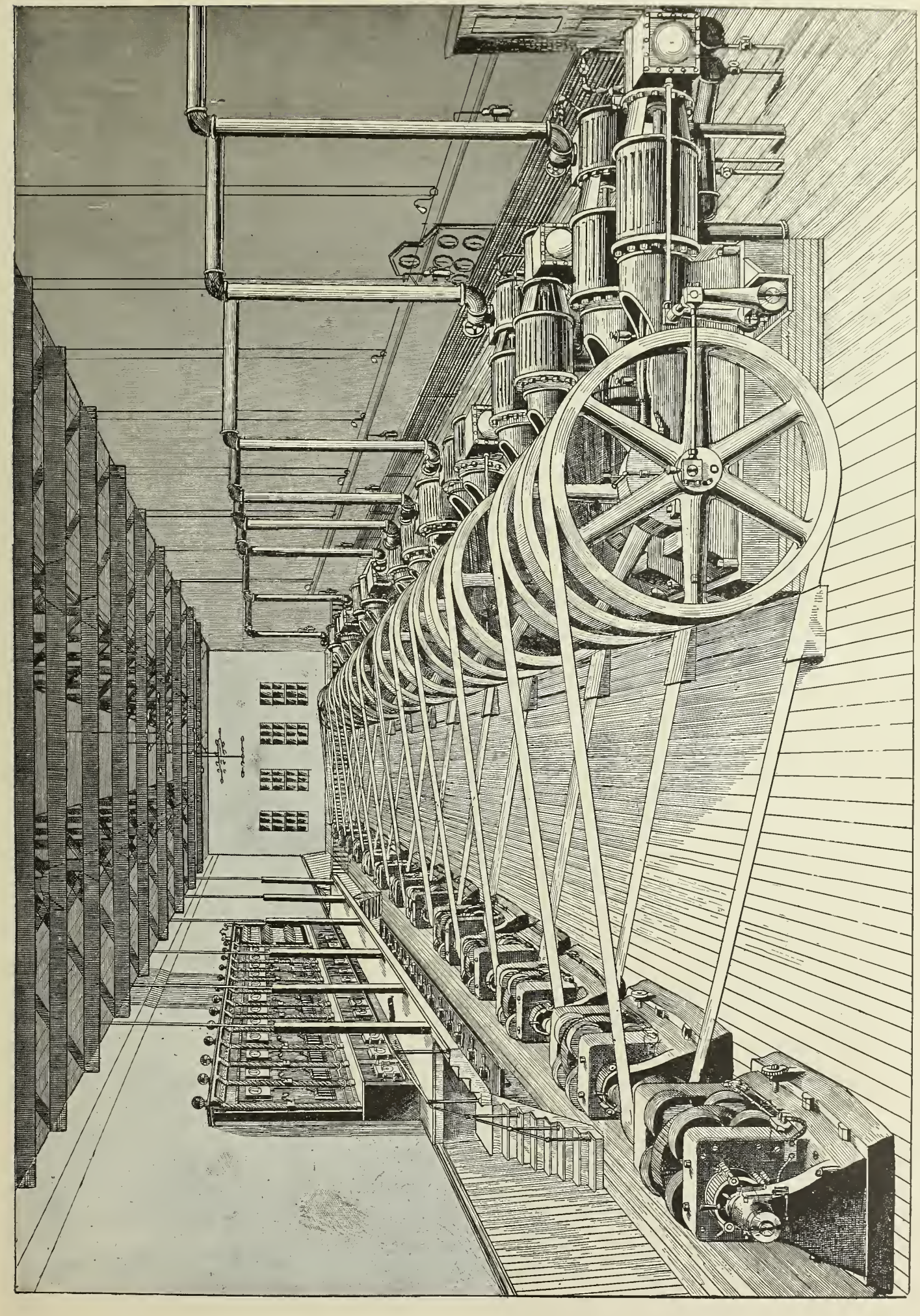


FIG. 1.—INTERIOR OF POWER STATION, SHOWING ENGINES, GENERATORS AND SWITCHBOARD—ROCHESTER ELECTRIC RAILWAY—SHORT SYSTEM.

being heavy, liable to damage from collision with street vehicles and awkward for the reception and discharge of passengers. It is expected that the entire system will be operated electrically by early summer.

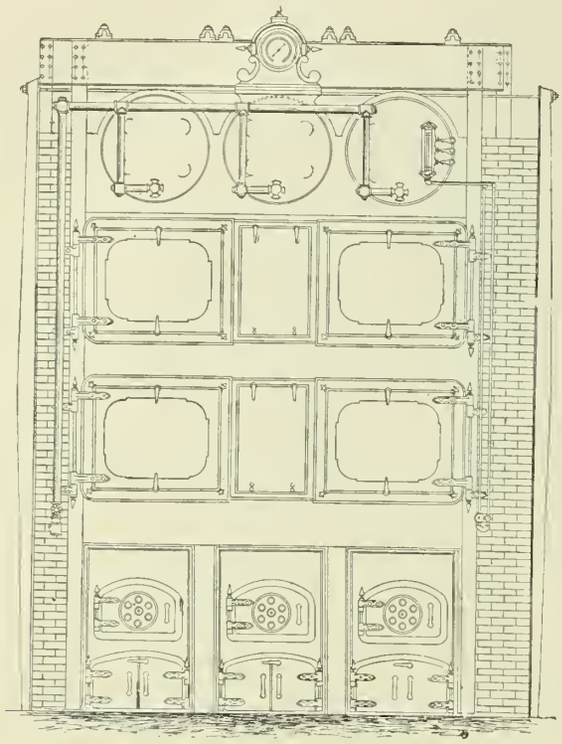


FIG. 2.—FRONT ELEVATION OF BABCOCK & WILCOX BOILER ROCHESTER ELECTRIC RAILWAY.

A number of changes have been made in the power plant since it was illustrated in our April, 1891, number, and we now take pleasure in presenting a second illustration showing the engine room as now equipped. The current is generated by ten 150,000 watts(Short)generators of the latest multipolar compound wound type which are giving the best of satisfaction and have the hearty endorsement of the management. The commutators of these machines consist of 200 segments, and are made hollow to provide for a free circulation of air. The journal bearings are of the self oiling ball type, and require filling only once in about six weeks. The terminals are all connected to cross bars, making it impossible for any of the inside connections to work loose. These machines have stood up well under the heavy service that has been imposed upon them during the severe winter weather, and have run cool under all conditions. Three more generators of the same type have been ordered, and will soon be installed.

The position of the switchboard has been changed and is now located on a gallery which has been provided for it. The board is a very handsome affair, the upper portion being of solid mahogany, divided into sections by carved pillars and having a shelf of highly polished marbleized slate. The gallery is seven feet wide, of nicely furnished hard wood and is placed about eight feet above the floor. The fuse board is of marbleized slate and is placed underneath the gallery as shown in the illustration. Through this all the feeders pass and underneath are lightning arresters of the Wason type. Ajax switches are employed both on the switchboard proper and the fuse board.

The present power equipment consists of eight engines all of which were manufactured by the Ball Engine Co., of Erie, Pa. Two of these engines are 300 H. P. four cylinder, trip'e expansion, three are 300 H. P. cross compounds and three are 150 H. P. single non-condensing. Each engine, with the exception of the three non-condensing, drives two generators to which they are coupled direct by sixteen inch, two-ply belts. From practical tests it is found that the entire plant is running on about twenty-two pounds of water per horse power.

Most of the belting was manufactured by the Jewell Belting Co. and is giving excellent service. A perforated belt, manufactured by Chas. A. Schieren & Co., has recently been put in service with the new equipment and also two or three of the Cross belts.

The original steam equipment consisted of four Heine safety, water tube boilers of 200 H. P each, fitted with the Gallagher furnaces. Last May a 416 H. P. Babcock & Wilcox boiler was added (Figs. 2 and 3.) It is proposed to make a competitive test to determine the relative merits of these two types of boilers, and when this is decided on additional equipment will be made.

The auxiliary steam equipment consists of two 1,000 H. P. Worthington independent condensers, which are located in the end of the engine room near the triple expansion engines. There are also three Worthington 500 H. P. feed pumps and three Berryman 500 H. P. feed water heaters. The building has recently been rewired, and is now lighted by ten light electroliers and rows of gooseneck side lights extending the entire length of the room.

The company have recently increased the pay of employes, and the following is the scale of prices for motor-drivers and conductors: Fourteen cents an hour for the first three months, sixteen cents an hour for the next nine months and eighteen cents an hour thereafter. A mutual benefit association has recently been formed among the employes.

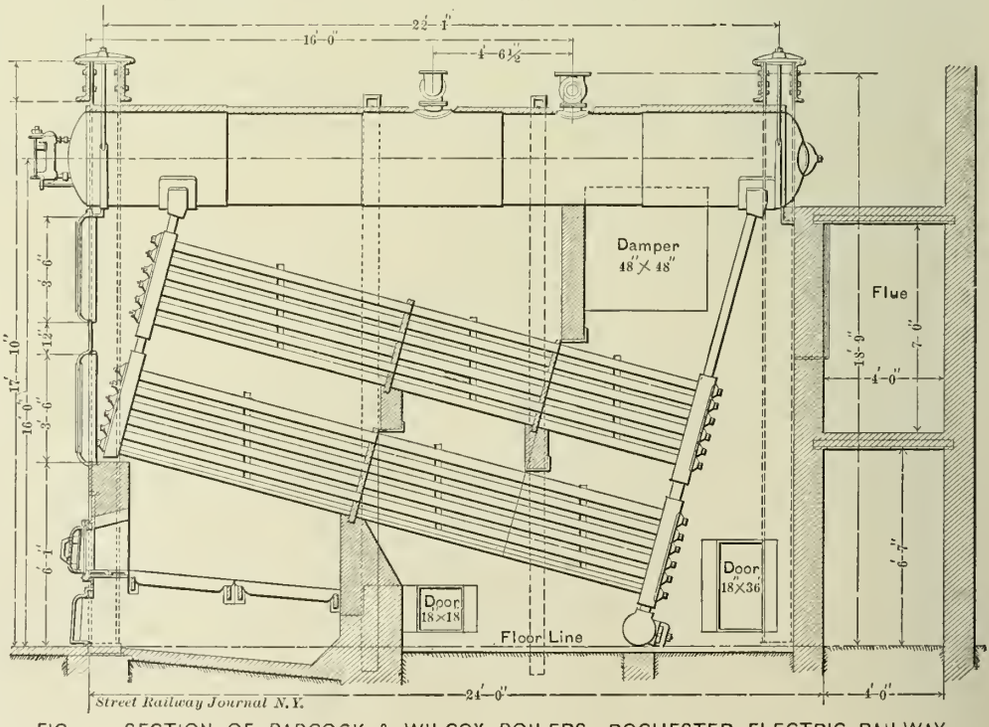


FIG. 3.—SECTION OF BABCOCK & WILCOX BOILERS—ROCHESTER ELECTRIC RAILWAY.

A new storage battery, the invention of Professor Main, has recently been tried in Brooklyn for operating a storage battery car built by the Lewis & Fowler Manufacturing Co. Eighty-four cells are used, which are stored under the seats. A single multipolar motor is geared to both axles. It is claimed that the car, motor, battery and all will not weigh over 3,500 lbs., and that the cars will run twenty miles without the necessity of recharging the batteries.

Love Underground Conduit Electric Railway in Chicago.

The Love Electric Traction Co. have just equipped, with their underground system, the Fullerton Avenue loop of the North Chicago Railway Co. This line, which is a little less than a mile and three-quarters in length, has four curves of different radii, two double and one single track crossings, and eleven switches. Every care has been exercised in the construction of the underground work, in order that a thorough test of the value of the system might be made.

The construction of the Love company is somewhat similar to the conduit used for cables. The yokes are twenty inches deep, and are placed four feet apart, a cast iron lining being used between the yokes. The conduit is fifteen inches deep and nine inches in width. A special feature in the construction is a rolled steel slot rail with depending flanges to carry off the surface water. The rail is fastened by means of a clamp having a lateral adjustment. By the removal of the clamp and rail, access may be had to the conduit at any point along the line. The track is laid with Johnson girder rail, weighing from seventy-eight to eighty-five pounds to the yard; on the curves a 100 lb. rail of the same manufacture is employed.

The electric circuit is entirely metallic. The two line wires, which are No. 000, B. & S. gauge, are held in the conduit by insulators in jaws. Contact with the wires is made by means of a four wheel trolley device, so arranged with springs, that it yields to every motion of the car above. Contact is made and broken by means of a lever similar to that employed on a cable car. Power will be furnished from the Lincoln Avenue cable station, where an Eddy generator and a McIntosh & Seymour engine are located.

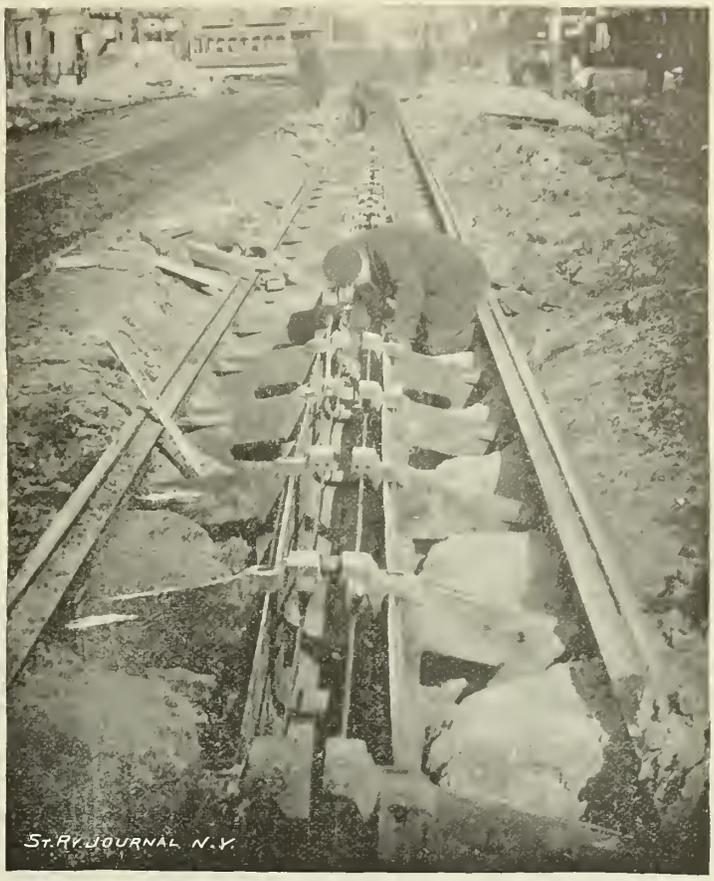


FIG. 1.—STREET SCENE—CHICAGO UNDERGROUND ELECTRIC SYSTEM.



FIG. 2.—STREET SCENE—CHICAGO UNDERGROUND ELECTRIC SYSTEM.

The cars to be used on the line were built by the Pullman company. Westinghouse electric motors and McGuire steel trucks will be used. The electrical construction work was done under the supervision of Professor Barrett, city electrician of Chicago, and the track construction was directed by the engineers of the North Chicago Railway Co.

The Rochester (N. Y.) Railroad Co. have decided to offer $1,000 in prizes to the conductors and motormen. $200 will be given to the conductor making the best record in neatness of personal appearance, good condition of car, courtesy to passengers, strict observance of rules, freedom of car from accidents, and prompt service. A similar first prize will be given to the motorman making the best record in a similar way, except that he will also be given credit for care of motors under his control. There will be second prizes of $150, third prizes of $100, and fourth prizes of $50, for each. The prizes will be awarded at the end of the year.

It is reported that it is the intention of the government to establish at the Exposition grounds a complete post office, equal in capacity to that required by a city of 200,000 or more inhabitants, and to operate it, not only during the Fair but for several months previous to the opening and after the closing. A government post office inspector is now on the grounds perfecting plans and estimates. It is believed, that the number of exhibitors will be between 150,000 and 175,000. To these mail will be delivered hourly.

Street Railways of Toledo, O.

Toledo is peculiarly fortunate in possessing enterprising street railway companies. To them the city owes not a little of its prosperity. They have provided the most approved rapid transit facilities, and they are constantly increasing the efficiency of their service. They have been greatly instrumental in making Toledo a desirable place of residence. The two companies cover the city thoroughly, so that it is possible to reach almost any point within the municipal limits quickly and conveniently. They provide rapid transit; one of them at the present time operates all its cars by electricity; the other company employs the same power for running the great majority of the cars. Within a year horses will be abandoned on all the lines.



FIG. 1.—MEKARSKI COMPRESSED AIR MOTOR CAR—TOLEDO CONSOLIDATED STREET RAILWAY CO.

TOLEDO ELECTRIC STREET RAILWAY COMPANY.

The Toledo Electric Street Railway Co. occupy sixteen and a half miles of street, on which are laid twenty-four and a half miles of track.

The power house of the company is located on Water Street between Oak and Adams Streets. The building has a frontage of 100 ft. and it is 165 ft. in depth. It is one story in height, but it is an exceedingly high building for a one story structure. When one visits the plant he is struck first of all by the wisdom of the owners in providing an abundance of room for increase in capacity.

Twice the amount of power now generated may be required on the road, and the necessary machinery can be located in the building, with an abundance of room to spare. So many electrical plants have outgrown their quarters, especially those intended for lighting, that this characteristic of the Toledo company's station may be referred to as an especially commendable feature.

The boiler room is located in the front of the building. The boilers now installed are four in number; they are tubular, and were manufactured by Stewart & Sons of Worcester, Mass. Two, and at times three, boilers generate the steam for the engines.

Coal is now used as fuel. Natural gas was used until November 1, when the general supply was not sufficient to meet the requirements of consumers in the city. Manufacturers and owners of steam plants were forced to use other fuel. About the first of April, when the demand from residences is much less, the company will resume the use of gas.

The power house was constructed with a view to securing solidity and freedom from vibration. The walls rest on 800 piles; 700 piles were driven in the space inclosed by the walls. All the machinery in the engine and generator room, that is, the engines, counter shafting and dynamos, rests on exceptionally massive masonry. The floor is covered with concrete to the depth of from one to four feet. The entire interior is perfectly free from moisture. The two engines were manufactured by C. & G. Cooper & Co., of Mount Vernon, O. They are of 450 and 500 H. P., but upon occasions they have developed 600 and 700 H. P. respectively. They are cross compound condensing. Water for condensing is secured from the Maumee River directly in front of the power house. The flywheel of the large engine weighs 55,000 lbs. and that of the smaller 42,000 lbs. Belts made by the Jewell Belting Co. are used throughout.

Eight generators supply the current. Six of these are Thomson-Houston machines of eighty H. P. each. The other two are Westinghouse four-pole machines of 200 H. P. each.

In operation the plant proves extremely economical. From six to eight men, including firemen, engineers and generator men, operate the plant for the entire twenty-four hours.

Until the recent fire, described in our last issue, which destroyed one of the car houses containing a considerable part of the equipment, the company operated forty-four Westinghouse single reduction motors of twenty H. P. each, six Thomson-Houston S. R. G. motors and ten double reduction Thomson-Houston motors of thirty H. P. each. Two special motors built by the company were also operated. The machines are somewhat different from the ordinary type. The fields are run in series, and, it is stated, excellent results both in speed and power have been obtained. Brill cars and trucks are used exclusively on the road.

The company has had two car houses. One of these has just been finished at the corner of Ontario and Galena

Streets. It has a frontage of 125 ft. and is 175 ft. in depth. It has ten tracks, and is provided with pits for the examination of motors. It is a well lighted and well arranged structure. The company's other car house on Canton Avenue corner of North Street, was recently burned.

Heating on some of the cars is effected by an electric heater constructed on the company's own design. It is extremely simple. Imagine a four-foot section of water spout constructed of zinc, and little need be added to the description. This cylinder is heated by passing a current of electricity through it. The bare metal is covered with asbestos cloth and then with canvas, and treated with a coat of shellac. Four of the heaters are placed in the car; they are hung just far enough below the seat so that passengers may rest their feet against them.

The officers of the company are David Robison, Jr., president; L. S. Baumgardner, vice-president and James J. Robison secretary and general manager.

TOLEDO CONSOLIDATED STREET RAILWAY CO.

The Consolidated Street Railway Co. of Toledo has an extensive system. Its twelve lines aggregate sixty-five miles, of which forty are operated by electricity at the present time: the remainder is traversed by horse cars. The company proposes to utilize electric motors on all its lines, and within the next year all the horses will be out of employment. It gives an admirable service. All the lines are now laid with heavy girder rails with the exception of fifteen miles on which a substantial steel tramway construction was built within the last four years. Seven-eighths of the lines are paved; indeed, thirteen miles of paving was done last year. During next year the company will build four miles of track in new territory, and will put in double tracks on several old lines.

The main station of the company is located at the corner of Water and Monroe Streets, fronting on the latter street. Its dimensions are 110×240 ft. The front part of the structure on the ground floor is used as a car shop. It is conveniently arranged with pits so that motors can be readily inspected. The repair shops are also located here. Directly overhead is the winding room, and excellent work in winding armatures and coils is done.

The power station is in the rear of the building. This portion of the building is entirely fireproof. The boiler room contains four Wharton-Harrison boilers, each of a capacity of 150 H. P. Crude oil is used as fuel. The Reed oil burner, furnished by the Standard Oil Co., is employed. Until within a short time natural gas was used; when the supply was cut off the resort to oil was made, and the change has proved so entirely successful that it is questionable if a return will be made to gas. The boilers are arranged for either kind of fuel. The oil is stored in a reservoir located on a dock in the rear of the building. It is brought to that point from the railroad yard in a small tank car which the company runs over its lines. The live steam purifier which is used is set below the water line of the boilers. It is of the type manufactured by Stilwell & Bierce, of Dayton, O. A Dean pump is used for forcing the water into the purifier and thence into the boilers.

On the same floor are located the engines, which are the Hamilton-Corliss, compound condensing, of 500 H. P. each. Water for condensing is taken from the river. In the same room is located the air compressor used in connection with the Mekarski compressed air motor shown in Fig. 2.

The generator room is directly above, the engines belting to a line shaft. The main belt, which is forty-eight inches in width, was made by Charles Munson & Co., of Chicago. Current is generated by two Edison machines of 250 H. P. capacity and five Thomson-Houston 80,000 watt machines.

The company are operating at the present time thirty-nine double reduction Thomson-Houston motors of fifteen H. P. each, and five Eickemeyer motor cars; four of these latter are double connected and the other is single connected. The capacity is thirty H. P. each. These motors, which were built by the Western Electric Co., of Chicago, are giving entire satisfaction. Six additional motors of this type will soon be put in operation. The electrical equipment of the road is working excellently and to the satisfaction of the residents of Toledo. There are several points in the road where, owing to the branching of several lines at one point, there has been some complicated construction, but all problems have been satisfactorily solved. The officers of the road are: Norman B. Ream, Chicago, president; Albion E. Lang, vice-president and general manager; William E. Hale, Chicago, treasurer; Charles L. Wight, secretary.



FIG. 2.—AIR COMPRESSOR—TOLEDO CONSOLIDATED STREET RAILWAY CO.

The Mekarski American compressed air motor car shown in Fig. 1, is in use on the road; it has been in operation a little over three months. It is giving satisfaction and as this is the first car of the kind built in this country, those interested are greatly encouraged by reason of the record that the car has made. It is twenty-two feet over all. The eight cylinders which contain the compressed air are located below the floor. They are made of steel plate three-eighths of an inch in thickness. The air pressure is 600 lbs. to the square inch. The compressed air engines are two in number, each of fifteen H. P. with cylinders 5 × 8 ins. The engines, with all their gearing, are encased in wrought iron with two doors opening on the side. The under frame of the car is of wrought iron or steel. On the front platform is placed a reservoir containing hot water, through which the air passes on its way to the motor cylinders. The reservoir is fitted with a valve, which regulates the air so that it can be used at any pressure desired. At the right hand of the driver is the ordinary lever for working the link motion. The brake is formed by two vertical cylinders placed on either side of the car between the wheels, a small pipe coming from the three way cock carries the compressed air under the piston for working the brake. The car will run between eight and nine miles without recharging, and is handled with ease and promptness, all the motion being under

perfect control, and requiring but a slight expenditure of physical force on the part of the driver. Its speed varies, at the will of the driver, from three to twenty-five miles per hour. It can be brought to a dead stop, it is claimed, in less than its own length.

Foreign Street Railway Notes.

By Our Special Correspondent.

THE ELECTRIC STREET RAILWAY IN HALLE, GERMANY.

The ancient city of Halle on the river Saale, is one of those German towns which, in consequence of its situation, large industries and trade, have become important railroad centres and has shown a rapid growth during the last twenty years.

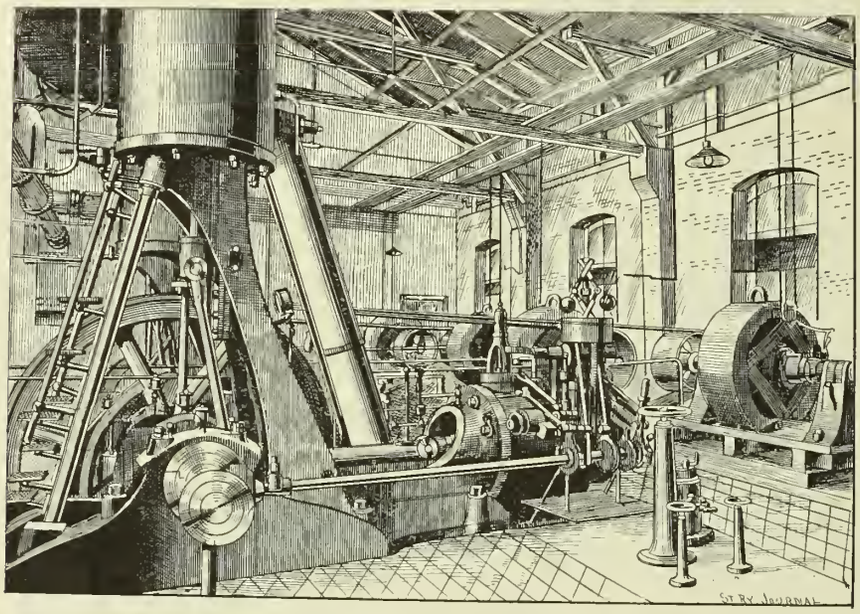


FIG. 1.—INTERIOR OF POWER STATION—HALLE ELECTRIC RAILWAY.

The intramural traffic of Halle has until recently been cared for by two street railways. The first of these was built in 1882 by a private corporation, and still employs horses as a motive power. The other, called the Halle City Railway was built by the municipality of Halle in 1888, and operated by a contractor who employed horses until a short time ago, when the road was leased to the General Electric Co., of Berlin. This company represent the Edison interests in Germany and have recently equipped the line with electric power.

The situation of Halle, is upon a number hills, so that there are on the line of the road a succession of grades, the greatest of which is about five per cent. The minimum curve radius is about forty feet. The line is single track 4.8 miles in length with turnouts at distances of about 1,500 ft. apart, and is shown in plan in Fig 3. The gauge is one metre or about thirty-nine inches.

The construction of the roadbed is shown in Fig. 2. Each of the four girders constituting the rail and guard has a weight of 23.14 lbs. per yard, and between each pair are cast iron blocks of forms shown in the engraving. The rails, blocks and tie bars are held by bolts and nuts. The total weight of the track, including the four girders, blocks, bolts and other parts is 119 lbs. per yard. The rails are laid on broken stone ballast mixed with sand and gravel.

The generating apparatus is installed in a building formerly used as a stable house, but which has been reconstructed for power station purposes. The steam generating plant consists of three Steinmüller water tube boilers, each having 1,301 sq. ft. of heating surface. Two of these are regularly employed for the operation of the road, the third being kept in reserve in case of the necessity of repairs to either of the other two. The steam is generated at a pressure of 150 lbs. The engines, which are of 200 H. P. each, are compound and three in number, two being sufficient for the needs of the railway, the third being kept as a reserve engine. The two cylinders of the engines are at right angles with each other, the high pressure cylinder being horizontal and the low pressure cylinder vertical. The former has 13.4 ins. diameter and 21.6 ins. stroke. The latter has a twenty inch diameter and 21.6 ins. stroke with working pressure of thirty pounds. The speed of the driving wheels is 180 revolutions per minute. Each engine is belted to two 60,000 watts multipolar generators. The engines were supplied by the Goerlitz Engine Construction Co., of Goerlitz, while the generators and all the electrical plant were furnished by the General Electric Co. The motors are of the Edison railway type. Fig. 1 shows the interior of the power station.

The rolling stock consists at present of twenty-five motor cars and twenty-five trail cars, each of the former being equipped with two fifteen H. P. double reduction Edison motors. The speed of the cars is limited by city ordinance to nine kilometres or 5.59 miles per hour, and they run during the busy portion of the day on a headway of six minutes. Each car is equipped with a sand box.

The zone or graduated system of fares, so common in European cities, has not been adopted on this road, but instead, the American system of a single fare for any distance traveled is in force. The fare charged is ten pfennigs or two and a half cents. Fare boxes are used.

The introduction of electricity on this road has resulted in the discharge of the former stock of 115 horses and has been followed with very gratifying results. The citizens of Halle seem to be very well pleased with the new motive power, and the traffic on the Halle city railway is reported to have increased twenty per cent. since the introduction of electricity. The road has attracted very much interest in Germany and has already been visited by a large number of engineers from different sections of the country.

THE ANNUAL REPORT OF THE BERLIN STREET RAILWAYS.

The report of the inspector of public works, etc., of the City of Berlin for the year 1890-91, gives the following facts: The street railways of Berlin are operated by three companies, the Great Berlin Horse Railway Co., the New Berlin Horse Railway Co., and the Berlin-Charlottenburg Horse Railway Co. Extensions have been made during the past year as follows: The Great Berlin Horse Railway Co., have built 5,905 ft. of single track and 10,498 ft. of double track. The New Berlin Horse Railway Co. have built 820 ft. of single track and 5,905 ft. of double track.

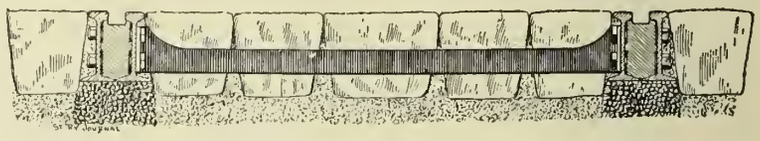


FIG. 2.—TRACK CONSTRUCTION—HALLE ELECTRIC RAILWAY.

According to their franchises the Berlin street railway companies are compelled: First, to pave within their rails and thirty nine inches on both sides of the track with a good quality of paving stones and ballast, as ordered by the inspector appointed by the municipality. Second, to pay a certain fixed annual rental, depending on the area of streets occupied by their tracks. Third, to make an additional payment to the muncipality of a percentage of their gross receipts.

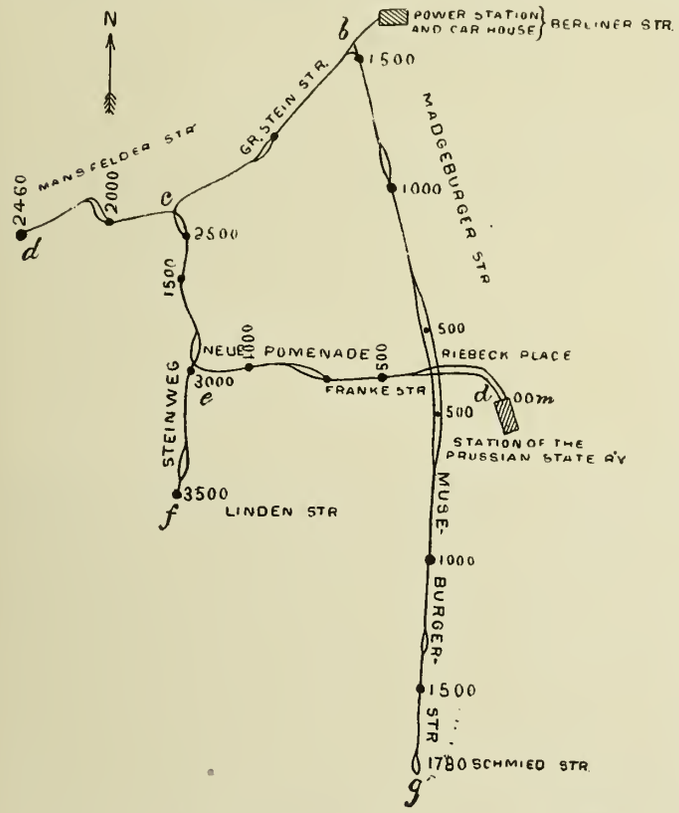
The following table shows the amounts which have been paid by the street railway companies during the years 1889 and 1890 in fulfilling these conditions:

	To Fulfill Conditions 1 and 2.		To Fulfill Condition 3.	
	1889	1890	1889	1890
Gt. Berlin Horse Railway.....	219,625	219,784	985,645	1,045,537
New " " "	42,693	42,693	62,553	65,000
BerlinCharlottenburg Horse Ry	17,623	17,623	12,342	20,187

All the amounts are expressed in marks, the German standard coin. The mark is equal to about twenty-four cents in American currency.

OMNIBUS LINES IN BERLIN.

When the street railway system of Berlin was extended recently so as to give easy communication between most of the suburbs and the centre of the city, the future of



The numerals indicate distance in metres from the Prussian State Railway station.

FIG 3.—ROUTE OF HALLE ELECTRIC RAILWAY.

the old omnibuses seemed to be very hopeless. These vehicles were of very old type, badly constructed within and without, and were not furnished with brakes or many conveniences.

New omnibuses have been built, however, which are comfortable, clean and attractive looking, to take the place of these old vehicles, and these are doing quite an extensive business. Fares are cheap, and a considerable speed is maintained. The employes are better paid than formerly, and are consequently of a better class and more polite. During the past winter a number of omnibuses have been lighted by electric light supplied by accumulators carried on the vehicles. Next summer a number of open buses will be put into service. The following table shows the number of passengers carried by the two prinpal omnibus lines of Berlin, the General Berlin Omnibus Co. and the New Berlin Omnibus Co. during 1889 and 1890 :

	1889	1890
General Berlin Omnibus Co.	17,319,814,	19,193,192.
New Berlin Omnibus Co.	6,841,292,	6,928,488.

The figures for 1891 have not yet been published, but they are known to indicate a large increase in the traffic over last year.

STEAM STREET RAILWAYS IN ITALY.

Many suburban street railway lines which in America would employ cable electric or horse power, are in Italy operated by steam dummies and this motive power in the past has been very popular. The lines referred to are entirely distinct from the main trunk transportation lines, and the tracks are laid in the highways, but at the side of the street. The entire length of road in Italy operated in this way is 1,578 miles. Of this, eighty-seven miles are laid on streets belonging to the govenment, 1,070 on streets belonging to provincial administrations, 221 mileson streets belonging to local administrations, and 200 on ground belonging to the street railway companies.

The average speed on these street railways is eleven and one-half miles per hour and nearly all are laid standard gauge. The rolling stock is light to avoid heavy roadbed construction and the cars resemble the American long double truck street cars more than the ordinary European railway coach. Trains of three or four cars are usually run. Owing to the comparatively high speed maintained there would seem to be considerable danger of collisions with carriages and other users of the street, but as the railways are not allowed to extend into the more populated parts of the cities accidents are not as frequent as they otherwise might be.

COMPRESSED AIR IN PARIS.

The Compagnie Générale des Omnibus of Paris have decided upon the adoption of compressed air as a motive power upon the lines between Paris, St. Cloud, Sevres and Versailles. Locomotives will be used, each of which will be capable of hauling a train of three cars, each car to have a seating capacity of fifty passengers. The construction of the power station will be commenced at once, and it is expected that the system will be in operation by the end of the present year. There are now in operation by compressed air two railway lines in France, one at Nantes, the other connecting Paris, Vincennes and Ville Evrard. There is also another in Switzerland, at Berne.

Proposed Underground Electric Railway for Berlin.

The population of Berlin has greatly increased within the last decade, and the present means of urban communication have become entirely inadequate. To provide for the increasing demand for transportation facilities the General Electrical Co. of the city propose to build a system of underground electric railways similar to the City & South London road. It is proposed to divide the city into quadrants by two main lines crossing each other at right angles, which are to be connected by an inner circle line built at an average distance of two kilometres from the centre crossing point. Ultimately, it is stated, an outer circle line with a radius of four kilometres will be constructed. It is proposed to build the main north and south line first ; this to be followed by the east and west line. It is intended to run trains at three-minute intervals at a speed of fifteen miles an hour. The trains will consist of three coaches and an electric locomotive. The rolling stock will be similar to that used on the London road. The cost of the first line will be about $3,000,000.

Fare Receipts as Tickets.

A novel method of interesting the public in taking care of fare receipts has been adopted by the Belt Electric Line Co. of Lexington, Ky. This company issue packages of printed receipts to their conductors, each conductor being obliged to give a receipt to each passenger for fare collected. The receipts are numbered, and at the end of the week seven numbers are selected by lot, one representing a ticket issued on each of the preceding days, and the holder of each receipt thus numbered can, upon presentation of the same within a week at the offices of the company, obtain a package of twenty-four tickets therefor.

This method is said to be extremely popular with the public and results in the preservation by passengers and others of the receipts which were before thrown away.

The Practical Side of the Electric Railway.

Chapter II.—Continued.—Overhead Construction.

By J. H. Bickford.

City councils generally require railway companies to use something that will present a better appearance than the ordinary cedar or chestnut pole. A straight painted pole is not so unsightly. No doubt the objection to the overhead system in many cities has arisen from the fact that members of the council have visited places where crooked and unsightly poles had been erected. They instinctively concluded that such were not suitable ornaments for their own streets, and forthwith declined to grant franchises.

It seems to me that a railway company contemplating the using of electricity as a motive power cannot afford to employ ordinary wood poles for its overhead wires. Because the telegraph and telephone companies use them there is no excuse for railway companies to do likewise. The latter have twice the number of poles in the street, ought to make their lines as unobjectionable as possible, therefore, and for their own good they should use the best material obtainable

It may be said that cedar or chestnut poles cost less, and it is not businesslike to invest more money in a line than is necessary. This is sound reasoning if we do not care for appearance, but appearance goes a great way in these days. A little finish that is pleasing to the eye is just as necessary in line construction as trimmings are to a building. Both are in the street, and are before the eyes of the public continually. Build your line, then, in harmony with its surroundings and please the public ; and when you do this you benefit yourself.

I would recommend the use of steel poles only because of their looks, and when wooden ones will not be allowed. The leakage in wet weather must necessarily be greater, and the double insulation required entails an additional expense for maintenance. The first cost is many times that of wooden poles if the proper size is used, and where heavy lines of feeders are run, both the positive and negative being on the same poles, the liability of short circuits is increased. A hard pine pole similar to

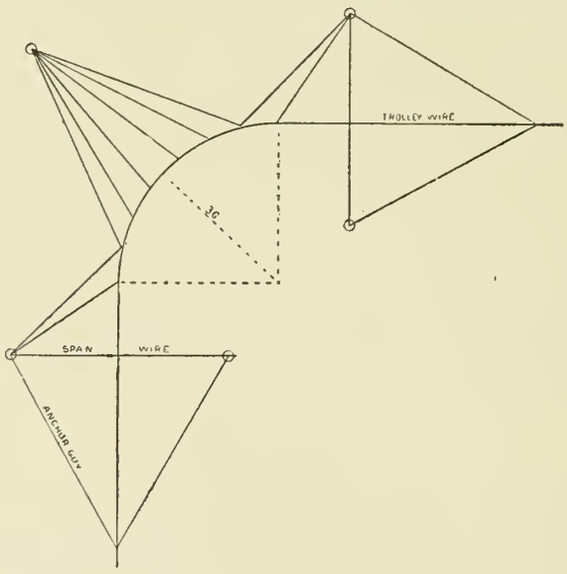


FIG 1.

that described above is not objectionable, and, everything considered, is the best pole to use.

We have said that our lines were constructed badly at first, and that we have found it necessary to reconstruct them since. Some reasons for poor construction have been given, but one other thing is worthy of notice. The contractor or constructor is not wholly to blame for the present reconstruction. The railway companies have been negligent in the maintenance of their lines ; some of them took it for granted that when the line was once built that it would last forever without attention But they became convinced after awhile this was not the case, and they began to make repairs. But alas ! such repairs ; they made no repairs at all, as a matter of fact ; they merely patched up here and there, and they kept on patching until the original garment was all covered with patches ; then when the line would not stand up any longer they concluded they must rebuild.

The line should be inspected every day just as regularly as the motors or any part of the equipment. All

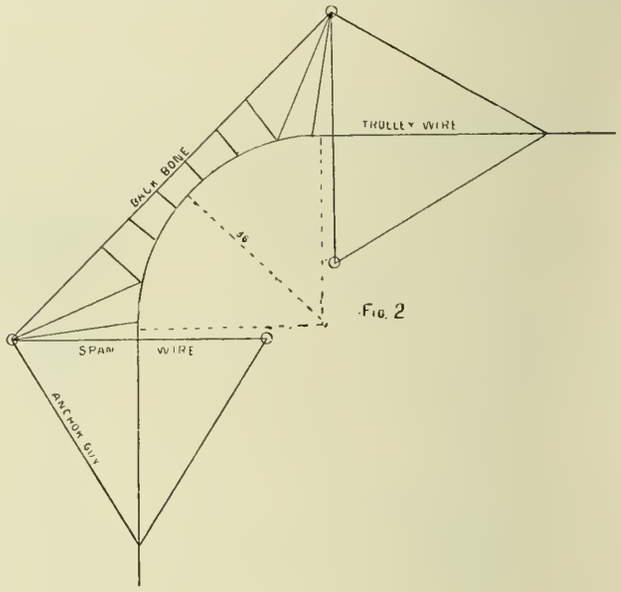


FIG. 2.

parts found defective should be immediately removed and something of a more substantial character should be substituted. If your insulators, pull-offs or any other device gives you trouble continually, do not buy more of the same kinds and thus keep putting up defective apparatus. Look about for something better, and if you cannot find it in the market, make it ; you should not be content till you have eliminated all faults. There is a great amount of line material on the market to-day that is not suitable for the purpose; the reason is easy to find; much of it was designed by persons who have had no experience whatever in the business, and who offer their wares for what there is in them and without particular regard for their stability. Buy nothing but the best, as none of it is too good.

Let us look for a moment at the most important points of construction which have not already been considered.

The height of the trolley wire is an important feature. It should be as high as practicable, for two reasons : There is less wear and tear to both line and trolley wheel, and the appearance of the line is enhanced. The trolley wire itself should be at least nineteen feet above track. In order to obtain this height the span wires should be placed about twenty-one feet high in streets of an ordinary width ; this will allow for the insulator and sag. As to the best kind of material for span wires there is great difference of opinion. I prefer, however, stranded wire as it will not break as easily as a solid wire. Seven strands of No. 12 steel galvanized wire formed into a cable make a strong and durable support ; its life will be prolonged by coating it with some good weatherproof paint. This can be easily done from the tower wagon after the wire is in position.

A special grade of silicon bronze wire has been used for span wires with good success, and is preferable in cities where the atmosphere is filled with sulphurous gases.

Guard wires are a necessity ; they protect the railway lines as much as they do the telephone and telegraph wires. The grounding of the trolley wire by low tension wires falling upon it is of frequent occurrence on roads not provided with guard wires. Electric light wires by this means are prevented from coming in contact with the trolley wire, thus lessening the liability of trouble to

dynamos and possible shocks to the employes. In sleety weather guard wires are of immense benefit if properly put up. They should be placed on a separate span wire at least twenty-four inches above trolley wires, and should have no connection, insulated or otherwise, whatever with the latter. Nothing short of a No. 9 or No. 10 steel galvanized wire should be used, and each wire should be placed about fifteen inches laterally from the trolley wire. I presume, a silicon bronze wire of the size mentioned would be preferable in smoky cities. In all cases a wire that has great tensile strength should be used, and it should not be capable of stretching to any extent.

The clip or fastening between the trolley wire and insulator on the span wire should be such that the bottom of the wire is left perfectly smooth for the trolley wheel to pass. If it projects below the wire even one hundredth of an inch, the wheel will partially break contact with the wire and an arc will be drawn, burning the trolley wire in all cases where it is the positive side of circuit. There are several clips on the market which obviate this trouble.

Feeders are an important factor. Few roads have enough of them. Our motors are designed for 500 volts and we should be able to get this amount on all parts of the line. Instead, we generally find anywhere from fifteen to thirty per cent. drop. This is decidedly wrong. In lighting circuits the drop is very slight at any point, the distributing wires being of ample capacity. Why should not this be the case with our railway circuits? If we expect our cars to run properly our potential must be constant and the same at all points on the line.

There are various ways of constructing right angle curves. Many are built on four poles and I have seen some built on three poles. In order that the shape of a curve may be preserved, I believe it should be supported by five poles, the apex pole being extra heavy and arranged to take the greater proportion of strain, similar to the annexed diagram, Fig. 1. Of course, circumstances sometimes interfere and a variation from this form must be made; but in nine cases out of every ten this plan can be followed. It will be noticed that the strains are direct and that each pull-off wire has a rigid terminal fastening to the pole, whereas, with a so-called backbone curve the trolley wire is fastened by pull-off wires to a second wire which runs from pole to pole and which is more or less yielding, making it almost impossible to hold the trolley wire in position over the track. See Fig. 2. The pull-off brackets should be so placed that the angle of pull will be sufficiently large to allow the trolley wheel to pass without striking the goosenecks. Undoubtedly the proper way to build a curve is first to get its radius and then to lay it out on paper, locating the poles and arranging the pull-offs to the best advantage. In other words a little engineering can be worked in here quite well. Generally there is too much guess work about line construction.

I find in practice that the trolley wire on curves if placed about eight inches from the centre of track toward inside rail, will receive less wear than if placed at any other point. Anchors should be placed each side of each curve as shown in diagrams.

As stated above, I believe the small silicon bronze trolley wire is preferable to larger sizes of copper wire and am led to this belief by experience.

Roads of any size should have the overhead system set apart into divisions, one entirely independent from another and each controllable from the power station by separate feeders. The current may then be turned on or off at will on any division of the road without interfering with any other section. System is everything and it should find place in the overhead wires. Provide for emergencies, such as fires, or the falling of the trolley and then the public will not become "shocked," and will have no chance to cast reflections on the already heavily laden "trolley system."

One word about switches or frogs. I have never yet seen a perfectly satisfactory one. But as they are very necessary adjuncts to the line, we must give them consideration. Undoubtedly the best form is what is termed the pan switch made right and left handed. It is usually made of cast composition metal and can be put up without cutting the trolley wire, which is a decided advantage. The tongues or approaches to the pan should be not less than twenty inches long, making a gradual slope for trolley wheel. If possible all switches should be placed directly under a span wire to insure them from tipping.

There are many switches with movable parts, but generally they are unsatisfactory, especially in winter, as snow and sleet prevent them from working properly, or the parts are broken by constant passage of the trolley. The simplest form will give the best satisfaction as a general rule. On short roads with many turn-outs two trolley wires running parallel the entire length will give better satisfaction than switches. Switches to work well should be placed from six to ten feet back of the heel of the track switch. This arrangement gives the car a chance to pull the trolley to one side enabling it to take the switch easily.

The parts of the overhead system are numerous, that space will not permit of considering them all; in fact, it has been possible to refer only to the most important points. I will only add that managers of roads should take into consideration the construction above the streets and make all repairs in the most thorough manner, so that the depreciation will be light. Close inspection and the best material are the most essential features. Do not wait for trouble to happen, but rather anticipate it and thus prevent disaster.

The Rights of Private Ownership in Railways.

By J. M. Batchelor.

The late Justice Bradley of the United States Supreme Court, in a decision rendered a little over a year ago, said: "When a railroad company is chartered it is for the purpose of performing a duty which belongs to the state itself."

Article 14, section 1, of the Constitution of the United States reads: "No state shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States, nor shall any state deprive any person of life, liberty or property without due process of law, nor deny to any person within its jurisdiction the equal protection of the laws."

The remark of Justice Bradley be it noticed, is an opinion only, and not the law itself. While it does not conflict with the Constitution, as above quoted, it is somewhat ambiguous; and in consequence has led many well meaning people astray. For the inference has been drawn from it that a railway charter when obtained is a tacit admission that the company obtaining it has more or less surrendered to the state its rights of private property control. This erroneous assumption is at the base of the anti-railway legislative movement which has so widely prevailed throughout the different states during recent years, and which has done so much harm to needed railway construction, and prevented many railways obtaining sufficient money to carry on their legitimate affairs. It has largely contributed to the distrust in the minds of investors regarding the desirability of investing in any form of securities where the right of property control is questioned by the legislatures of the various states; and this injury to the placing of railway securities has extended itself to Europe, where foreign investors have had their doubts of rectitude in our legislative assemblies, and in consequence they think it advisable to largely let "Americans" alone until the times get more settled.

In several decisions of the United States Supreme Court which relate to the issue before us, while the verdict was in favor of the rights of private property control, the decisions were handed down with a majority of one, gentlemen like the justice quoted, handing in a minority opinion, taking exception to the court's decision. For some reason not fully explained, these exceptions have been more widely accepted as the correct interpretations of the law than the decisions themselves. But this may be explained as the effect of the widespread desire of the masses to subject all large business organizations to the

people's control regardless of the private rights of property. However this may be, there are many reasons for saying that the encouragement of this view is highly likely to result in serious mischief, for by and by it may become difficult to draw the line where this ignoring of the rights of property may well cease. Either a man has a right to the control of his own property under the law or he has not. The Constitution distinctly says he has such a right, and further, that no state can deprive him of it. Then the issue before us rests upon what a franchise is, or what a contract obtained from a state and named a charter, really means.

The origin of the corporation laws of all states is confined to the idea of dividing a firm into parts whereby a larger number of capitalists can be brought into union than is possible under the ordinary ways of firms, and to limit the liability of such partners to the amount of money they invest in the business. Since then many laws have been made governing corporations in different businesses, railways having special laws of their own which only in part apply to other businesses; but in no case do these special laws interfere with the original purpose of corporation organization, as described, except in those states where the anti-railway movement of recent years we have alluded to, has taken attitude which directly conflicts with the Constitution as above quoted. But aside from the constitutionality of these adverse laws, there is an element of grave injustice in their breach of contract with all railway corporations which invested their money under laws giving the property owner the right of property control. To make a law destroying the rights of private control after a corporation has invested its money with the understanding that it would not be deprived of its property rights is virtually confiscation, a matter which the constitution expressly prohibits. While such a law against property rights might properly have due weight in warning all organizations who organize after the law was made, or with those organizations whose term of existence has expired and require a renewal, the application of it to past organizations contains an element of gross injustice, an injustice which must reflect upon the honest intent of the people of the United States.

The error at the root of these adverse laws is in the erroneous supposition that the state gives away something when it gives a franchise; but this view is not sustained by the facts; the state gives nothing in exchange for the registering of a corporation's papers; it merely records the papers, like a mortgage; the state never yields up any exclusive territory to a railway company; should another railway company come along the next day, and file corporation papers to do precisely the same business and in the same place, the state would grant another franchise, except that the privilege asked for come under the head of a nuisance or interfered with the criminal laws in some way. With street railways, too many railways on one street might be deemed a nuisance, and because of this and other objections appertaining to laws entirely outside of the corporation laws, such as the public health, etc., a special permit, in the shape of a legislative law, is required to get permission to build such railways. But this permit must not be confounded with the idea that the state has given anything away, for it has not. Except to the injury of existing property which the law is supposed to protect, another railway corporation could get a permit to build another railroad directly alongside of the first. This has been done repeatedly in different cities, and an instance of it may be seen in West Fourteenth Street, New York, which clearly shows that the state, in granting the first railway occupant of that street the privilege of constructing a railway, granted nothing which it would not grant to later comers.

In regard to a state or a city selling outright the privilege of constructing a railway in certain streets, that is another question, and not a part of the one before us. A bargain or a contract is one thing, and a breach of contract is another. Our purpose here is to show that a contract should not be broken when once made in compliance with the law. That a contract has been entered into by the state when it grants a charter, cannot be questioned; that contract is that the incorporators, so long as they comply with the law, shall be protected in their privileges; not from competition, but from any attempts to deprive them of their property, without due process of law.

Engineering, vs. Word Painting.

By WALTER C. KERR.

We hear much from time to time about "established practice," "consensus of opinion among leading engineers," "the results of broad investigation," etc., etc., all meaning something. But what? In the abstract these expressions may be credited with useful interpretations, but as commonly used they simply fill in where nothing more definite is at hand. When applied by way of argument, usually without backing or even illustration, they are an impediment to reason and contribute no facts. Their danger lies in their influence in diverting from facts and reasons which are specific, and the whitewash that they brush over definite circumstances and practical conditions needing consideration.

In engineering, whether of construction, purchase or advice, the most difficult part of a decision lies in the holding of one's mind to the conditions under which the decision must be made, the tendency being to judge what one would do were things slightly or wholly different. When one starts out to learn something, whether it be how to build, what to buy or how to remedy defect or trouble, he generally finds there is more knowledge at hand than he has any use for, and correspondingly little that he can make available.

Let us suppose that he is to erect a large power plant, and at once he has before him the several problems above referred to: How to build, what to buy and how to avoid the defects observed in other plants.

Generalities come in fast; A advises low steam pressures and B advises high; slow speed engines only are fit to use, while again, nothing but high speed will answer; the building must be large, substantial and put up for all time to come, or barely sufficient at the least expense to house the plant. Conservative advisers urge the use of nothing that has not been tried to a conclusion, while bolder voices impress the necessity of taking advantage of every latest improvement. And over all this is ladled the glib reference to "established practice," "consensus of opinion" etc., etc.

Let all this verbiage be cleaned out, and let word painting be relegated to the Seventeenth or some other back number century. Let merit, old or new stand for what it is worth in the service proposed, and let every consideration bear directly upon the purpose for which the enterprise in hand is created.

In illustration, and in keeping with the objects of the STREET RAILWAY JOURNAL for which this is written, let us examine the power plant of an electric railway, or, that we may not occupy to much space, take the engine alone.

One may have a somewhat reasonable impression that in this day compound engines only are to be considered. Soon however, he hears that this is a serious matter, and is advised that compounding is not advantageous under varying loads; that unless condensers are used, compounds are even less economical than simple engines; that very high steam pressures are essential to their efficiency; that to be advantageous each engine must be designed especially for the particular load and steam pressure under which it must operate; and finally, that this represents the "consensus of opinion among leading engineers" on the lines of "established practice." All this seems very complicated, and shrouds the compound engine in a mantle of doubt not anticipated.

The limitations enumerated are to the intending purchaser bad enough in their way, but it is the "consensus of opinion" and the "broad investigation" that particularly stick in his crop. It is therefore refreshing to find that he has been treated to a bit of word painting as a finish to certain facts, which, like the fundamental im-

possibility of dividing the electric current in multiple arc, were facts once but are facts no longer. Any compound engine that ever was built will do good service under certain conditions. But invention is never content, and it now transpires that irrespective of conditions his varying loads can be economically handled at any steam pressure, not only condensing but non-condensing, and by engines not especially built for a fixed load or pressure; all of which results have been created since the information he first received became "standard practice." He now begins to perceive that "consensus of opinion" has much less to do with making money by running street cars, than the engine that will do the business.

Then there is the old story of slow speed *vs.* high speed, the arguments over which have been worn down until they need more repair than the worst engine of either class. Slow speed came first—it usually does—and that higher speed should follow is neither chance nor design; it is the inevitable result of requirements—specific requirements—and could no more be held back or permanently obstructed than can electric railway service. Its presence does not discredit the virtues of slower running engines, and only time can gently force each type into the service for which it is best adapted.

The advantages of high rotative speed need not be argued here; they belong elsewhere; but it is pertinent to ask: What is high speed? and to observe that it depends wholly upon the service in which it is employed. That is, high speed and low speed are entirely relative terms. Which is the high speed engine? One that at sixty or 100 turns per minute flinches under the shock or partial stoppage from the accidental reversal of electric currents and whose flywheel bursts from the momentary speeding up due to tardy regulation when the "lightning arrester" is induced to cut off the load? Or, one that at 250 or 300 turns can be repeatedly stopped and reversed by a balky dynamo without injury, or that can let fly its whole load in an instant without harm?

Very few who confess to a prejudice against high speed engines can give detailed reasons for their opinions. Specifically they do not charge that a piston speed of 600 ft. per minute divided up in an engine running 300 turns is any different from the same 600 ft. in another running at seventy-five turns. Nor do they insist that there is danger in a well lubricated shaft revolving 300 turns per minute, in generous bearings. Their dread of lost motion disappears before the principle of single action, and so on through the list. Their false impressions arise partly from the fact that the high speed engine is the product of the present generation, thus enabling the average man to know more about the difficulties attending its development than he possibly can of the even greater troubles that attended the creation of the slow speed type, and partly to the word painted mottoes "safety of slow speed," "slow and reliable," and other idle expressions too persistent to be easily discarded and too vague to be convincing. The sooner that speed is seen to be what it really is, merely an incidental feature in engine design and not a characteristic, slow when one kind of service demands and the design allows it, and high when another service requires and the type employed permits it, the sooner its significance will be understood and wisely employed.

There is no abstract virtue in any engine such as the word-painter attributes. Its merits must be concrete and definite. They are to measured wholly with reference to the service to be performed. To the old types many virtues are commonly attributed that would not stand the searching criticism to which newer forms are subjected. In the blind belief that what has long existed, and about which conventional expressions have accumulated, must be the most able for all purposes, it is frequently found that some with otherwise discerning minds exhibit a confidence only equaled by that of the small boy who, looking at a circus poster showing an elephant balanced on the tip of his tail on a wine glass, was asked whether he believed that, answered: "Why I don't think there aint nothing what an elephant can't do."

This is hardly a discourse on engineering; it scarcely attempts to instruct, much less to argue. If, however, it should cause anyone to reflect on the futility of many stereotyped expressions that pass as current engineering gospel and cast them aside to make room for specific facts and approved reasons, allowing definite relations between means and ends to occupy that clear and important position they deserve, the engineering atmosphere will seem to be less hazy to those whose duties occasionally fall within its boundaries.

The Street Railway Situation in Chicago.

The report of the commission, consisting of aldermen, citizens and representatives of the street car company, appointed by Mayor Washburne to investigate the intramural transportation problem in Chicago, was presented to the City Council on February 9. The findings of the committee are not radical. Its recommendations to a great extent coincide with the views of railway men of Chicago. That it was not more revolutionary and that it did not attack the surface roads was unquestionably disappointing to the press of the city, which had opposed the companies so bitterly.

The report commences with a reference to the contracted business section of Chicago and then attacks incidentally the custom of hitching horses to curbstones, a practice so persistently followed in Chicago that the available width of roadways is in consequence materially reduced. The committee then asks the question: "Why can not wagons going in one direction be compelled to take one street and those going in another direction to take another street."

In regard to the need of intelligent policemen, the report says:

> The policing of the streets in the heart of the city is a very important matter and should be done with officers who are able to judge of the necessities of the traveling public. They should be instructed to see that the streets are kept free for the movement of cars and vehicles and that nothing should interfere with this. All vehicles should be forced to draw up alongside of the curb and none be allowed to back in. If it is unhandy for parties to load the teams in that position, they must so contrive their wagons that this can be done. The placing of building material should be so regulated that while it may take up some room on the street it must not interfere with travel. The greater point to be obtained is to prevent blockades and everything should be subservient to that end. We consider this one of the most important matters—fully as much as by increasing the number of cars, for the reason that even though the number of cars might be increased, if there are not proper facilities for moving them, the increase would be of no avail.

The committee thinks no West Side car lines should pass east of State Street. It also suggests that the council and the department of public works take steps to put Clark Street in such condition that it can be made a suitable thoroughfare for traffic. It is now so covered with railroad tracks near Sixteenth Street that traffic is rendered almost impossible. This brief reference is then made to the necessary growth of Chicago:

> Relief cannot be obtained until surface roads are not supplanted, but supplemented, by elevated roads. Your committee being of the opinion that the growth of Chicago will continue at the astounding rate of not less than 50,000 inhabitants per annum, believes that the surface roads, even if every concession be granted them and the maximum number of cars be run, yet in the not distant future will not be able to satisfy the demands, for the transportation demands of a city of 2,000,000 inhabitants are in proportion much greater than those of a city of a million and a quarter.

The actual recommendations of the commission are contained in the following list:

1. That the ordinance allowing cable trains to consist of only a grip and two trailers be changed so as to allow three trailers. This would of itself be an increase of at least fifteen per cent.
2. That the additional loop asked for by the South Side company be granted. This, according to the statement of Mr. Wheeler, would increase the carrying capacity of the road fully fifty per cent. There can be no doubt but what during the rush hours the present loop is taxed to its maximum carrying capacity.
3. That the Madison Street loop, as asked for by the West Side company be extended to State Street and that the cars return on Washington Street, thus greatly relieving Randolph and LaSalle Streets.
4. That the loop through the Van Buren Street tunnel be granted as far eastward as Dearborn Street, which would relieve the Washington Street tunnel fully twenty-five per cent., and which, with the increased capacity of the enlarged Madison Street loop, would increase the capacity of the West Side cable system fully sixty per cent.
5. That franchises for crosstown lines be granted wherever they

would relieve travel in certain districts, which in turn would help the main lines.

6. That the number of cars on all cable lines and the main horse car lines be increased not only during the rush hours, but also during other hours, as at present the accommodations certainly are inadequate.

7. That more trippers be run during the rush hours on all lines (on some they can only be run when better loop facilities are afforded).

8. That more night cars be run, especially during the winter season.

9. That waiting rooms be erected at the principal points in the outlying districts where crosstown cars connect and where transfers are given.

10. That all double fares ought to be abolished.

11. Transfers ought to be given on all intersecting lines.

12. Experience teaches that fully one-half of all delays in Chicago on the street car system is caused by vehicles either breaking down or getting stuck for some little time in attempting to turn out of the track. This also causes great expense to the owner of the conveyance. Much annoyance, a great deal of time and vast expense could be saved by adopting the flat rail system which works so perfectly in the city of Berlin.

13. Stopping at only every second corner, would, we think, be no inconsidable saving of time. This plan works admirably in every European city.

14. The changes in reference to street car loops will in our judgment be sufficient to relieve our streets from their overburdened condition for at least several years, when the city is in its normal condition in reference to population. But what shall we do upon the opening of the Columbian Exposition? If no changes in our street transportation are made, we venture the opinion that when the Exposition is running in full blast no woman, child, old man, feeble or sick person will be safe within the area bounded by Harrison, the South Branch, the river and the lake. We are, therefore, of the opinion that as a measure of permanent relief all cars and tracks must be excluded from the business centre. The area between Harrison Street and the river, the lake and the South Branch is not one-fourth part the size of the territory supplied by the elevated roads in New York City. We never hear complaints of the walk at the end of the elevated roads from our New York friends. For this purpose we would recommend the immediate construction of auxiliary loops outside of the territory above mentioned.

ELEVATED ROADS.

Chicago is peculiarly fortunate in having alleys parallel with our great thoroughfares in all parts of the city. We have examined the South Side Elevated Passenger Railway now under construction, and are convinced that elevated roads constructed on the plan that this road has adopted would not seriously damage property, would not be objectionable in appearance and would combine all the requirements of a first class road for the purposes for which it was designed.

The committee states very emphatically its belief that all steam roads entering the city should be elevated, and concludes its report as follows:

Your committee would, therefore, suggest the appointment of a committee of experts representing the various interests involved, and that said committee be empowered to collect data on which to base an emphatic report as to the most practical system to adopt, and believe that a report covering the whole question should be prepared at a date as soon as practical, to the end that if the present surface system is to remain the viaducts now in course of construction may be completed and the further construction of safety appliances, viaducts, etc. etc., may be commenced and completed without delay.

Believing electricity to be one of the great motive powers of the future, this committee cannot see any objection to an overhead wire system in the outlying districts. In a word, this committee believes that on the North Side, with all these foregoing recommendations adopted, the facilities of the surface roads would be increased fully sixty per cent., even during the rush hours, on the South Side fully 100 per cent. and on the West Side about the same.

TAXPAYERS' ASSOCIATION.

The committee of the Taxpayers' Association, appointed to investigate the local transportation question, and to recommend means by which rapid transit facilities could be increased, has presented an interesting report. The document was read at a meeting of the Association at Farwell Hall. It commences by stating that the committee's study has been confined to the rush hour between 5:30 and 6:30 P. M. If this period was provided for no trouble for the remaining hours need be entertained. The committee states that on the South Side the twelve steam roads transport about 13,000 passengers during the busy hours, while it is thought they should carry 20,000 or 25,000. The street cars designed to carry twenty-four to twenty-eight persons were made to hold from sixty-five to ninety. The report continues:

"If the South Side Street Car Co. will adopt double deck cars, overhead electric wire system on their long lines until a better system can be invented and the suburban trains will double their carrying capacity, the problem of transportation for the South Side will be solved."

The committee makes a suggestion of great interest for the North Side. The two main cable lines running on Wells Street might be operated, the former as an express and the latter for short hauls. The report says:

"A partial separation of the short travel from the through travel can be made on certain lines, especially on the North Side. It seems entirely practicable to devote the Wells Street cable to travel bound north of North Avenue so that no stop need be made between that avenue and Illinois Street, the short travel being handled by the Clark Street cable, and by present or future electric or horse lines with a liberal system of reciprocal transfer. This would shorten the time to Lincoln Park and points north several minutes and leave other lines less crowded. Mr. Yerkes has said that this would be entirely practicable.

"It is quite worth considering whether a similar separation of long and short travel may not be effected on the South Side by devoting the Wabash Avenue cable to through travel with no stop between, say, Van Buren and Twenty-second Street."

For this distance the Wabash Avenue and State Street cables run within a block of each other.

The committee also suggests a loop for the Wells Street line on Kinzie Street, which is the first street north of the river. This idea of making people walk from the places of business on the South Side to the cable on the North Side will be unpopular, as the committee readily foresaw, and it sought to anticipate the objection in these terms:

"It seems probable that passengers would walk from this line to the South Side as readily as 20,000 or 30,000 people now walk daily to and from the various steam trains."

The committee says there is a prospect of the operation of the South Side Alley L road, which will give great relief. It recommends the passage of the ordinance giving a franchise to the Chicago & Jefferson Urban Transit Co. in order that relief may be given to the West Side, and commends the Chicago & Evanston electric railroad.

The committee mailed a circular to the mayors of several hundred cities, asking for a report on the trolley system. The replies, which were received from seventy cities, were in the main highly favorable. Samples of the letters are given in the following summaries:

Toledo, O., T. R. Wickenden, city engineer—Two companies operate overhead wire trolley systems, and the people favor it. Our ordinance might be interpreted to provide for a removal of overhead wires. No persons have been injured or killed.

Dallas, Tex., W. C. Connor, mayor—We have fourteen miles of overhead electric road and no other system. No persons or horses have been killed or injured. People objected when the line was laid, but all objection has since ceased. Property abutting and served has been greatly increased.

Lynchburg, Va., Robert D. Yancy, mayor—We have four miles overhead electric system, which is a grand improvement upon the horse cars. It has increased the value of property everywhere.

Ann Arbor, Mich., reports that it has five and a half miles of the Sprague-Edison overhead system, that no persons or animals have been injured, that it has increased the value of abutting property, and that the people are pleased with it.

Washington, D. C., city engineer Capt. G. J. Fieberger—This city has 9.4 miles of electric road, of which 8.3 is overhead and 1.1 storage battery, and four miles of cable, with four and a half miles additional in process of construction. Congress has passed a law preventing the further erection of any overhead wires of any kind whatever. Property, especially that in the suburbs, is increased in value. Overhead wires are preferred to cable or horse cars, except from a standpoint of beauty.

Denver, Colo., reports thirty-nine miles of cable road and seventy-nine miles of overhead Thomson-Houston electric road working satisfactorily.

Salt Lake City, mayor George M. Scott and city engineer Samuel Paul—There are seventy miles of the Edison, Westinghouse, and Thomson-Houston overhead wire system here. There have been no fatalities connected with the system. The people are in favor of extensions, and the substitution of electricity for mules has greatly enhanced the value of property abutting and property served. Our running speed is twelve to fifteen miles an hour, or eight to ten miles schedule time, including stops. The speed of electric cars being regulated individually, they are enabled to make up time lost by frequent stops and to avoid the bunching common on cable roads during the rush hours. Breaks in the trolley system seldom cause delay of more than a few minutes.

Detroit, Mich.—H. S. Pingree, mayor, reports favorably as to the Healy noiseless steam motor, and states that attempts to establish a suburban line with the underground wire proved unsatisfactory and was changed to the overhead system.

St. Paul, Minn., through its mayor, Robert A. Smith, reports eighty-five miles of Thomson-Houston overhead system and fifteen miles of cable.

Milwaukee, Wis.—We have sixty miles of single track operated by the Edison overhead system and fifteen miles by the Thomson-Houston, and people generally favor these lines strongly, as no accidents have happened and property has been greatly enhanced in value. The work of substituting electric for horse car lines is going rapidly on, and by next December we will not have a horse car in the city. The people are anxiously looking forward to this change.

McKeesport, Pa.—We have four miles of Edison overhead system in use, with no competing systems. No accidents have happened and property along the route has been increased in value.

Joliet, Ill., P. C. Haley, mayor.—We have sixteen miles of the Thomson-Houston overhead system. Our people favor the electric road, as it has caused a marked increase in the value of all property served. We have no cable or other systems and do not want them.

The Mt. Generoso Inclined Railway.

Mr. Roman Abt, in the *Schweizerische Bauzeitung*, gives a description of this rack rail mountain road which commences at Capolago, on the shores of Lake Lugano, in Italy, and ascends a spur of Mount Generoso, one of the principal Alpine peaks intervening between the lakes of Lugano and Como. It has been constructed entirely for tourist traffic, as the prospect from the Generoso embraces extensive views over the Alpine range northwards, and of the plains of Lombardy to the south. Its length is 5.6 miles, and it terminates at Vetta, a point close to the Italian frontier, at a height of 5,235 ft. above sea level, or 4,326 ft. above Capolago. The line was completed and opened for traffic on June 22, 1890, or sixteen months after work was commenced. The fare charged at present is $1.56 single, or $2.00 for the round trip. Personal baggage up to eleven pounds is allowed free, and an extra charge of ten cents up to twenty-two pounds, and one cent for every additional two and one-quarter pounds.

being bent downward; they each weigh 55.3 lbs. The rails are of steel, weighing 40.3 lbs. per yard run, and are four inches deep. The joints of the rails are provided with fish plates, and the attachment to the sleepers is by nuts and bolts and spring washers

The rack rail running along in the centre of the track is attached to the centre of the cast steel sleepers by nuts and bolts and spring washers. It is formed of a specially rolled iron stool, to each side of which is bolted a dentilated plate, the teeth of one breaking joint with those of the other, so that the toothed wheel of the engine, which is made with a corresponding double-break joint cogging, is always in full grip with the rack rail. The weight of metal in the complete permanent way varies according to the thickness of the dentilated plates, from 202 to 222 lbs. per yard run.

The "creep arresters" for the permanent way on the inclines are formed in some cases of steel rails set on end, and let into holes bored into the bed rock and cemented, their tops reaching slightly above the sleepers which rest against them; in other instances, stone blocks and a rail laid transversely, are used for the same purpose. These creep arresters are laid at distances varying from 219 yards to sixty-six yards apart, according to the steepness of the incline.

Six locomotives are in use, constructed on the system designed by Mr. Abt. There are two axles, on each of which are keyed a toothed traction wheel, and a third trailing wheel axle.

The speed, both on the up and down journeys, is three and three-quarters miles on the heavy grades, and five to six and one-quarter miles on the lesser inclines per hour. The length of the wheel base of the

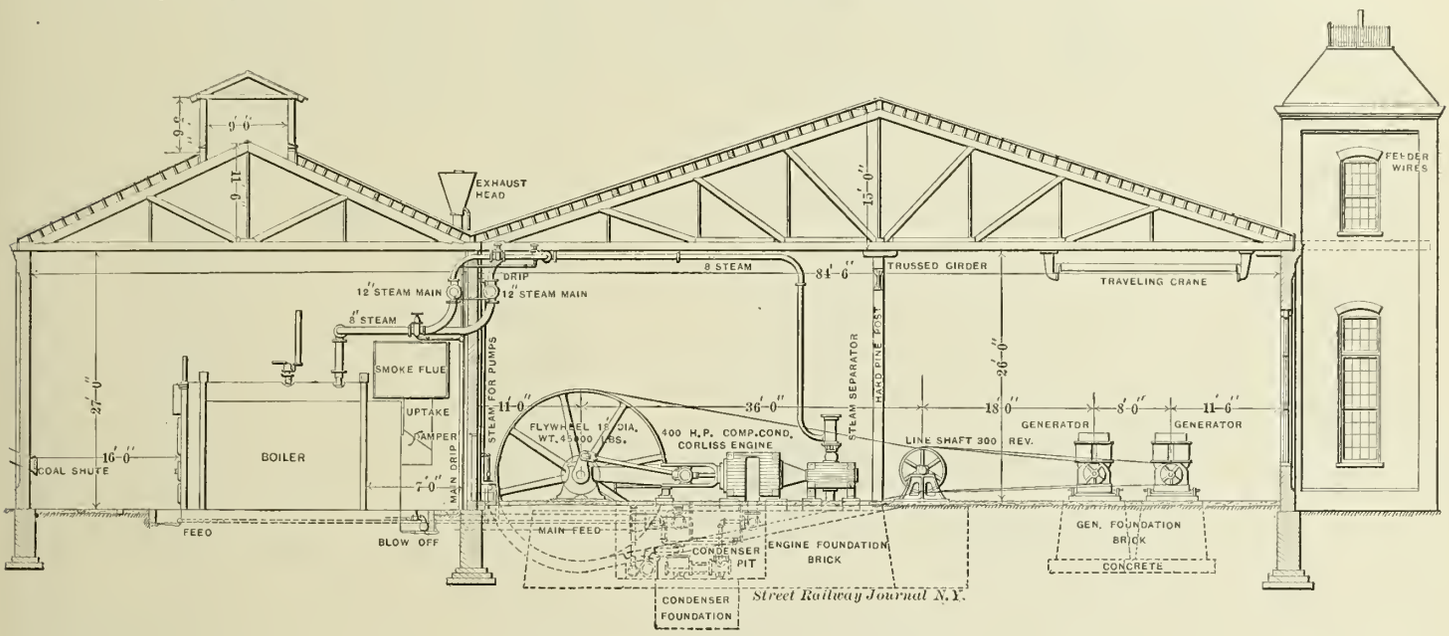


FIG. 1.—SECTION OF MODEL POWER STATION.

The commencement of the line at the St. Gothard railway station is close to the landing stage of the Lake Lugano steamers, and its course for a distance of a quarter of a mile is parallel to the main line; it then rises and crosses over the latter by a skew-bridge of sixty-one feet span and passes under the main road from Capolago to Mendrisio, whence, winding along the mountain slope at a distance of 1.67 miles, it pierces the rocky shoulder by a tunnel of 180 yards in length (on a gradient of one in five, and a curve of 263 ft. radius) and, doubling back, its course from here to its termination at Vetta is almost directly the reverse of the first portion. Near the upper end of the above mentioned tunnel is the station of St. Nicolao, at 2,288 ft. above sea level. The other intermediate station—Bella Vista—occurs at 3.9 miles, and is at a height of 4,075 ft. above the sea. Besides the above, there are four other tunnels of seventy-eight, seventy-one, forty-four and twenty-seven yards in length. The quarter mile at the commencement is on the level, and the rise from thence to cross the Gothard line is one in 16.6. Beyond this the grade for a short distance is only one in 33.3; but at the end of the first half mile begins to sharpen, and soon changes to one in five, and a maximum of one in 4.54, which latter grade occurs on the line for a length altogether of 3,630 ft.

The grade given by the whole length of the line divided by the height would be one in 6.82, or two-thirds of the steepest grade adopted. There are no reverse grades on the main line.

The vertical rounding off at the changes of grade varies from curves of 1,640 ft. to 3,280 ft. in radius; the former is recommended as a minimum where such sharp grades are adopted. On account of the heavy works, especially on the lower half of the line, and the desire to make the line as economically as possible, the gauge adopted was two feet, seven and one-half inches. The minimum radius of curves originally contemplated, was 197 ft., recurring frequently, but in construction this was altered, except in two instances, to 263 ft.

The extreme width of the rolling stock being six feet seven inches, the width of cutting and embankment at formation level was fixed at thirteen feet nine inches; in the latter there are no side drains cut, but these are formed by the space left between the ballast, which is built vertically at the edges and the foot of the slope of the cutting. The extreme width of the tunnels is eleven feet ten inches, and the height fifteen feet nine inches.

The sleepers are of cast steel, five feet eleven inches long, the ends

engines is nine feet three inches, and the weight in full running trim is fourteen and one-half tons. The remaining rolling stock comprises five open cars, each for fifty-six passengers, and two closed cars of the American pattern, for forty-eight passengers. The freight cars are capable of carrying six tons net.

The cost of the construction of the line, including engineering, land, rolling stock and workshops, together with tools, was $352,020, or $62,933 per mile, and the receipts for the fraction of the year 1890 (149 working days), during which the line was opened, were $17,788.

Power Plants for Electric Street Railways.

J. H. BICKFORD.

The essential features of a power plant for electric street railway work are stability, reliability, economy of operation, small expense for maintenance, capability of enlargement at small cost of building, accessibility to all parts, convenience of arrangement, compactness, but not at sacrifice of more important features; moderate first cost and a moderate amount of style.

Plants for this work are generally divided into two classes, according as the engines operate at high speed or low speed. In the early days of electric roads the high speed engine played a very important part, as only a few hundred horse power were required, but at the present time when large roads are equipping their entire systems and installing anywhere from 1,000 to 5,000 H. P., the question has arisen in many minds whether the high speed type is the most desirable.

It is a well known fact that the Corliss type of engine has a reputation for economy, both in operation and maintenance, and as these are two of the essential features many have turned their attention to this kind of engine. It was discovered at first, however, that these engines did not govern quickly enough to respond to the varying loads always existing in street railway work, but recently they have been so improved that they are considered by many to be the most reliable, as well as economical and substantial.

The accompanying illustration, Fig. 1, represents a plant employing these engines and arranged to develop 1,200 H. P., or, with a slight change in building, 1,600 H. P. can be installed. A brief description

of the most important points may be of interest to those about to erect a plant.

It will be noticed that in this particular plant only a portion of the 1,200 H. P. is to be put in immediately, the dotted lines showing the future increase in present building, additions being made as needed.

If, when it becomes necessary to install the third engine, it is ound that 1,200 H. P. will not meet all demands of the future, an 800 ent ones could be put in. Thus, it will be seen, that the future increase can be taken care of with but slight expense as regards change in buildings.

The boilers of the plant shown in Fig. 1 are of the water tube type, but differ in some respects from those generally sold. They are arranged in pairs forming batteries of 500 H. P. each. In order to secure a large amount of steam space, three drums, thirty-six inches in

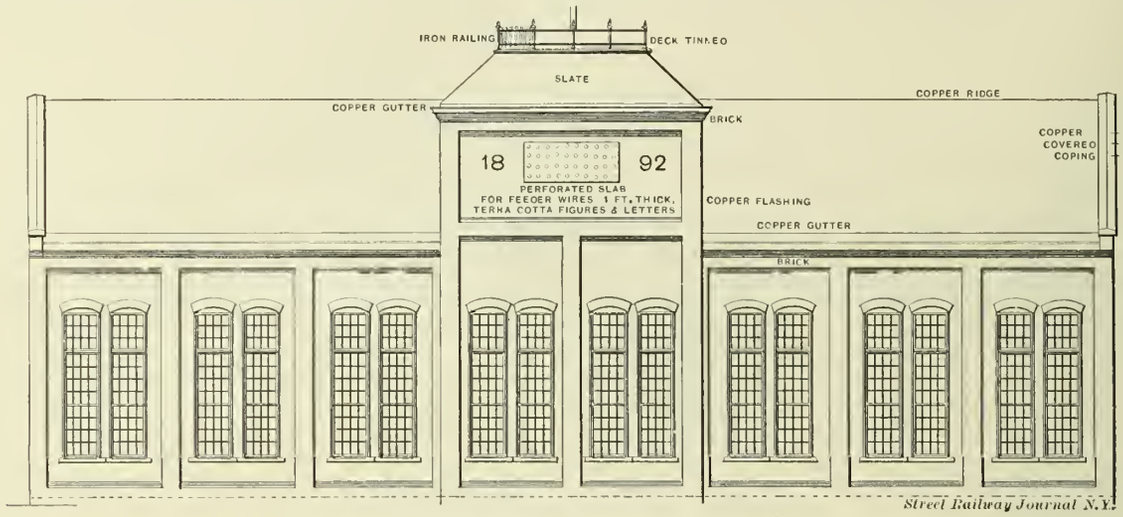


FIG. 2.—ELEVATION OF MODEL POWER STATION.

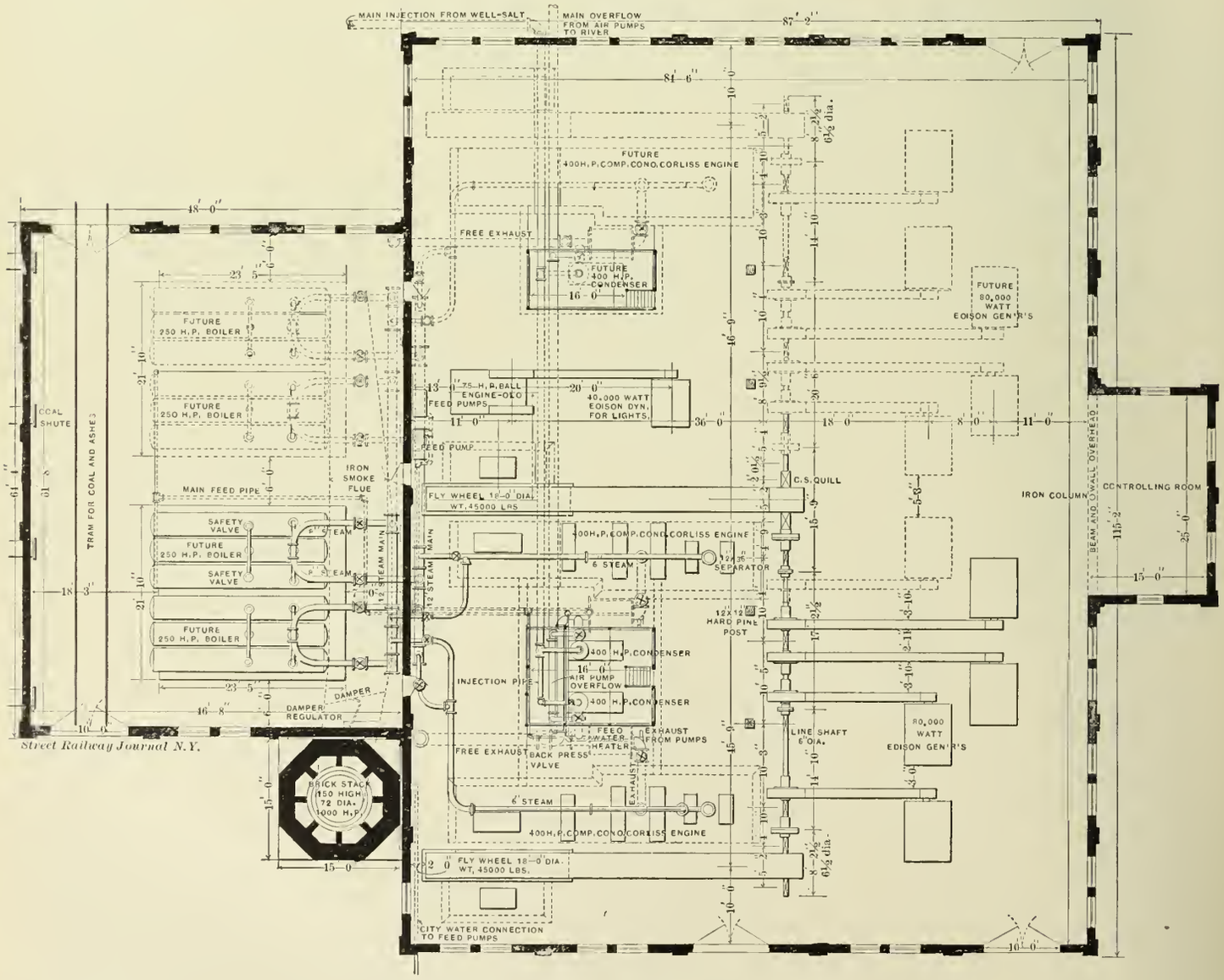


FIG. 3.—GROUND PLAN OF MODEL POWER STATION.

H. P. engine can be installed and easily be made to work on the same shaft, the space in the engine room being adequate. To obtain more boiler capacity, the end of the boiler room could be taken down and moved out sufficiently to install another battery. If the present chimney would not take care of all the boilers, a small one could be erected on the side of boiler room opposite the present stack. To obtain larger dynamo capacity, machines of double the capacity of the pres- diameter and twenty-one feet long, are placed on each boiler, making six to each battery. These drums have wrought iron heads and each one is provided with a manhole in front. The boilers proper are suspended on iron columns entirely free from brick work and are free to expand in all directions. All sides are readily accessible for cleaning and repairs. The ordinary setting is used, the writer believing this to be quite as good as the so-called patented furnaces. The boiler room

is provided with plenty of light, and with appliances for removing ashes; in the rear is a coal pocket provided with chutes for delivering coal directly in front of boilers. The main smoke flue is built of No. 10 tank iron and has a damper controlled automatically, also each uptake from boilers is provided with separate hand damper.

Particular attention has been paid to steam piping, to avoid water being drawn into the engines. About four feet extra in height was added to the building in order to arrange the piping as shown. This may seem to some an unnecessary expense, but, as this is one of the vital parts of the whole plant, it cannot be too well arranged. Throughout the piping the tendency is for the water to run back to boiler, except where the pipes descend to engine, and to provide against any trouble at this point, a separator has been employed. To add further to the safety of the engine, each main valve is provided with a drip as well as the mains themselves, and, to insure against shut downs, the main steam pipes are all duplicated. Instead of elbow joints, pipe bent to a radius is used and freedom of expansion secured. All piping is arranged to carry a working pressure of 150 lbs. per square inch, all joints being packed with soft sheet copper, no fibrous packing of any nature being used. Pumps are arranged in duplicate and to feed the boiler directly or through heaters.

The engines are of the Corliss type, tandem form, compound condensing, built extra heavy, and are of a capacity of 400 H. P. each, with 125 lbs. of steam at seventy revolutions, and one-quarter cut-off. Sizes of cylinders are: Low pressure, thirty-four inches; high pressure, eighteen inches. Length of stroke, forty-eight inches. The fly-wheel is eighteen feet in diameter, forty inches face, and weighs 45,000 lbs. The engines have safety attachments to prevent running away in case of breaking of governor belt or too sudden change of load. Engines are connected to independent jet condensers, direct acting, and are so arranged that, with two of the engines, either one will work with either condenser. A feed water heater is placed between the low pressure

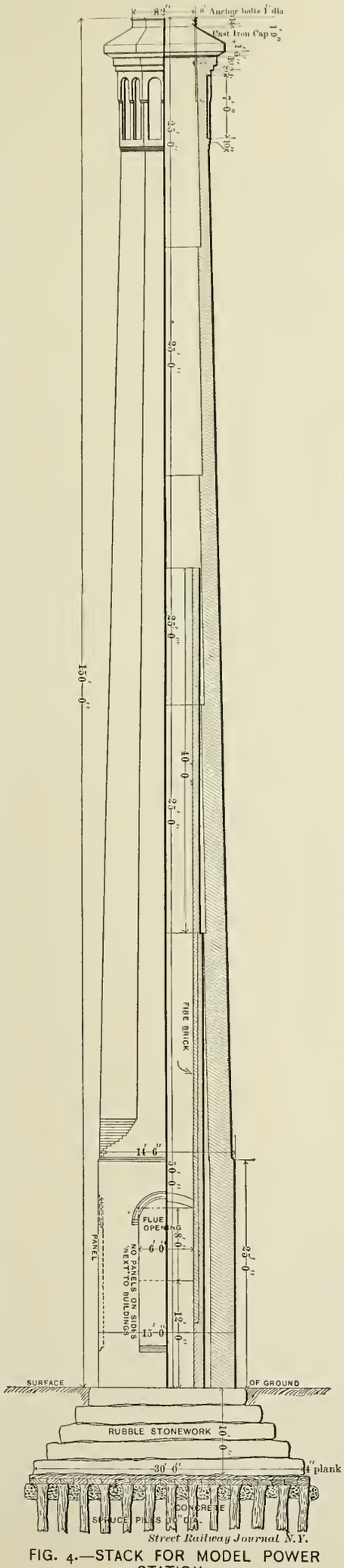


FIG. 4.—STACK FOR MODEL POWER STATION.

cylinder and the condenser on each engine. The exhaust from condenser and pumps is also passed through heaters and into condensers. If water is not heated sufficiently by this method, an auxiliary heater may be placed in the condenser pit and the exhaust from condenser and pumps passed through it to the open air exhaust. It will be noticed that the condensers have been placed in very close proximity to the engines so that full economy of vacuum may be obtained.

The arrangement of engines and dynamos is such that all belts have the slack side on top, giving greater contact to the pulleys.

The counter shaft is six inches in diameter and makes 300 revolutions per minute. Each engine is connected to shaft by cut-off couplings and either one can be connected or disconnected with shaft running. The centre engine is connected by means of a quill or hollow shaft. Each dynamo is connected to shaft by means of a friction clutch, and one or all can be thrown on or off while shaft is running. The shaft is in two sections and can be connected by means of a friction cut-off coupling. It will be noticed that the arrangement of the machinery is such that either engine can be made to turn a portion or the whole of the shaft.

A small traveling crane is arranged over the dynamos. These latter are of 80,000 watts capacity each and make 650 revolutions per minute.

The building is of brick with wooden trusses. The engine and dynamo room is 84 x 112 ft., boiler room 46 x 64 ft., and each twenty-six feet post.

Special provision has been made for the circuit feeders. A tower 15 x 25 ft., and thoroughly fireproof, has been erected, as shown on the diagram, opening directly out of the engine room, and forming a sort of bay window or alcove. The feeders enter the upper story passing through a perforated stone in the front, suitable insulators being placed in the perforations. Inside the tower they are secured to a stout structure and then drop down behind the switchboard which runs lengthwise of the tower in the lower story. The leads from the dynamos are carried in fireproof conduits through the concrete floor to the switchboard. It will be seen that by this arrangement the wires are all concentrated at one point which is fireproof, and the liability of fire from the wires destroying the building is very slight. Any fire which might start could be extinguished before it had done any damage. Heretofore but little attention has been paid to bringing the wires into a power plant. This is a mistake, however, as the wires are just as important as any part of the plant and should have proper consideration.

The building is provided with plenty of windows, the upper portions of which are transom hung so as to secure good ventilation and to prevent dust from being blown in as is the case where windows are open from the bottom. The chimney is of brick, octagonal shape, is 150 ft. high and has a seventy-two inch flue. The first 100 ft. has an inside shell, and the first fifty feet in this shell has a lining of fire brick. The top has a cast iron cap. A special engine and dynamo has been placed in the plant to supply lights only; this is done principally to avoid running the large engines at night and also to ensure steady lights.

While, perhaps, this station has no features strikingly new, yet it will be seen that the arrangement is such that all the essential features named at the beginning are obtained. The writer is well aware that a loss exists in transmission of power by counter shaft, which loss does not occur in a station supplied with direct coupled engines and dynamos. But looking at this question in its true light, the question arises whether is it practicable in all cases to use direct coupled apparatus. There are certainly some disadvantages as well as advantages. For stations of 1,500 H.P. and under, it seems to me that the direct coupled apparatus has no great advantage. For instance, in a station such as I have described above, the engines are of 400 H. P. each and but two are to be put in at present. If they were direct coupled then there would be but two units of generation, and in case one became disabled one half of the entire installment is thrown out of service, as the electrical portion is of no use unless the steam portion is in running order, and *vice versa*. If we put in more units and retain the same capacity each unit must be smaller and we lose the economy of the slow speed engine and increase the first cost and number of wearing parts. If the units remain large and lightning destroys the dynamo the repairs become great and difficult, and would in most cases necessitate sending the apparatus to the original manufacturer to be repaired. Whereas with the plant just described the units for generating the current are of good size, the engines are sufficiently large to secure good economy, and any damage to dynamos can be repaired at small cost and on the spot.

One other thing in regard to direct coupled apparatus. The sudden change in load will undoubtedly cause severe shocks to the engines, more so than where power is transmitted through belting there being a certain elasticity in the latter method.

For stations of a large number of horse power the direct method is a step in the right direction and when fully developed will form the ideal method for such roads as operate a large number of cars and are fitted to take care of such repairs as might occur.

THE ordinance recently introduced in the Chicago City Council providing that Chicago street railway companies be compelled to conform to the principle of "no seat no fare," was defeated January 18.

IT is rumored that some Boston capitalists contemplate purchasing the entire system of electric lines owned by the Chattanooga Electric Railway Co. This includes the St. Elmo, Ridgedale, Market Street, Montgomery Avenue and East Ninth Street lines.

Car Building.

From Advanced Sheets of "Street Railways" (Trams).

By C. B. Fairchild.

[copyrighted.]

The present American styles of street cars are a natural and legitimate product of American ideas. They differ greatly from the passenger vehicles of the first street railroads, for these retained to some extent the form and arrangements as well as the name of the omnibuses and stage coaches which they superseded; and, naturally, for the mechanics of that day were only familiar with the construction of coach bodies. For instance, the form of the lower portion of the sides was made concave, a form necessary with an omnibus in order to provide space for its large wheels, but with the street cars having small wheels which are placed wholly under the body the concave form is found to be unnecessary, and the tendency now is to build with sides vertical or nearly so, the concave form of the lower panel being retained for the sake of strength and appearance, and because it allows of passing street vehicles more readily where those stand in close proximity to the track, for the hubs of the latter, in case they extend slightly beyond the plane of the vertical sides, do not interfere with the concave panel.

Notwithstanding the many changes in the styles of cars which have been brought about during the past few years by the change in motive power, the ideal car that will meet all the conditions of rapid transit under any one kind of motive power is not to be expected, for different lines need different equipments. For instance, the style of car best adapted for use on narrow streets, with large traffic, where passengers are continually getting on and off the cars, from one end of the line to the other, would in some points be unfitted for the business of a line in a city having a large suburban travel, where the passengers are mostly taken on and let off near the termini. The time will come, doubtless, when the type of car best suited to the requirements of certain conditions of traffic can be named. This desirable result can be reached only after a large number of street railway companies in widely separated localities shall have each expressed an opinion as to what style or type of car would be best suited for their respective needs, when the car builders can put the suggestions into practical form.

Thus, it is apparent at the outset that an attempt to describe in detail the different styles of street cars now in use, with particulars of construction and material, would swell this chapter into a volume, or even many volumes. This is not desirable, but in order to supply a long felt want we shall attempt to give an outline of street car construction, noting here and there the essential points that must be observed in the making of any style of car, that the product may have the combined attributes of beauty, lightness and strength. Let it not be expected that this chapter will prove instructive in all particulars to those who have long been engaged in street car building, either for the trade or for personal use. It is not a treatise on the methods which will be employed in works devoted to street car building in the next century, but the practice of the present day, so that all the particulars must necessarily be familiar to some one somewhere.

Different car works have each some special characteristics; not that they are larger, and differ in form, color or situation; but in the adaptation of means to ends, in the utilizing of labor saving appliances, in the styles of cars turned out, there are differences, and no one is so perfect that it cannot be made better by adopting some of the characteristics that are to be found in each of the others.

No one can study the designs of cars and methods of construction now in vogue and not be convinced that the business is still in its infancy, that the room for improvement is larger than the improvements already made, so that innumerable, marvellous and fruitful discoveries await the future workers in the line of street car building. The increased patronage awarded to "steam palace cars" and lavishly furnished great hotels, strikingly illustrates the curious tendency of modern travelers to demand luxuries and showy trappings in public conveyances and hostelries greatly beyond what the most of them enjoy or would enjoy in their own homes. This tendency is spreading to the street car, and as the character of the cars is improved, so much more will people ride. The love of ornament is inherent in human nature, and for this reason those who provide means for comfort should at the same time administer to their love of beauty. But in the combination of the æsthetic with the useful, good judgment and care must be exercised. Carvings and upholstery that are easily broken or soiled or that will accumulate dust and soon look dowdy should be avoided. Elements of beauty, however, may enter largely into ceiling and deck light finish, and since the art of manufacturing the materials for this purpose (three ply veneer and ornamental glass) has reached so high a state, this line of decoration is plentifully and cheaply supplied. Not only should a reasonable amount of decoration be provided in cars which are patronized wholly by a cultivated class of people, but in all cars, for by this means the comforts and solaces of fine art will be brought to a large number of lives and hearts that cannot afford to provide them in their own homes.

This chapter, it is believed, will prove helpful, in some particulars, to the veterans in the business, to new men engaging in this line of work, and also serve as a medium by which men engaged in the operation of street car lines may communicate intelligently with commercial car builders, or with the men employed in their own repair shops, while it gives to the general reader a "speaking acquaintance" with this particular industry.

KINDS.

In present practice we find four distinct types or kinds of street cars each of which is subdivided according to the accompanying diagram:

- STREET CARS
  - (1) Horse
    - Closed — One horse; Two horse
    - Open — One horse; Two horse
  - (2) Cable
    - Grip
      - Closed — Four wheel; Eight wheel
      - Open
      - Combination
      - Double deck
      - Vestibule
    - Trail — Closed; Open
  - (3) Electric
    - Motor
      - Closed — Four wheel; Six wheel; Eight wheel
      - Open — Four wheel; Eight wheel
      - Double deck — Four wheel; Eight wheel
      - Vestibule — End; Side
    - Trail — Closed; Open
  - (4) Miscellaneous. — Steam; Air; Gas

To properly construct these cars it is necessary to consider the particular work they have to do, and where the principal strains will come, depending upon where the power is applied.

The horse cars and trail cars should be light, strong and durable, with as little heavy lumber as possible, unless a change of motive power is contemplated, when they may be built heavier and so framed as to be readily changed and adapted for mechanical power.

The cable car must have a strong under frame, put together with heavy timbers, and a neat and strong body, avoiding as much as possible a clumsy look.

The electric car must have a strong under frame, with cross timbers so arranged that portions of the floor may be removed to give access to the motors, and if it is operated by the overhead system the roof should be provided

with iron rafters or carlines to support the trolley stand and the weight of the workmen who are required to adjust or repair the same, while the extra weight at the top, increased speed and lurching, require that the framing throughout be stronger and heavier than on other types of cars.

INCEPTION.

The purchasing officers of street railway companies either furnish drawings and specifications of the cars they may desire to have built, or they merely state the dimensions and general style of the car they desire, after having examined the drawings or photographs of different styles of cars that have been previously built, with which most shops are supplied, or after having visited the works of the manufacturer and studied the different types in process of construction, when the chief designer of the shops where the cars are to be built, after full conference with the parties desiring to purchase, makes detailed drawings and full specifications. After these have been approved and accepted, and the contract has been closed, the manager of the shops receives written directions quoted from the specifications, with drawings which are numbered and known as shop orders for a particular lot of cars.

These drawings usually show, first, an elevation of side and end of a car frame (Figs. 1 and 2), then, in detail, the sills and floor framing and all matters relating to the floor (Figs. 3 and 4). The drawings of the side framing show the side posts and side bracing and side panels Another set of drawings exhibits the details for the deck, including everything above the side frame, such as carlines, deck posts, deck sills, deck plates, and side plates, beginning at the top of the posts. There are also drawings showing the ceiling finish or headlining. There are full detail drawings of hoods, platforms, carvings and even of the bronze trimmings, however small. Some of these details rank as "standard," and go into all kinds of street cars built at the shops. The following are copies of actual shop orders, which will give some idea of the amount of detail incident to the business:

Description of One Closed Electric Street Car.

Plan.....310-U. Length over sills, sixteen feet. Width over sills, five feet eleven and one quarter inches; over all, seven feet ten inches. Height over all ten feet four inches.
Roof.....Three iron carlines, strengthened and arranged for trolley.
Hoods.....Removable.
Framing.....Closed street car. Height from top of sill to under plate five feet, ten inches.
Outside.....Paneled with white wood.
Flooring.....Yellow pine.
Window sash.....Mahogany.
Blinds.....Mahogany frames and basswood slats.
Glass, windows.....Crystal sheet.
Glass, doors.....Crystal sheet.
Glass, decks.....Embossed.
Mirrors.....Plate glass beveled.
Inside finish.....Mahogany.
Ceiling.....Burl oak, decorated with gold.
Lamps, centre.....Two, one (1) light.
Heater.....One coal stove placed in a zinc lined box.
Seats and backs.....Spring seats placed longitudinally.
Seat covering.....Wilton carpet.
Trimmings.....Bronze.
Bells.....One at each end with leather bell cords.
Gongs.....One under each platform.
Door catches.....Placed on each door.
Fare registers.....One.
Fare boxes.....One.
Lenses.....Red glass at each end in upper deck.
Change gates.....In each door.
Floor matting.....Standard diamond.
Body Grab Handles...Bronze.
Steps.....Steel steps, Stanwood pattern.
Platforms.....Standard, open at sides.
Dash boards.....Iron, closed centres.
Dash grab handles....Bronze.
Brake handles.....Bronze, adjustable.
Brakes.....Operated by hand on all wheels from platforms.
Track brake.....To be applied for use on grades and for sudden stoppages.
Sand boxes.....Four.
Platform gates.....Four folding, iron.
Life guards.....On each end of truck.
Track cleaners.....To be applied in front of each wheel.
Headlights.....One arranged for electricity.
Draw bars.....Standard radial.
Running gear.....Four wheel gear, as selected by purchaser.
Motors.....As selected by purchaser.
Gauge.....Four feet eight and one half inches.
Wheel base.....Six feet.
Wheels.....Cast iron, thirty inches in diameter, with two inch tread and five-eighths inch flange.
Axles.....Steel, three and one-half inches in diameter.
Painting.....May be what is known as "Standard Broadway," which is a light yellow.
Decoration.....To correspond with body color.
Lettering.....LIDGERWOOD" on sign boards, "WASHINGTON" on main panels.
Number.....1
Electric light.....Car to be lighted by electricity.

Specifications of a Closed Motor Double Truck Street Car.

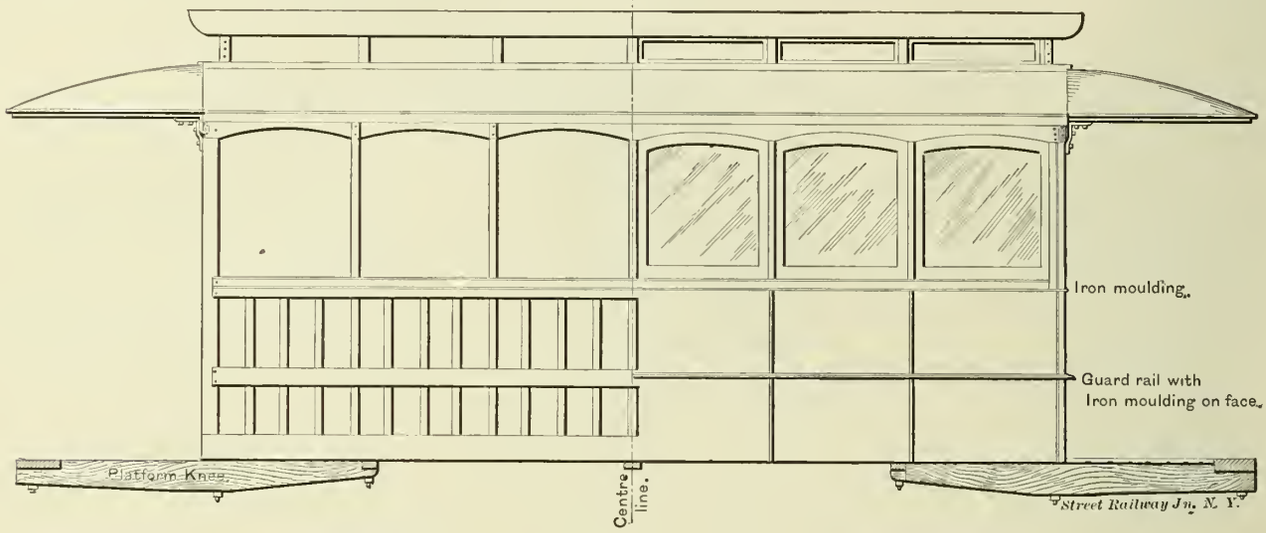
Plan.....831-B. Length, twenty-two feet ten and three quarters inches over body; twenty-nine feet two and one-half inches over car, and thirty feet five inches over all. Width, seven feet one and one-eighth inches over all.
Roof.....Strengthened with five iron carlines, and arranged for trolley.
Hood.....Detachable on rear end.
Framing.....With straight post. Height from top of sill to under plate, five feet eight and one-quarter inches; over all, eleven feet two inches.
Outside.....Ceiled (or sheathed) with white wood.
Flooring.....Yellow pine.
Window sash.....Cherry.
Blinds.....Cherry frames and basswood slats.
Glass windows.....Double thick French.
Glass doors.....Double thick French.
Glass decks.....Ruby colored glass.
Mirrors.....Beveled plate glass.
Inside finish.....Cherry.
Ceiling.....Maple.
Centre lamps.....Two two (2) light.
Seats and backs.....Ash and red birch slats, covered with Wilton carpet.
Trimmings.....Bronze.
Bells.....One at each end.
Gongs.....One under front platform.
Door locks.....One on cab door.
Fare registers.....One per car.
Floor matting.....Applied.
Body grab handles....Bronze.
Steps.....Stanwood steel, double tread.
Platforms.....Arranged with cab on front end and rear end, open on one side only.
Dash boards.....Iron, on rear end only.
Brakes.....Hand brake on both trucks, operated from platform.
Brake handles.....Cast iron brake wheel in cab and bronze brake handles on rear end.
Air brake.....Sessions patent.
Sand boxes.....Two per car.
Life guards.....On front truck.
Headlights.....One, arranged for oil.
Draw bars.....Radial on rear end and buffer on front end.
Running gear.....Four wheel double trucks.
Gauge.....Five feet two and one-half inches.
Springs.....Coil.
Wheel base.....Four feet six inches.
Wheels.....Thirty inch steel, two-inch tread.
Axles.....Iron, three and three-eighths inches in diameter.
Motors.....Two fifteen H. P. per car.
Painting.....Light yellow, with carmine panels.
Lettering.....CENTRE & NEGLEY AVENUES" on each side of car at centre.
Number.....55.
Electricity.....Cars equipped with electric light.

The above method of providing drawings and specifications is recommended for use in large shops, and in some modified form in all works, whether engaged in building for the trade or in constructing home-made cars, as it will be found to save time and insure the perfect fitting, when assembled, of such parts as are prepared by different gangs of workmen. It is the practice in some shops, however, to make all the detail drawings full size on large boards, which are placed in a convenient position so that the workmen have access to them, and from which they make their own measurements. The full sized drawings, it is claimed, insure a better fitting of parts.

MATERIALS.

Storehouses and yards are provided for the different classes of material which is usually kept in stock, and includes lumber, glass, wrought, cast, malleable and sheet iron, steel, paint, varnish, cloths, plush and other uphols-

tery goods, nails, tacks, screws, hinges, catches, locks, and other small hardware and metal goods (trimmings) that are too numerous to mention. Some large car building establishments manufacture their own veneers, trimmings and, in fact, everything entering into the construction, even the paints and varnish. Others purchase from manufacturers trimmings, etc., ready finished for their place in the car; while a few street railway companies, which build their own cars, purchase everything, even woodwork, in which case the work of car shops consists merely in fitting the parts, painting, furnishing and decorating.



HALF ELEVATION, SHOWING FRAMING. FIG. 1. HALF ELEVATION, SHOWING BODY COMPLETE.

LUMBER.

The enormous strains to which the frames and covering of street cars are subject, make it absolutely necessary that they should be made of the best lumber prepared in the best manner. Hence, to insure durability and long life, great care must be exercised in the selection and seasoning of the lumber.

In the selection of any particular wood its appearance should not always govern, but the region in which it grew should also be considered, for the locality has much to do with the texture of woods of the same name. In some cases, however, the supply has been exhausted in the regions which produce the most desirable qualities, so that in this respect no choice is left, and a change of wood for the same purpose is sometimes rendered necessary.

The woods principally used in car building are of both native and foreign growth. The native woods include ash, white, Norway and yellow pine, hickory, basswood, poplar (whitewood), birch, butternut, cedar (both green and mined), cherry, cypress, gum, elm, white oak (second growth), burl oak, maple and sycamore. Of the foreign woods, mahogany, satin wood and teak constitute the principal kinds employed in this industry.

The seasoning process should occupy two years or more, and much of it requires to be kiln dried in addition. The lumber having been purchased, it is piled with the ends toward the prevailing winds in open order in the lumber yard, or, better, under sheds when these can be provided. It is also of advantage to cover the ends of all boards and stocks of timber, as soon as the lumber is piled, with some kind of heavy paint to prevent season checking.

The kind, size and condition of the stock determine the time the material should remain in the drying kiln; for heavy sill timbers, from three to four months where the temperature, ranging from seventy-five to one hundred degrees, should be regulated to suit the conditions, care being taken not to destroy the life o' the wood. In case, however, the structure is designed for service in high and dry latitudes, it is often necessary to continue the seasoning process till all moisture is expelled, or otherwise checks will appear and the car will soon go to pieces. After leaving the kilns, the material, if not needed, should be stored in closed sheds.

In large establishments, the work of car building is usually subdivided, and several gangs of men do the work in successive stages. The lumber, when ready, is delivered to the wood-working shop, usually on trucks, the yards and shops being provided with trucks for their accommodation. It is then cut into proper dimensions and then passed to the planers when the further work to be done upon it is laid out from templates by the foreman. It then goes to the shapers and mortising machines, and the small pieces are put through scrapers and sand papering machines and made ready for the blind builders and cabinet makers.

The economy exercised by the manager or shop foreman in laying out and utilizing all the building material, and the nicety with which just the number of pieces of all kinds are made which are required for a given lot of cars, frequently covers the margin of profit in certain orders.

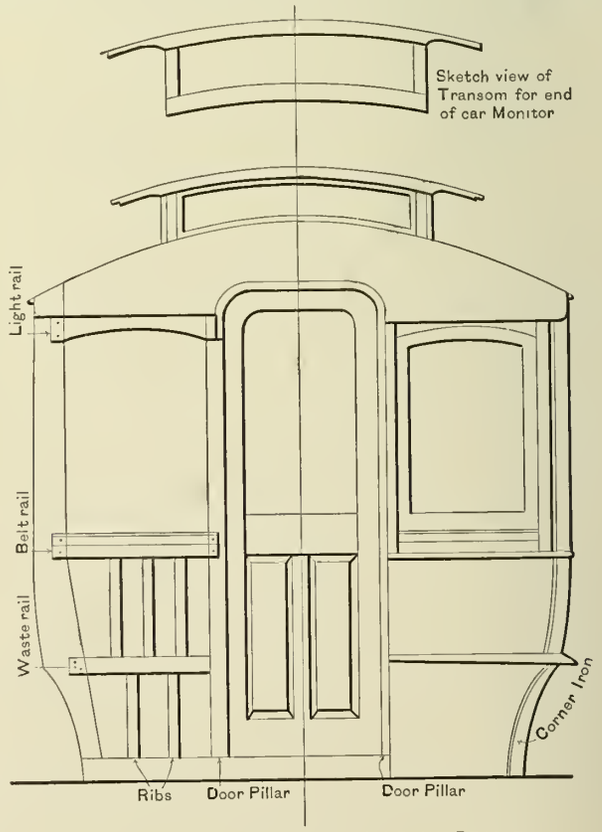


FIG. 2.—END ELEVATION, HALF IN FRAME.

As the work progresses through the different departments it should be carefully and repeatedly inspected by the manager to see that the work of each gang is properly done. Even with the most careful supervision it will sometimes be found that the different cars of the same

order when finished vary in real value a good many dollars, owing to the superior skill, or want of it, on the part of the different gangs of workmen, although the material for each was the same and prepared in the same manner.

The material ready prepared is now delivered to the erecting stop. The sills, cross ties, bracing, flooring, iron tie rods and angle irons go to the gangs whose duty it is to frame the bottom and lay the floor. In some cases this work is done by the same men that construct the body.

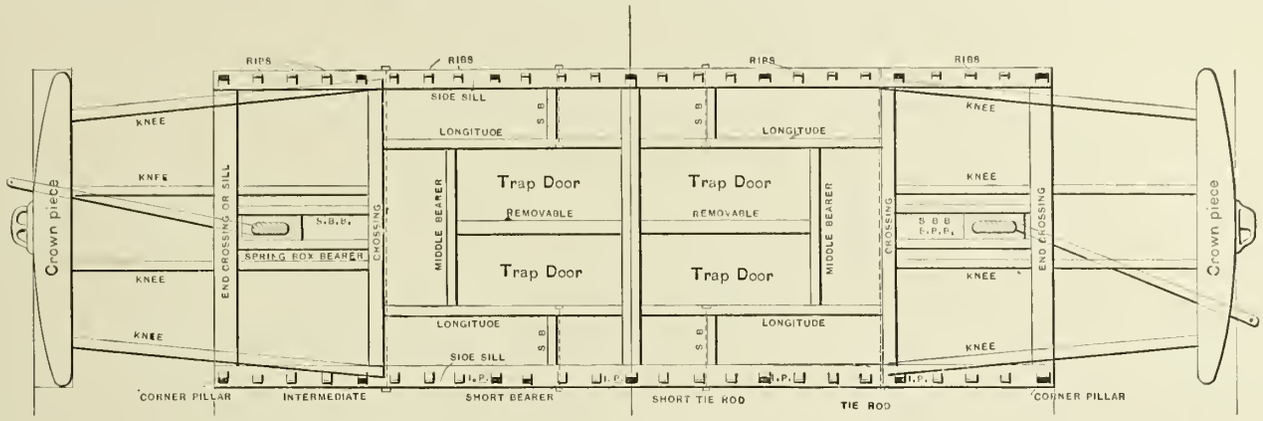


FIG. 3.—FLOOR FRAME FOR ELECTRIC CAR.

If it is a sixteen foot electric car that is building, we have two side sills, two end sills, two first crossings, centre crossings, four longitudes, two cross longitudes, two movable bars, eight platform knees and two crown pieces or platform bumpers (Fig. 3) Yellow pine is usually employed for the side sills and flooring. Oak is also used for side sills, and usually for the cross and end sills, although ash is sometimes employed for cross sills, and the crown sill of platform is sometimes made of elm. The side sills are usually 4×5 ins., and are sometimes strengthened by the addition of a thin steel plate bolted to the outside. In some practice the sills are veneered with some light colored wood which offers a better surface for paint. The end sills are of the same dimensions, laid flatways and framed to lap on the side sills or may be mortised in. All mortises and tenons should be covered with white lead to prevent the access of moisture. The cross or middle sills may be framed to lap the side sills or may be mortised. The middle crossing should be the heaviest and have a tie rod through the centre. The platform knees, usually of ash or hickory and strengthened sometimes with steel plates, should lap the first cross sill. The cross framing should be arranged to provide for traps in the floor to give access to the motors. The traps may be hinged so as to turn up or they may be lifted out altogether. If built quite long the same form of trap will suit a number of different motors. If we were building a long eight wheel car the framing would be different, and the traps would come at each end of the platform floor. It is quite important, before designing the floor framing for electric cars, that the type of truck to be employed should be specified. The diameter of wheels, wheel base and dimensions of trucks vary so much, that the framing for one will not suit another.

For flooring, hard pine or maple boards may be employed. The material should be straight grained and free from knots. It is usually dressed on one side to about seven-eighths of an inch in thickness, grooved or jointed and fastened with screws to the cross ties and braces, all the top surfaces of the latter having first been given a coat of white lead. The platform knees and end timbers or crown pieces are conveniently put on by turning the frame upside down. This is not necessary, however. The crown pieces should be two or three inches thick, and of sufficient length to come out as far as the side sills of the car, and the outside knees should be set back far enough to make room for the side steps, and also spaced to provide for placing the rheostat under the platform, if one is to be employed. The platform is usually so connected that it may be detached from the body. The platform floor is commonly laid with oak, but may be of the same material as the car floor.

The platform is now delivered to the body builders where it is supported, preferably, under the middle by a low two or four wheel truck, upon which it can be moved about the shop as the work progresses. Low horses, a trifle higher than the truck, are placed under each end so that the frame will sag a little in the middle as it helps to strengthen the car and prevent the ends when finished from drooping, as they are liable to do with heavy loads, if built straight and mounted upon trucks with a short wheel base.

The side post (pillars) (Fig. 5), which have previously been grooved by machinery to provide runs for the window sash and blinds, are next set up in mortises cut in the side sills, all mortises and joints being covered with white lead before the union is made. These posts are usually of ash (dark colors being employed for closed cars and light colors for open cars), $1\frac{1}{8}$ ins. to $1\frac{1}{2}$ ins. thick. Being set in the mortises they are firmly held in place by strap bolts which come up through the sills with the strap portion extending up several inches on the inside of the lower end of the post. The corner posts come next, and these should be $3\frac{1}{2} \times 5$ ins. at least (Fig. 6.). Door posts should be heavy enough to allow of a groove down the centre for a tie rod which fastens the head rail and pillars down to the end sills, and groove for electric wire which leads through to the roof. The end may be put together on the bottom of the car and then raised into position.

Erect temporary scaffolding on which to stand and put on the plate, and fasten stretchers across the top, making the sides the same width at the top as at the belt rail. Square everything true and put on the belt rails which are commonly halved on the posts. The work on the belt rail, if laid out from the mortises in the sills, will bring the space between the posts of the same width all the way up. Add the convex and concave ribs, according to the curvature of the sides, then the drip rail and the

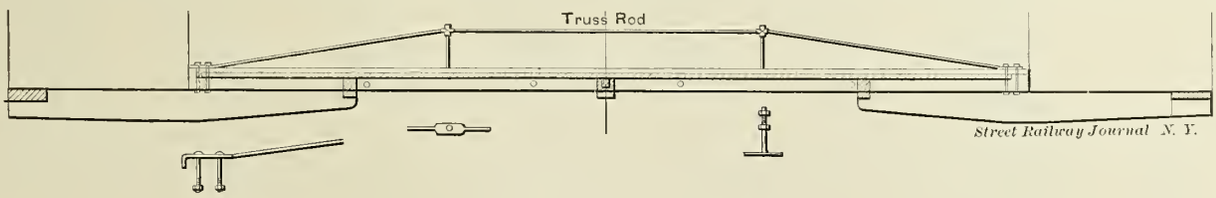


FIG. 4.—TRUSS ROD END PLATFORM SILLS.

letter board. The sash rails, light rails, strainer rails, straight ribs and head rail of the ends are next added and the frame is made ready for the panels. These are usually made of whitewood, and having previously been bent to proper shape and dried, are put in place, the lower outside first, after which the ends of the car are paneled up, care being taken that the panels are all up to the ribs. The whole inside is then covered with scrims put on with hot glue and painted, when it is left all night to set. Next morning the panels are all dressed off and sand-papered, when the painter gives them a coat of oil priming and the work is left to stand over night. The braces and stretchers are now taken out and the car is ready for the roof.



FIG. 6 CORNER POST.



FIG. 5. SIDE POST

The above applies to cars in which a truss rod is employed to strengthen the under frame. In some shops a different method of construction is followed for double truck cars and which is designed to do away with truss rods. As shown in Fig. 7, the bracing consists of angle pieces of boards (*a*) bearing partly on the side posts, sash rests and side sills, and secured by glue and clinch nails to longitudinal pieces (*b*) of the same material. The longitudinal pieces extend the full length of the car and have a shoulder rest on each post by means of a groove one-eighth of an inch deep. The outside sheeting (*c*) consists of narrow pieces of boards put on vertically, with white lead in the joints and glued and nailed to the longitudinal pieces. Before applying this trussing the middle of the car should be slightly arched as before described, and the structure will be found to have great strength.

The roof, which may be made plain or after some one of the monitor or Bombay types, is usually prepared in the cabinet shop, or may be made by the body builders who work on it at intervals. The frame, which may be of ash or oak, depending upon the proposed inside finish, should be strong, with at least three compound carlines to support the weight of the trolley stand and prevent the sides from bulging. Compound carlines are usually made of flat wrought iron or steel strips which, being reinforced on each side with half round wood, bolted through, have the appearance when finished of the ordinary wooden carlines. Instead of employing compound carlines for supporting the roof, some builders frame the ventilator rails and uprights in an arched form which is strengthened by means of truss rods running from end to end of the car immediately under the bottom ventilator rails. The roof covering may consist of half inch ash boards, beveled or rounded on the under edges, or of three-ply veneer, depending upon the proposed inside finish. Oak or birdseye maple veneer, firmly fitted on top of the carlines, makes a very strong roof for carrying trolley stand, and being decorated makes a fine inside finish, especially where oak carlines are employed to match the oak veneer. The roof being in place, it is slightly shored up in the middle, when the ends are fastened to the head rail, and the carlines to the eaves-plates which have been previously mortised to receive them. The edges are then dressed off, when the roof is given a priming coat, the nail holes filled with putty, and after drying, the roof cloth, which consists of heavy canvas (laid in white lead), is put on, stretched very tight and tacked under the outer edges. The eaves moulding is then put on and the car is ready for the hood which is really an extension of the roof over the platforms, but so put on as to be readily removed for convenience in shipping. In vestibule cars, however, the hood constitutes the roof of the cab and is framed with it. The hood is made on a form in the shop, and covered with a canvas the same as the roof, when it is put up and bolted to the head rail. The water table is then added and the entire roof is covered with a coat of mineral paint.

The scaffolding being removed, work on the body is resumed. A moulding of half oval iron is next put on over the top panel joint, which extends around the corner posts to the door posts. This is usually put on with screws, and the heads being filed off it makes a neat looking job. Next a fender rail is added, which is placed over the joint between the upper and lower panels, and being finished with an iron moulding as described above, serves to protect the panels from coming in contact with street vehicles. A plain flat band moulding covers the end joint of the upper panel and a corner iron the joint of the lower or concave panel. One or two flat vertical mouldings of wood or strap iron on a line with the side posts may be added, which divide the side into panels of different sizes and improve the appearance. The iron dash posts, dashers, brake staff, bumpers and controlling stand are next put in place and all iron work given a coat of paint. The dashers are usually made of sheet iron, but in some cases wire is employed.

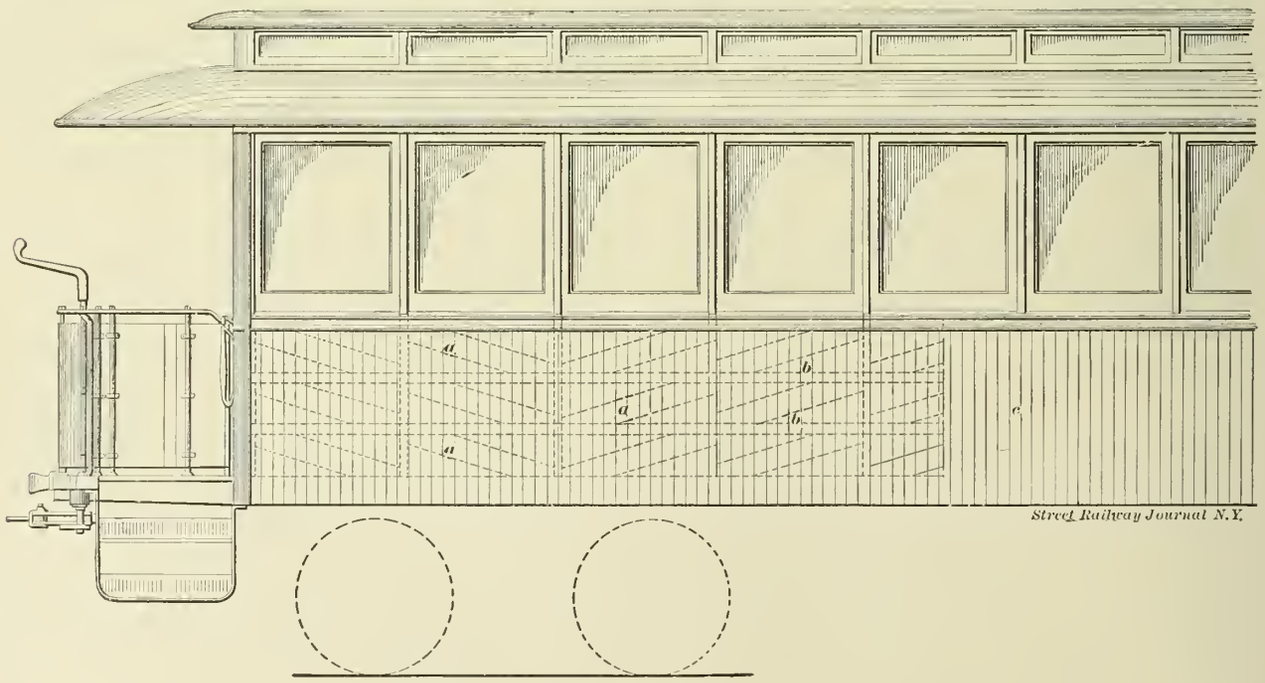


FIG. 7.—FRAMING WITHOUT TRUSS ROD.

The sash doors and blinds which have been made in the cabinet department, are next fitted each to its place, numbered and given the car number, when they are sent to the paint shop for finishing, after which the glass is set and the sashes are rubbed down and varnished.

The overhead and bottom tracks for doors are next laid down, door guards put on, doors hung, head linings fitted, also end panels, heel boards, seat rails, stove box, mouldings and curtain fixtures. Then, all parts being numbered, they are taken out and sent to the paint shop for finishing. To produce a carline finish in case veneer is not employed for the roof, the ceiling between the carlines is covered with veneer. Oak, birdseye maple and birch veneer is employed, and may be left plain or perforated and decorated. Matched boards of different colored woods are also used for ceiling finish, and sometimes the entire heading is of veneer, fastened to the carlines, arched and brought down to the top of the plates.

The body now goes to the paint shop, where a rough coat is first put on, the entire surface scoured down, and the car is made ready for the electric wires which are put in by experts, which work should be done before the inside finish is applied to the car. The tinners also put in the end lamps and flues, stove pipe, thimbles, and the piping, if the cars are to be lighted with gas. The sash doors and blinds are now put back and the car is left with the painter to finish and decorate.

PAINTING.

The painting department should be assigned to commodious quarters, carefully partitioned off to exclude dust and insects, and the room should be constructed to provide ample light all around, and in order to facilitate the work, should be warmed in winter to an average temperate of seventy-five degrees. The method of mixing the paints and the time allowed for the different coats to dry, depend upon the time limit for filling the order. When durability and high finish are sought, time is an important factor. To meet both conditions we give two methods of practice, the first when haste is important, as in filling large orders, and the second when time is not a condition.

The foreman must keep a sharp lookout for all new work as it advances, and order the priming coat put on, which can be done in an hour, but will often advance the work at least a day. A good priming coat consists of pure lead mixed with two parts boiled oil, one part raw oil, a little elastic japan, and sufficient turpentine to cause it to work freely under the brush. This should be thoroughly brushed into the pores of the wood, care being taken to introduce the color into the nail and screw holes, unless these are too large, in which case they should first be filled with wood buttons or with a mixture of sawdust and glue. Where putty is employed for filling large holes, it is apt to crack and fall out after the car is put in service. After drying, the priming is sand-papered lightly, when the first coat is laid on. This may consist of pure lead (ten pounds) mixed with one pint of boiled oil, one pint of elastic japan reduced with turpentine. All nail and screw holes are now filled with putty, and in doing this care should be taken to so introduce the putty that all the air will be excluded, for should there be a bubble of air confined by the putty it will expand and bulge the surface. To produce a good job the puttying should be done at two operations. At the first, the hole is not entirely filled, but the filling is scooped out with the corner of the knife, and left slightly below the surface. After drying a short time more putty is added, until the surface is uniform. This being rubbed down the second coat of paint (mixed the same as the first) is applied.

Two or three coats of rough stuff, consisting of English or American filling, are next laid on, not over two coats a day, however, and better only one if there is time. When sufficently dry the entire surface is thoroughly rubbed down with pumice stone, or better, with Schumacker's rubbing brick which is manufactured in different grades, fine medium and coarse. After being surfaced and washed the body should be left at least twelve hours to dry, before the next coat is added.

The surface is now ready for its final color. If this is to be a transparent color the surfaced panels must receive a preparatory coat, which should be as near the desired color as possible. If it is to be finished in an opaque color this can be applied at once, and consists usually of a japan or quick drying color which is laid on in two coats and followed with clear varnish, or color and varnish.

The surface being flattened, it is prepared for striping, lettering and ornamenting. After this work is done the body goes to the varnish room, where two coats, one of rubbing, one of finishing varnish are applied, the first being carefully rubbed down.

When the time is not limited the following formula and practice may be followed for a first class job: The priming coat may consist of keg lead with pure raw oil mixed to about the consistency of milk, this being well brushed into pores, screw, and nail holes is left to dry three or four days, when it is sand-papered lightly. The first coat, consisting of keg lead mixed with raw oil two parts, japan one part, with enough turpentine to make it work easily is next laid on, and after two days the holes are carefully filled with putty which is made of dry white lead mixed with equal parts of japan and rubbing varnish. After the putty is dry the surface is again sand-papered. The body is now ready for the second coat which may consist of one part keg lead, two parts raw oil mixed thick with japan and then thinned with turpentine. The rough places are now filled with soft putty and after this becomes dry it is smoothed off and the surface is ready for the next coat which consists of keg lead mixed thick with turpentine, to which is added a little oil, japan and and rubbing varnish to bind the coat well. After drying, three or four coats or enough to fill the work are next laid on. These coats consist of English filling three parts(light for light grounds, and dark for dark grounds) dry white lead two parts, keg lead one part, mixed with japan two parts, rubbing varnish one part, and turpentine to thin properly. This being rubbed down and cleaned the colors are applied until the surfaces are properly covered. Rubbing varnish is next applied and being thoroughly rubbed down with pumice stone, the lettering and ornamentation may follow, and this is usually done by another class of workmen. After being rubbed down well, finishing varnish is applied. If each coat has dried properly, paint applied in this manner will last for years without cracking, peeling or fading. To produce the smooth ivory-like finish which some fine cars present, it sometimes requires as many as fifteen coats of paint and varnish. The outside decoration should be solid, plain and neat; too many large scrolls sometimes spoil the beauty of a car.

The inside finish is now put on by another class of workmen, and in some respects this is the most particular work on the car. The ornamentation may be plain or rich as the taste may demand. The headings are often finished in hand painted designs, including landscapes, figures of men and animals, wreaths of autumn leaves spring flowers and vines, or they may be ornamented with stencil work or covered with stucco. The woodwork is sometimes finished dull and sometimes in bright colors. If dull finish is wanted, the surface should be flattened. All woodwork after filling may be treated with rubbing varnish.

The appearance of a finished car will depend largely upon the skill and taste that have been exercised by the head painter in making the designs for letters and ornamentation, and in so blending the finishing colors that they will harmonize. Care must also be exercised in selecting the colors, that when faded even, some degree of harmony will be preserved.

In the direction of car ornamentation there is a broad field in which a painter can exercise his ingenuity. No set designs for copying can be given, but a few are presented in this connection which may suggest to the thoughtful painter other conventional forms which he can introduce with pleasing effect.

The seats may be upholstered with hair or rattan cushions, or seats and backs may be made of perforated veneer covered with Wilton carpet. In some cases build-

ers have seat carpeting woven in special designs. If window curtains are employed, they should be of durable material (Russia leather) and mounted on self acting stop rollers with brass guide rods. In some climates, neither curtains, cushions nor carpeting can be employed, owing to their furnishing a harbor for insects.

The floor may be covered with matting made of wood, wire or jute. A very durable floor finish, known as the Everett system, consists in reinforcing the plank with narrow wooden strips, about half an inch apart, laid lengthwise in closed cars, and crosswise in open cars and fastened with screws. To prevent warping, the strips should be divided into sections of three or four feet. In some cases the floors are first covered with linoleum before the strips are put down.

The bronze trimmings are next put on, and include the end window guard rods, window lifts, strap pole brackets, bell bushings and bells, fare wickets, brake handles, etc.

The body being sufficiently elevated the truck is run under, body lowered and sills attached to the truck. The spring box, radiating draw bar, and carriers are now added, all wires connected, trolley stand put in place, when the car is run out and is ready for the road or for shipping.

(*To be continued.*)

Legal Intelligence.

Electric Railway—Interference with Telephone Company—Injunction. In an action to enjoin defendant from operating an electric railway, wherein the referee dismissed the complaint, and the plaintiff appealed.

Held, 1. That a grant by the legislative and municipal authorities to a street railway company, to use electricity as a motive power, though it does not designate the particular system by which the power is to be supplied, does not give the company a right to use a system by the use of which the electricity will pass from the street and interfere with the current of a telephone company, which has previously lawfully erected its poles and wires on private property, where there are other systems which might be used by the railway company at a greater expense, but at less additional expense than would be required by the telephone company to change its system.

Held, that where a street railway company is about to use electricity as a motive power, to be supplied by a system which will allow the current to escape to the wires of a telephone company, erected on private property, and to continuously interfere with and injure the business of the telephone company, an injunction will lie, there being no adequate remedy at law.

Hudson River Telephone Co. v. *Watervliet Turnpike, etc., Ry. Co.* N. Y. D. C, Oct., 1891.

Note: This decision is contrary to the holding of the Ohio Supreme Court in the case of the *Cincinnati Inclined Plane Ry. Co.* v. *City & Suburban Telephone Co.*, decided June, 1891. There it was held that the dominant purpose for which streets in a municipality are dedicated is to facilitate public travel and transportation and, in that view, new and improved modes of conveyance by street railway are by law authorized to be constructed and a franchise granted to a telephone company of constructing and operating its lines along and upon such street is subordinate to the rights of the public in the streets for the purpose of travel and transportation. No priority of right can be given the telephone company, and if its operation is interfered with by the improved mode of travel, the remedy of the telephone company will be to readjust its methods to meet the condition created by the introduction of electro-motive power upon the street railway.

Condemnation Proceedings — Corporate Existence — Private or Public Purpose—Joint Use of Another Company's Track. In a proceeding by plaintiff street railway company to condemn the right to use equally and jointly with defendant street railroad company certain street railway tracks in the City of Toledo, the court *Held:*

1. That proof of the corporate existence of plaintiff is made out by placing in evidence its articles of incorporation, its certificate of subscription to the capital stock and the record books of the company showing the election of officers, etc.

2. The right of the plaintiff to make the appropriation is shown by establishing that the appropriation is for a public and not merely a private purpose.

3. The inability of the parties to agree as to the compensation for the property taken is established by proof of *bona fide* attempts to reach a settlement and not merely colorable, formal efforts; no special or set forms of words is necessary, and acts showing a desire and effort to agree may be as convincing as speech itself.

4. The necessity for the appropriation by one street railway company of the joint and equal use with another company of street railway tracks laid in a public street in Toledo by the other street railway company will not be defeated by proof that no physical impossibility exists to prevent the plaintiff company from operating a slightly different route. The discretion conferred upon Council to first pass upon the necessity and need for a street railway is not to be disregarded by the Court.

Seniority of rights in a street confers no priority of right, and a junior street railway company is entitled to take a joint and equal use of tracks with a senior company.

Proof of a street being a business centre where the people largely seek to go, will establish the necessity for such appropriation. And the people of one portion of the city will not be given a greater opportunity to go there by street railway than those of another portion. The police powers of the city are ample to regulate the joint use of the track by the different companies.

Toledo Electric Street Railway Co. v. *The Toledo Consolidated Street Railway Co. et al.* Lucas County, Ohio Probate Court, November, 1891.

Street Railway Co.—Injury to Passengers—Evidence. In this action against the defendant company for personal injuries where it appeared that plaintiff while standing on the side step of a crowded car on defendant's road, was, without fault on his part, struck and injured by another car going in the opposite direction on the adjoining track. There was evidence that at the place of the accident the tracks were nearer to each other than at other places along the road, and also that, by the sinking of the inner rails on the tracks, the cars pitched toward each other, making the position of a person standing on the steps dangerous.

Held, that a verdict for plaintiff, on the ground of defendant's negligence, was warranted.

Gray v. *Rochester City Street Ry. Co.*, N.Y., S. C. Oct. 23, 1891.

Injury to Passenger—Alighting from Moving Car. The plaintiff set forth in his declaration, that he boarded defendant's car, paid his fare to a certain place, and ordered the driver to stop and let him off when he reached that point. Supposing his instructions would be obeyed, he got on the rear step, and, as the car did not stop, he was thrown violently to the ground, and received severe injuries for which he asked $500 damages. The defendant demurred to the declaration, which was sustained and the plaintiff appealed.

Held, That a declaration which alleges that plaintiff boarded defendant's car, paid his fare to a certain place, and ordered the driver to stop, and let him off at that point, and, supposing that the car would stop, went to the rear step, and, as the car did not stop, was thrown to the ground and injured, states a cause of action and requires an answer, and does not show contributory negligence. Judgment reversed and remanded for new trial.

Bowie v. *Greenville St. Ry. Co.*, Miss. S. C., Oct. 1891.

The Brooklyn City Railway Co. have rececntly ordered fifty-five new eight wheel, thirty-four foot, open cars for their South, or Fort Hamilton division. These orders were placed as follows: Twenty cars with the Lewis & Fowler Manufacturing Co.; twenty cars with J. M. Jones' Sons, and fifteen with the J. G. Brill Co.

Important Leases in New York.

During the last month negotiations have been commenced by which the Metropolitan Traction Co., which already control a number of the most important lines in New York City, will secure possession of two more extensive systems, and while the contracts at the time of going to press had not been actually signed, matters had been carried so far that the result is practically assured. The lines which will thus pass under the control of the Traction company are the Sixth Avenue and the Ninth Avenue lines. The life of the lease in each case will probably be put at 999 years.

The nominal lessor in the case will be the Houston St., West St. & Pavonia Ferry Railway, of which D. C. Lamont, a leading member of the Traction syndicate, is president, the reason being, it is said, on account of a clause in the charter of the Traction company which prevents it making contracts of this kind. Both lines will probably be cabled soon. There has been quite a rise in Traction stock since the announcement of the proposed leases.

The Boston Rapid Transit Question.

It is most interesting to watch the various phases of the rapid transit problem in Boston as they approach solution at the hands of the Rapid Transit Commission. The latter is a very able body, and has applied itself to its enormous task with commendable industry. Its work comprises three distinct features: The improvement of our present system of surface transit by street railway; the rearrangement of the terminals of the steam railways, and the better organization of their suburban service and the establishment of a system of urban rapid transit.

It is evident that the entire problem cannot be satisfactorily solved within the brief period assigned the commission to complete its work, but the plan will be pretty well outlined in its permanent features, and it seems now likely that its elaboration and extension will be entrusted to a permanent commission.

The proposed constitutional amendment permitting cities and towns to take land for public improvements in entire properties is viewed with general favor. It will allow improvements to be made at much less expense than is now possible, for more land can thus be condemned than is absolutely needed for the improvement, and the rest can be either resold or leased.

Some impatience is felt at the slowness of the process of constitutional amendment, for as a passage by two successive legislatures and then a submission to the people is required, after which laws necessary to make the amendment effective must be passed, something over two years must go by before any steps can be taken under it. The actual work of selecting a desirable rapid transit system is a problem most difficult to deal with owing, to the complications introduced by Boston's narrow streets and Common, the public being extremely jealous of entrenchment upon the historic pleasure ground.

The features of the urban rapid transit system proposed and already described in these pages, are a ring or circuit line connecting all the steam railway terminals with the exception of the Boston, Revere Beach & Lynn, and running through the congested district, with radiating lines to the outlying sections. This system will consist partly of an elevated railway and partly of an underground railway. The operation of the line by electricity will make the transition between elevated and underground an easy matter.

Besides a "shuttle line" to the East Boston and Chelsea ferries, the radial lines will run to South Boston, Roxbury, Cambridge, Somerville and Charleston. With such a system trains can be run very easily from any given outlying section by way of the ring line through to any other outlying section with easy facilities for transfers. For instance, a train starting from South Boston would run over the westerly side of the ring line through to Cambridge or Somerville, and the next train from the same section might run over the easterly side of the ring line through to Charleston.

How the line shall be built, is one of the most important questions. Although a report upon this matter will probably not be made for some time to come, it has become pretty generally understood that the commission has practically decided to recommend that it be constructed under public auspices, for the reason that it is considered an undertaking too large to be entrusted to private enterprise, which could hardly be induced to take hold of it except under conditions which could hardly be sanctioned by public opinion. It is held that the cost of building the system by the public would be much less than by a private corporation, for the reason that money for the purpose could be obtained by the city or the state on much more favorable conditions than by private enterprise. Moreover, in the former case, by the establishing of a sinking fund, the capitalization would eventually be wiped out, leaving only the operating expenses and maintenance to be met from the earnings, while in the latter the capitalization would remain, with the necessity of permanently earning dividends upon it. These are understood to be the reasons that will actuate the commission in its report. Mayor Matthews, who is chairman of the commission, holds that it is possible to devise a method of constructing the system by public authority as economically as it could be done by private enterprise so far as the work itself is concerned; with the advantage, besides, of obtaining the necessary funds at a low rate of interest. It is not likely that the state itself would take the work into its own hands, although, of course, the state is largely interested, by reason of the effect upon its great city, and as the proposed system goes beyond the city limits into at least two other municipalities it would not be a work for the city of Boston alone. The plan that appears to meet with approval is to constitute a "metropolitan rapid transit district," which shall issue bonds for the purpose, that shall be guaranteed by the state, after the method now commonly pursued in Australia, and which was recently adopted by Massachusetts in establishing the metropolitan sewerage system for Boston and the surrounding cities and towns.

It has been strongly urged that the principle of public operation, as well as construction, of the system be adopted, but the commission appears hardly ready to go to that length yet; it is likely, therefore, that the leasing of the line for a term of years to a private corporation will be recommended, perhaps with a proviso that upon due notice and under certain conditions the lease may be terminated by the city, or district, as the case may be.

The street railway companies are much interested in a bill which was introduced into the Legislature last year, but has since been referred to the commission. As it definitely fixed the status of the street railways for thirty years at least, even though it subjected them to certain obligations in the way of taxation, etc., from which they are now free, Mr. Whitney favored it, since it would make the companies so secure in their relations with the state and the municipalities that capitalists would invest the sums needed for carrying out important improvements upon terms much more favorable to the companies than can now be obtained. But there is a strong public sentiment against such action, on account of fear of the consequences of tying up the city with a corporation for so long a term.

Mr. Whitney defined the supplying of transportation as a function belonging to the same order as the supplying of water, sewerage, or any other necessary business of the community. The West End company was blamed, he said, for being so often at the State House, but it had to go there in self defence when so many measures were brought up aimed at the integrity of its property. While favoring the proposed law, with its provision for a thirty years franchise, since it would protect the company from interference and thus assure cheap capital, he seemed to recognize the strength of the objection to it, for he expressed his willingness to accept a provision that the city could buy the property at any time it chooses, paying simply the value of the securities in the market for five years before the time the purchase may be demanded. He desired some law by which the company could get the cheap money needed; he would, therefore, have the charter properly fixed, let the stock be sold at auction, and provide in some such way as stated that the city might purchase the property. He wished laws that would give investments in the transportation system the same security as those made by the city of Boston, and if they would provide for the proper application of the revenue, and for the examination of the books and accounts it would meet the views of the company. With the company's present means the change of motive power from animal traction to electricity could not be made so rapidly as demanded. They were now running 275 electric cars and wanted 800; the people wanted them right off, but as limited by present conditions they could only go a certain distance year by year.

The cities and towns now served by the West End company have at present the right to take possession of the property, although there is no direct provision to that effect in the charter of the company. But in the charters of the original companies out of which the West End was formed, provisions were made for municipal ownership on payment of the par value of the stock together with ten per cent. dividends on the same from the beginning, after deducting the amount of dividends already paid. The charter of the West End provided that that company should assume all the liabilities and obligations of the companies out of which it was composed. It would not only be a very complicated matter to estimate the sum to be paid in event of the change to public ownership, owing to the various issues of stock by so many companies and the varying rates of dividends thereupon, but a dismemberment of the system would be necessitated by reason of its existence in so many different municipalities, and without further legislation it would be hardly possible for all these municipalities to act in unison upon the matter.

Mr. Whitney's proposition to pay the market value of the stock for five years previous—that is, its average value for that period—would greatly simplify the problem of assuming public ownership, particularly if coupled with a provision for this being done by the suggested metropolitan rapid transit district.

Although the West End company proposed to construct the elevated system and still has a charter for that purpose—now held in abeyance pending the report of the Rapid Transit Commission—Mr. Whitney says that the company now does not care to take hold of it, having enough to do to look after the surface system. He thinks, however, that some means should be agreed upon by which the surface and elevated systems can be operated in harmony.

If the elevated system is to be constructed by the public and then leased, the West End company would, on that account, doubtless be the most suitable lessee.

The question of the steam railway terminals and their suburban service remains for consideration. The Rapid Transit Commission has as yet made no report upon this subject, but it is understood that a thorough and radical rearrangement of the terminals would be recommended.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

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Position Gives Power to Do is a trite saying, and one that eminently fits the STREET RAILWAY JOURNAL. But at the same time, this power is not utilized by the street railway fraternity in the direction, or to the extent that it might be. We have no means of knowing just what knowledge is of most worth to certain individuals in certain localities, unless they inquire for it; and it does not seem to be generally understood that we are in a position to act as an information bureau in almost all matters relating to the business. We are daily in receipt of letters asking for information regarding the success attending the use of certain appliances; from what parties other appliances may be purchased; the durability of track construction in certain localities; copies of patents; capital stock; bonded indebtedness, or income of certain lines; how to prepare exhibits for the World's Fair and secure space for the same, and many other matters, all of which we take pleasure in answering by letter or through the JOURNAL, so far as we are able to give the information desired. And when we do not know, we undertake at once to inform ourselves. We desire it to be more generally understood that this is our position, and that it is not a burden but a pleasure to give attention to matters of this kind. Not that we claim to know everything, but such questions indicate to us what we need to know, and enables us to conduct the paper in the direction of the best interests of the business at large. We have but one aim, and that is the betterment of the street car service, by helping in every way those who are engaged in it, by promoting a better acquaintance among the fraternity, by serving as a ready and best medium of communication between the manufacturers or dealers in supplies and the consumer, and also by encouraging the use of new inventions and bringing the inventor's work to public notice. If a better paper is wanted by those engaged in the business, they can obtain it by helping along in the lines above indicated.

The Introduction of Dynamite as a factor in the settlement of disputes between employers and employes is a subject which calls for more than passing notice. Strikes on street railway lines are, unfortunately, common. Two having more than the ordinary dimensions were in progress last month in this country, one being at Allegheny, Pa., the other at Indianapolis, Ind. In both, the original cause was the same; the question whether law abiding citizens should be permitted to manage their own property in their own way. In both the use of violence as an argument of the justice of their demands was freely employed by the strikers, and in both, this kind of logic met only the half-hearted remonstrance of the general public and municipal authorities. Only in Pittsburgh the strikers or their sympathizers went a step farther, placed a dynamite bomb on the track at night and blew up a car loaded with passengers. It is gratifying to know that the authorities are making vigorous attempts to discover and punish the perpetrator or perpetrators of the dastardly act, but it would be an interesting question whether the local government could not be held responsible in this and similar cases for damage to property resulting from violence which they had failed to prevent. The old English law of "hundreds" made the inhabitants of each city district pecuniarily responsible for every act of destruction or robbery occurring within its limits, on the theory that if they had afforded the necessary protection no violence would have occurred. The same claim was recognized by the Pennsylvania Supreme Court after the extensive riots of 1877, when, aided by an early statute, some of the sufferers recovered from Allegheny County the value of the property destroyed by the mob. Nothing would rouse the people and authorities to the justice of defending the property rights of a street railway company against a lawless band of strikers so much as the knowledge that they would be held liable for any lack of protection, and this thought would often change a silent acquiescence into a determined stand for order.

The Victory of the Ottawa (Ont.) Electric Railway in its fight with the snow is a fact of no little significance. It demonstrates that an electric street car service can be maintained successfully in spite of all the rigors of a Canadian winter. Whether such a result could be accomplished has been questioned. When the project of applying electricity in Montreal was broached it was rejected, we believe, for the reason that it was claimed that the continued operation of street cars during severe months was impracticable. The distance between Montreal and Ottawa is about sixty miles only, and the climatic conditions are in no wise different. While it was not denied, in the former city, that plows and sweepers would keep the tracks clear, still it was maintained that they would pile the snow in such shape on the sides of the streets that they would be impassable for sleighs. To remove the snow wholly from the streets was considered out of the question on the score of expense. During the winter months, therefore, in both the cities referred to, the cars were housed and passengers were carried in sleighs. When the new electric railway was installed in Ottawa the projectors expressed entire confidence in their ability to cope successfully with the severest storms, and to maintain their service. They studied the problem thoroughly, secured statistics from cities in which similar, though not as severe, conditions were found, and then made their plans. The result has been entire suc-

cess. Although it is found necessary to remove the snow wholly from the streets through which the cars pass in order that sleighing may not be interfered with, still the service is as regular as in warmer months. While the expense account is high during the periods of snow fall, still we understand that the item for labor is by no means so high as to prove disastrous. The significance of the victory lies in the fact that the experiment has been watched with the keenest interest by towns throughout Canada. There are a great many of the smaller places throughout Quebec and Ontario which are possessed of great natural advantages in the way of water power, and which are wholly without local transit facilities. Now that the proof is no longer lacking that roads can be operated throughout the winter, there arises a great probability that the water power will be harnessed and that the demand for street car service will be satisfied. Capitals are, usually, not enterprising cities, but by its victory in the snow combat Ottawa has earned a reputation, and Canadian cities generally may emulate to advantage the example of the capital of the Dominion.

The Toronto Experiment has been extensively referred to as proving the desirability of municipal ownership of street railways. The conditions under which the present contractors operate the street railway lines in Toronto have been so widely mis-stated, and so many false assumptions have been made from these erroneous statements that a resumé of some of the conditions existing in Toronto would not be amiss. The city owns all the street railway lines within its limits and leases them to contractors. It furnishes the roadbed, keeps it in condition and does all necessary paving and repaving and has agreed to purchase from the contractors at the expiration of the lease the entire operating outfit at a fair valuation, thus guaranteeing the safety of the capital invested. All that the contractors or lessees have to do is to provide for the operation of the road. The length of the lease is thirty years. In return, the city receives a certain percentage of the gross receipts during the period of the lease. These conditions must have been favorable to the lessees, otherwise these gentlemen, who have wide experience in the operation of street railways in many cities would not have accepted the contract; but this does not show that street railway companies in other cities can afford to pay equally large amounts to their city treasuries under other conditions for the simple use of streets. Many roads have, in advance of demands of actual traffic, laid lines in unsettled localities which have been operated at a loss with the expectation that future earnings would more than repay the amount expended. These suburban lines have been of the greatest benefit to the localities which they have helped to build up and the municipal authorities can well afford to allow them to reap some of the benefits which they were largely instrumental in creating. But even where the privileges enjoyed by the street railway company are exceptional and the traffic so great that some return to the public seems justified or is demanded for the right to build new lines, it is an open question whether some more equitable plan could not be adopted than that of paying certain sums or percentages into the city treasury. This practice, though somewhat common has one result only, that of lightening the tax assessment, and hence, is a discrimination in favor of the property owner. In other words, a benefit to which are all entitled is perverted to benefit a class and a class which least needs financial aid. A fairer method would seem to be no taxation of the street railway company beyond that paid by other corporations or individuals for defraying the expenses of the city government, and to make any added concessions from the railway company lie in the line of reduced fares or more frequent service. This would bring the benefit of valuable railway franchises to those who use the cars and to whom the entire value of any street railway franchise is due.

The Best Design of a Power Station for an electric railway has not been agreed upon. Men who have carefully studied the question with the sole object of reaching a correct conclusion, without interest in any class of machinery or desire to promote the sale of a particular kind of apparatus, have reached extremely different results. The proper sizes of engines and generators, the best method of connection, and the most advantageous arrangement of a station generally, for example, all involve questions concerning which engineers of the broadest experience and ripest judgment entertain radically different opinions. But there are certain matters on which we all agree. Of these, most essential is the elementary principle that a station should be built on a general plan. At no time would the necessity of conformity to such a principle have been denied, yet it has been disregarded in a vast number of instances, and, until recently, perhaps, its great importance has not been adequately emphasized. Stations have in many cases been well built, and each of the several departments, has, perhaps, been well designed, yet unity in the entire plan has been lacking and the result has been decreased efficiency and increased cost of operation, in addition to the host of minor evils which may be classed as inconveniences. The time has now come when more and more are railway men coming to regard their generating stations not as composed of several substantially separate departments but as units. Those who have followed articles bearing generally on station building which have appeared in the Street Railway Journal will realize how persistently this matter crops out and how important it is now regarded by the best engineering talent. If the design of the station be a good one, and if those engaged to plan each department be compelled to subordinate their particular part to the harmony of the whole, the result will be a station from which the more ordinary faults, at least, will be eliminated. There is one other point to which attention should be called, although the subject has been treated so frequently that it is rather hackneyed; still, the danger of fire is ever present, and the necessity of adopting precautions can never be too strongly emphasized. The fact that within the last few weeks three electrical stations in Chicago have been utterly destroyed by fire makes a reference to the matter especially timely just now. The day of installing costly electrical apparatus in tumble down buildings is, fortunately, passed, even in the electric light business. Some hard lessons have been learned, and heavy losses have been sustained by reason of the installation of plants in buildings wholly unsafe, and unfitted for the purpose. The electric railway companies have not suffered as bitter experiences for they have not sinned so heinously in locating plants; still their losses have been sufficiently high to prove instructive. In the design of new stations, perhaps, the matter of protection against fire should come first, and when the station is built the necessity of exercising the utmost care that the

danger may be kept at a minimum should never be forgotten.

The Street Railway Situation in Chicago has formed the topic for several articles which have appeared in these columns during the last few months. It has been stated that the surface railways on which the people have to depend wholly for intramural transportation, have been fairly overwhelmed by the tremendous demands made upon them. The public demand for increased facilities became so imperative as the result, perhaps, of the unreasonable and outrageous attacks of the press upon the surface companies, that Mayor Washburne, realizing that the approaching World's Fair would make matters much worse, appointed a committee of Aldermen, citizens and representatives of the street car companies to take the whole matter into consideration and make recommendations which might improve the situation. Their report has just been made public, and an abstract is given elsewhere in this issue. The document is extremely conservative in character and exceedingly mild in tone. It does not enter into the subject generally, but the suggestions it contains relate almost wholly to minor changes which may result in a speedy improvement of the street car service. It suggests that blockades in the business district might be made less frequent if teams be compelled to traverse one street when going in one direction while those going in another direction take another street. The duties of the police in preventing blockades are alluded to, and the committee also refers to the unloading of wagons, which is such a vexatious source of delay to street cars in Chicago. This matter was considered in our columns last month, and the committee reached the same conclusion that we did, that policemen should see to it that the streets were kept clear. Perhaps the most important suggestion that the committee makes is that the cable companies be granted additional loop facilities hitherto denied them. Certainly this is a decided victory for the companies. It was also suggested that the city ordinance providing that cable trains should not consist of more than a grip and two trailers be amended so that another car could be added. The most striking suggestion in the report is the recommendation that during the World's Columbian Exposition street cars be excluded entirely from the business section of the city. Such a radical change is demanded, the committee thinks, on the ground of safety. We do not think such a plan would be popular, although under the existing conditions there is much to commend it. The business district is so small that if the cars remained just outside the most crowded portion no one would have far to walk. What we have referred to thus briefly covers the greatest part of the report. If the ideas are adopted, the committee thinks that the transit facilities will be very greatly improved. A committee of the Chicago Tax Payers' Association has been investigating the same question, and its report is more radical than that to which reference has just been made. It makes some suggestions which are novel, and, on the face of them, commendable. For example, the proposition that certain cable lines be operated exclusively for express trains seems under certain limitations a very admirable suggestion, as especially on the North and South Side of the city such a plan, it would seem, could be arranged without any great difficulty. The suggestion that electricity be employed as a motive agent is not so valuable. In handling the traffic it is perhaps a very serious question if electricity would give as good service as the cable in the downtown streets in Chicago. Certainly only the overhead system is at present available for such service, and ærial wires are not permitted in Chicago at the present time. Electricity on the cross lines undoubtedly will be adopted, and will greatly add to the general efficiency of the service. Both the reports are well worth studying as they deal with a subject which is exceedingly complex, and of which some aspects most street railway men are obliged to study at one time or another.

Legislative Breaches of Contract with transportation companies have been common in the past, and at present form one of the chief dangers to which such companies are exposed. It is now generally conceded that one of the largest, if not the largest, conditions favorable to the industrial progress of a people is a rapid, convenient and confortable means of intercommunication, and that the rule holds as well for city and suburban traffic as for a communication between distant cities. No people realize this fact better than new communities who, in other localities, have tasted its benefits. So great is their anxiety on this point, that they frequently grant large concessions to any responsible parties in the shape of lands, freedom from taxes, guarantees of interest on the investment and in numerous ways, to encourage the employment of capital for such purpose. Often such investments in new communities are unprofitable for some years after they are made. Only in thickly populated districts is there any reasonable surety of immediate and profitable returns; and because of this general experience, the main reliance of the promoters of such undertakings is frequently confined to holders of real estate along the line, or to those whose property is likely to be improved by such a road. It is a very common experience among such communities after a number of street railways have been constructed under the described conditions, that the benefits derived are such an every day matter, that the people forget how hard it was to induce capitalists to enter the business, and in such forgetfulness they form meetings to restrict the growth of these "monopolistic" street railways, and through legislative enactments do what they can to restrict such "monopolistic" privileges. Capitalists will not invest their money without reward in one shape or another; it is folly to expect it. Consequently, if a community seeks the aid of capitalists, it must grant a profit in some way. Of course, any community can build its own railways, and in such ownership do what it pleases, but a pretty large experience in this field does not show much profit in it to the community. It has generally been found that private enterprise can make a good profit, where a road in the people's hands cannot make both ends meet. This result is due to a good many reasons, the main one being, in the case of a public road, that there is a lack of personal interest in the minds of both the management and in the employes. All of these workers go through their duties in a sort of perfunctory way, which means a great waste of resources. To conduct any business properly, and make a profit out of it, necessitates a watchfulness in details, and a strict economy in the entire management, a matter which is rarely, if ever, attained when the business is entrusted to public hands. Not that a publicly conducted business cannot be done at a certain cost, and at the same time be done well; but no instance has yet been shown where private enterprise could not do

the same business equally well in all particulars for considerably less cost. If it be conceded that private ownership can render the same service at a lower cost—and we could cite many examples to prove that to be a fact beyond all question, if space permitted—the next point to be considered is, the rights of such private owners. No man invests his money in a business when he has reason to suppose that the right of control of that money is to be taken from him after he has invested it. This can be set down as a fact beyond dispute. Conceding this, when a capitalist is invited to invest his money on a certain understanding that certain privileges are accorded him if he will put his money in it, and he invests his money with that understanding, it becomes a breach of trust on the public's part if, after the money is invested, it sees fit to alter the contract without the consent of the capitalist. It always takes both parties to an agreement to make any just alteration in its particulars. Merely because a public is the stronger party, does not justify it in ignoring the rights of contract, nor the rights of property. And further than that, it is not a safe proceeding for any republic to put into practice. In truth this very issue was the cause of the foundation of our republic, viz., a determination to be rid of feudal or government confiscation without due process of law. Now, can we in safety ignore all this past and vast experience of the misery consequent to ignoring property rights, and in the shape of legislative enact ments break contracts merely because the power exists to do so? A contract should not be broken without due process of law. In fact, the Constitution of this country does not permit it. If the public wishes to retain any part of the profits belonging to any franchise it grants, let all such provisions be incorporated in the contract when it is made. The public can no more justifiably break a contract to which it is a party, then the public can without process of law confiscate the private property of any individual composing it. Both acts are precisely the same thing. If a public franchise is worth anything, let a bargain be struck beforehand, and give public notice of it; then if capitalists can be found to put their money in it under the advertised conditions, well and good; and if the right is reserved by the public to alter the contract at will and without the consent of the capitalists, by means of legislative enactments, let it be so stated in the contract or franchise. In that way only, may later adverse laws be made which will accord with the Constitution of the country. But in so doing we venture the prediction that there will be remarkably few capitalists to accept the proposition. Usually investors do not do business that way. We merely suggest its being done, in order to convince the public that there is an element of injustice in attempting to do, after a contract has been made, what could not be done before.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Cable and Electric Motor Power on Street Railroads.

February 15, 1892.

Editors Street Railway Journal:—

A letter writer in the Street Railway Journal, for February, says: "It would be interesting to know what reasoning finally induced the clear headed men" who control the principal street railroads in Brooklyn, to decide in favor of electricity (instead of the cable) for their lines.

A general survey of the press makes one wonder that cable railways continue to be built at all.

The magazines give us popular accounts of the progress of electricity; the big dailies have their electric column; the street railway journals are under a heavy electric pressure, and electric pamphlets, papers and paragraphs fill all the gaps. The presses are generously fed by the wealthy corporations, and numberless individuals immediately interested in the electric boom. Bonfires are lighted everywhere and nothing escapes the rake that can be made to blaze for the glory of electricity. There is more evidence offered for the efficacy of electric traction than sufficed to make a bonanza of Perkins' Tractors.

And who speaks for the cable?

Day after day we read the cable road costs nine times as much as the electric; its operating expenses per car mile are as 14.12 to 11.02 cents, or, with interest added, as 20.91 to 14.05; the cable road burns three times as much coal as the electric; the cable has an "efficiency" of fifty per cent.; electricity has an efficiency of eighty-five per cent.; operating expenses per passenger .05488 for the cable, against .04736 and so on.

You will recognize the figures. I did not invent them.

Some of us know better, and some wonder why cable roads are built; but the electric man has the next word, and it is: "As these figures have not been questioned by any authority upon the subject, they may be accepted as substantially correct."

It seems natural that some of the "clear headed men" who control street railroads should make the Brooklyn blunder. The mass of evidence is overwhelming.

Occasionally some one of these "clear headed men" suspects its one-sided nature. Perhaps he asks how it is that cable roads operating at such an enormous disadvantage pay, in the "twenty seven principal cities," 10.15 per cent. dividends against 5.59 per cent for the electric; and why in the census table of "eighty-one per cent. of the operating roads" the cable shows a net surplus $557,749, against $30,820 for the electric; and why cable road stocks are high and electric low; and why this electric road with a business of $1,500 per day cannot sell its bonds from San Francisco to London, while that cable road offering $2,000,000 at 9 A. M. has $2,500,000 called for by 2 P. M.; and why the papers are almost silent about some thirty-five miles of cable road to be built this year in a neighboring city while every mile of half-built electric road with its two cars is paraded in every possible way.

And having got this far he may chance to hear for the first time of cable roads operating for 9.5, 8.5, 7.4, 7.2 and 6.6 cents per car mile (exclusive of interest on bonds only); and of others for from fifty-five to forty-two per cent. of gross receipts; and of others for 2.75 to 1.50 cents per passenger; and he may be shown that the cable road burns one pound of coal to the electric three (instead of three for one), and that if fifty per cent. is a good figure for the "efficiency" of the cable road, no electric road can show forty per cent., or thirty per cent., and few, if any of them, twenty per cent. measured in the same way, and other unsuspected things.

If he himself "cables" he may give thanks, but he does not roar with a loud voice, and there is no "authority" in the shape of organized boomers of "systems" and of patents by the thousand, to drag him into the chorus.

I merely wanted to suggest why some cable roads are *not* built, and to explain the seemingly greater anomaly why some *are*.

Cable Railways.

New York, February 23, 1892.

Editors Street Railway Journal:—

My attention has been attracted by a communication in your last number signed "Civil Engineer," touching the reasons that have induced the hard headed business men who control the Brooklyn street railways to adopt the trolley system instead of cables. As your correspondent seems to be sincere in his desire for information I trust that the following explanation of the present status

of electric and cable roads will show the course of reasoning that inspired the wise decision that has been made:

As regards the quality of the service furnished the public, one may frankly state that, either system installed and operated in accordance with the best recent practice leaves little to be desired. The cable road possesses certain advantages that are unquestionable—the ability to surmount extraordinary grades, and a very high efficiency *when under particularly favorable conditions.* On the other hand the electric road also has its own characteristic properties—great flexibility as regards variations of speed, invaluable when a continuous line operates both in the city and the suburbs, the ability to back cars, very useful in crowded streets, and a comparatively high efficiency at light loads.

Either system is quite capable of giving thoroughly reliable service when properly managed. The electric road now and then is afflicted with a short circuit, the effects of which may easily be limited to a section of a few hundred feet in length, while if a cable breaks, the whole line is temporarily crippled, for it is utterly impracticable to subdivide it to any considerable extent. Fortunately a break does not occur frequently and a duplicate cable permits traffic to be soon resumed, provided the broken cable does not entangle its mate. Still, a failure in cable service is serious, as the Brooklynites had occasion to notice last summer when an accident on the bridge system blocked traffic for three or four hours in the busiest part of the day.

As to danger, little need be said. Accidents will happen on any rapid transit system whatever. The electric car, however, can be stopped or backed with great facility, which gives it a certain advantage in working its way through crowded streets. With cable cars there is always the unpleasant possibility of a broken strand catching the grip, in which case nothing but good luck can avert an accident. No street railway line is entirely guiltless of casualties, but I know of none with a bloodier record than some of the Chicago cable lines.

Your correspondent is apparently under the erroneous impression that the current from the trolley wire is capable of killing or maiming the passer-by in case of a break or a cross with another wire. In this connection I need only say that, having investigated every report of such kind during the past two years, I am able to state positively that up to date no human being has ever been killed or seriously injured in such manner. Furthermore, I have personally, like hundreds of others who have been engaged in electric railway work, received divers shocks from the trolley wire under conditions ensuring considerable severity, and while the experience is somewhat disagreeable, it is far from dangerous. The present standard voltage (500 volts) was chosen with public safety in view, and the event has proved the selection to have been a wise one.

Now, as to the commercial features of the case,: Did the conditions involve a comparatively short, straight line with continuous grades of above ten per cent., operating in a densely populated district, the cable would be chosen without hesitation. But street railway systems seldom operate only in regions of dense traffic, grades are very generally slight, curves are usually unavoidable. It is highly desirable to have continuous lines reaching from the suburbs to the heart of the city, fulfiling the conditions of rapid transit in the former, closely limited in speed in the latter. The system which adapts itself to all conditions economically is naturally the one to be chosen. So far as grades are concerned, any road that is commercially practicable for horses can well be operated by electricity.

Your correspondent desires exact data as to the cost of construction and operation of electric roads. These I am happy to furnish, and by way of comparison I have before me detailed reports from the officials of eighteen cable roads, giving the facts of cost, efficiency and operating expenses, and besides these a detailed estimate for a three mile double track cable road prepared by a well known authority on tramways, approved by several cable road contractors of wide experience. On these I shall base a comparison.

First, as to the general facts about electric roads. Details obtained from twenty-two trolley roads, in many cases coupled with examination of the books, gave the following averages: Total cost of construction and equipment, $555.60 per mile of double track; total cost of operation including maintenance and repairs of whole system, 11.02 cents per car mile; cost of power, including fuel, wages, and all power supplied, 1.96 cents per car mile. The average efficiency of these roads, reckoned from indicator card to car wheel, is, estimating from the known efficiencies of the several parts of the system, probably thirty-five per cent. This figure is readily attainable even with conditions somewhat unfavorable. The lowest recorded efficiency for an electric road of old and poor design is twenty-five per cent.

Now, as to the reports from cable roads: Average weight of rail per yard (eighteen roads) fifty-four pounds. Cost per mile of double track exclusive of power house and special features, (ten roads) $107,142. Cost of power per car mile (eight roads) 5.22 cents. Efficiency (thirteen roads) forty-one per cent. Three roads confessed to an efficiency of seventeen per cent., a figure I hope and believe unequalled by any electric road in existence. The highest efficiency noted was seventy-one per cent. and in this case it is stated elsewhere in the report, that the whole road is now being changed to the overhead electric system on account of expense and difficulty of operating cable by reason of the number and sharpness of curves. All these averages are taken from all the reports made on the given topic. Four roads only gave operating expenses (average 17.18 cents per car mile) a number too small for valuable conclusions.

Following are the estimates for a three mile, double track road, on both cable and electric systems. Figures for cable are drawn from authority named. Figures for electric drawn from the *Electric Railway* (Crosby & Bell), allowing, however, the same cost of track construction as given for the cable system:

ELECTRIC.		CABLE.	
Track	$111,000	General street construction	$304,396
Allows heavier rail if necessary, by reason of less paving expense.		(Track and paving, $111,000.)	
Bonding	3,600	Special street construction	28,500
Poles (set)	9,000	Ground, and power and car house, including chimney	40,000
Trolley and feed wire in place	8,700	Power plant, &c.	62,000
Station (can be placed irrespective of line, where real estate is cheap)	40,000	Rolling stock, 15 grip and 15 tow cars	33,000
Steam plant	15,000		
Electric plant	12,000		
17 Motor cars	59,500		
17 Trailers	20,400		
Total investment	$279,200	Total investment	$467,396

The accuracy of these figures can be easily verified by any contractor for either system. For operating expenses the authority mentioned, supposing each cable train to make 110 miles per day, fifteen being in operation, gives 8.4 cents per car mile. With interest added this reaches 10.5 cents per car mile

For the electric railway the cost per car mile of a motor car (the *Electric Railway*) on a conservative estimate is 11.33. Allowing about six cents per car mile for a trailer, a figure in accordance with fact, the cost of operation per car mile becomes 8.6 cents, or, with interest added, ten cents. Thus for the same line, with same high cost of track and doing the same service the electric service appears to have the advantage by about 0.5 cent per car mile—$6,000 per year. The accuracy of the figures for the electric road is attested by the average of the twenty-two roads referred to, and also by the facts that with trailers in use several roads are actually operated on about eight cents per car mile. The trailer is a material advantage as the cable men have found.

From the foregoing, it appears that even assuming the same conditions, a well managed electric road can compete on at least even terms with an economically built and operated cable road, while under more usual conditions when the electric road can be built and fully equipped for about $60,000 per mile as against $150,000 for the cable, the advantage of the former is marked. Possibly these facts may have entered into the minds of the gentlemen from Brooklyn and moved them to adopt the trolley system, instead of the undoubtedly efficacious, but too expensive cable.

Louis Bell.

February 19, 1892.

Editors Street Railway Journal:—

The paper on the "Relative Advantages of Cable and Electric Power on Street Railways," published in the February number of the Journal, is one of great interest to every one in the street railway business; but while the rates of variations there given in the cost of motive power may be applicable to the two roads considered, they will not apply in case of any great variation in the car mileage or to any other road. A more rational way would be to separate the individual items of cost into their constituent parts, and determine what are fixed and what will vary with the load or car mileage.

In an electric system, a car can make only a definite number of car miles in a day, and consequently any increase in car mileage necessitates a corresponding increase in the dynamo, engine and boiler capacity, and consequently in the number of engineers, assistants and firemen; the cost of engineers alone being constant.

Repairs of engines and machinery, and oil and waste for engines and dynamos, may be constant up to the capacity of the engines and dynamos, but increase directly as the number of engines and dynamos in use.

Part of the fuel and water is used in overcoming the friction of the engines and dynamos, and is constant for each engine and dynamo; and the remainder is used in overcoming the resistance of the line and in moving cars, and varies nearly as the car mileage.

Repairs of dynamos vary directly as the number of dynamos, and in a small ratio as the car mileage up to the capacity of the dynamo, it being evident that the more work is put upon it the more repairs it will need. Repairs of motors, line and trolleys, and lubricants vary directly as the car mileage.

In a cable road the conditions are similar to those of an electric. The cost of engineers is constant for all car mileage, while that for the assistants and firemen is constant up to the limit of the capacity of the cable, and beyond that increases in a ratio as the number of cables; the increase in the amount of machinery and boiler capacity necessitating a corresponding increase in the number of oilers and firemen. Repairs of, and oil and waste for, engines and machinery, are practically constant for each set of winding drums and engines Lubricants for cables and pulleys vary directly as the length of the cable or line. Part of the fuel and water is used in overcoming the friction of the machinery and engines, and is constant for each cable; the remainder varies directly with the loads hauled or its equivalent, the car mileage. The cost of the renewals and repairs of cables is made up of two parts; the first depending on the character of the road, the number of curves, and the details of construction; and the other depending on the loads hauled.

If careful tests were made of the existing cable and electric roads to determine the different items of cost as indicated above, and a comparison made of the results, formulæ might be made that would indicate very closely the cost of motive power for any car mileage on any length of road. Further, the total cost of operation, including the interest on the capital invested, can also be obtained, provided the cost of the different items of construction does not vary greatly in the different roads.

In both a cable and electric road, the cost of operation and the cars themselves are proportional to the car mileage; and the cost of repairs of road bed bears a ratio to the car mileage and the length of the road. The cost of the road bed is proportional to its length, while the cost of the plant is, in an electric road, nearly proportional to the car mileage; and in a cable road, is made up of three parts, one proportional to the car mileage, another to the length of the road, and the third dependent on the character and alignment of the construction.

If, then, in any street road—

L, miles long, and making

M, car miles, and

A, represents the fixed cost of superintendence and engineers.

a, cost per car mile for engineers, assistants and firemen.

B, part of total cost of repairs, and oil and waste for engines for a cable road.

b, cost per car mile of repairs of, and oil and waste for, engines.

C, cost of part of the fuel and water used, in overcoming the friction of the plant.

c, cost per car mile and the car mileage.

c', cost per mile of road of same.

d, cost per car mile of lubricants for dynamos and motors, and repairs of line and trolleys; and

d', cost per mile of lubricants for pulleys and cables.

e, cost per car mile of repairs of dynamos and motors.

e', cost per car mile of renewal and repairs of cable.

e'', cost per mile of road of same.

f, cost per car mile of cars and of operation.

g, cost per car mile of repairs of road bed, and

g', cost per mile of same.

h, cost per mile of road bed.

I, a fixed cost, depending on the character of the cable road.

i, cost per car mile of an electric plant, and

i', cost per car mile of a cable plant, and

i'', cost per mile of same.

Then the cost per car mile for any car mileage will be, for an electric road:

$$\frac{A + M\,(a+b+c+d+e+f+g+.06\,i) + L\,(g'+.06\,h)}{M}$$

And for a cable road:

$$\Big\{A+B+C+.06\,I+M\,(a+b+c+e'+f+g \\ +.06\,i')+L\,(c'+d'+e''+g'+.06\,h.+06\,i'')\Big\} \div M$$

Mechanical Engineer.

Track Brakes.

Boston, Mass., Feb. 12, 1892.

Editors Street Railway Journal:—

In answer to your inquiry as to the best form of track brake, I must say that I know of none that I would recommend; in fact I have never heard of one that was as efficient as a good wheel brake. It goes without saying that the only reason for having two sets of brakes on a car is in case the regular wheel brake mechanism should give out there is some other form of brake to hold the car.

My advice to all railroad companies would be to have a double set of wheel brakes; and they will find that they will have better results from a wheel brake than they will from a track brake. It is true, I must confess, that it prevents the flattening of the wheels; but as an emergency brake it is not in the race, particularly on electric cars.

All forms of track brakes have been attached to the side bars of the trucks. When applying a brake of this description I have observed that the resistance against such a brake would be the weight of the car, less the weight of the wheels, axles and motor equipment. If one stops to think for a moment he can readily see that the weight of the motor, wheels and axles, remains on the track and furnishes traction for the revolving armature, which will result in carrying the car some distance before it can be stopped with the track brake; whereas, the wheel brake resists the revolving armature.

I wish to say that our general manager, about a year ago, was impressed very strongly with what he heard of track brakes, and at his request I visited a neighboring city where track brakes were employed on a line having an eight per cent. grade. The track was in just the condition I desired, being covered with slush and snow. The superintendent of the railroad was present and assisted in making the test. The hill that runs toward the river was selected as the place for making the test. The motorman was ordered to run down the hill a little faster than usual and to stop with the track brake on receiving one bell. He applied the track brake with all his power, but the speed of the car increased as it descended the grade; when the speed became dangerous orders were given to appiy the wheel brake, which was done, and the car came

to a stop about as quickly as it possibly could be done by stopping the wheels; and I tell you we would have gone into the river if we had not applied the wheel brake, for the track brake would never have stopped the car.

On my arrival home I reported what my experience had been with the track brake. The manager then instructed me to purchase one and apply it to some one of our short cars with the Bemis 6 A truck. When it was put on, the manager and others came out to see it in operation.

Our method of making the test was as follows: We applied the track brake with all the power that one man could give it; then we gave the motorman instructions to start up the motors and as a result the car would crawl right along with the track brake. In order to stop the car we had to apply the wheel brake. Our next order was to release the track brake and apply the wheel brake with all the power possible, which was done. The motorman's next order was to turn on the power and see if the motors would carry the car along, but they failed to do so; the fuse would blow first.

I wish to emphasize the fact that there is no sense in applying a track brake to any street car, horse, cable and particularly electric. After the power is turned off the electric car has considerable force which is entirely different from a horse or cable car. The only propelling force in the two latter is the momentum of the car, whereas, in an electric car there exists also the revolving armature. Then again, with the track brake a motorman might be careless and apply it in going over crossings and curves when it would be likely to catch on the guard rail.

I call to mind that on starting the cable road in New York City, the superintendent of that line devised, as I consider it, a very efficient track brake and applied same to cars. This was to be used only as an emergency brake. The time arrived when, as we may call it, the "emergency brake" was to be applied. On account of not being operated continually, it worked stiff; but for all that, the brake was applied and did not work very satisfactorily. The superintendent at once saw the weakness of same and ordered them from the cars, and instead applied an extra set of wheel brakes.

If railroads could depend upon brake mechanisms; that is, to have everlasting qualities, I do not see any reason to apply an emergency brake, for as long as the brake mechanism holds, the car can always be stopped. If the wheels and axles should break there is no necessity for applying a brake, for the car will stop of its own accord.

L. PFINGST,
Master Mechanic West End Street Railway Co.

Electric Traction Abroad.

CHICAGO, ILL., February 13, 1892.

EDITORS STREET RAILWAY JOURNAL:—

It affords me great pleasure to supply you with some particulars regarding my trip abroad. The object of my trip was to examine and investigate the workings of four electric conduit railways, operating in Buda-Pesth, Austria. As you will remember, the great firm of Siemens & Halske have been the pioneers in the electrical field. They built and successfully operated an overhead line four years before we had any similar road in the United States.

In 1883 we first began our efforts in the United States to build an electric railway, carrying the electricity under ground. This first line was built in Cleveland, O., under the Bentley-Knight patents. From that day to this, six different lines have been built, to my knowledge, at an expense involving many thousands of dollars, and I believe every one, without a single exception, has been abandoned, owing to the impossibility of successful working.

Some time ago, Siemens & Halske turned their attention to the construction of an electrical conduit, and we, having heard that they had succeeded in the problem undertaken, and that they had a road in successful operation in Buda-Pesth, were desirous of seeing same in operation. Our Mr. Meysenburg, when abroad last summer, visited Buda-Pesth, and was so much pleased with what he saw, that as soon as I could close down on our cable work, I went to Buda-Pesth. I found that the working of the first line had been so successful from an electrical and from an economical point of view, that three other lines had been completed, and that all four were giving entire satisfaction, and several other lines under the same system are now contemplated.

The construction of this road was so fully illustrated in the July issue of the STREET RAILWAY JOURNAL, that little remains for me to describe. In all the cities that I visited in Europe, I found the grooved tram rail in use. I did not see a buggy during my trip abroad. The tires on all the wheels are so wide that they do not enter this groove. Owing to this fact, the opening (which we call the slot rail in cable railway construction) is made where this groove would come, and it is made the same width as the groove in the ordinary rail, viz., one and three-eighths inches, a width that would not be permissible in American cities, where buggy tires are so very narrow. Having the slot under one rail, they necessarily made the conduit under the same rail. The other rail is held to gauge by means of tie bars, and carried on concrete. This construction would have to be changed in America for an ordinary open slot in the centre of the horse path.

I was particularly struck with the magnificent results achieved by the Siemens & Halske electrical machinery. They are building dynamos far in excess of American practice, some being 1,000 to 1,500 H. P. each. These being built directly upon the engine shaft, are driven at a considerable saving in power. I found the cars in Buda-Pesth being operated with one-third the amount of power used by an overhead electric line, of which I had some knowledge in the United States.

The construction of such a system in the United States would necessarily be expensive, for the reason that in building any substructure to sustain an open slot, we are compelled to build with reference to the street strain, rather than our car traffic; therefore, this road would cost about the same as a cable railway, but its advantages in operation are obvious. In the first place, the power will be directly as the number of cars operated. If we build a cable railway, say, ten miles long, we are compelled to expend 150 H. P. in operating the cable alone. We have to maintain all the carrying sheaves and curve pulleys. Of course, the larger the number of cars operated, the less the expense per car. We are also dependent upon the one form of transmission of power, the cable itself. If, through the carelessness of one of the gripmen, the rope is cut, all the cars on that line are stopped. In the electric road we have all of our machinery in the power house in duplicate, so that there is nothing to stop the line there. If anything happens to an individual car along the line, the next succeeding car can push it out of the way. I believe, therefore, that the electric conduit railway has a great field before it in the United States. It is used in Buda-Pesth, under similar climatic conditions to a great portion of the United States, and is successful from a mechanical and financial standpoint, as demonstrated beyond peradventure. I hope that it will be introduced into the United States within a few months, when those interested can have an opportunity to investigate its workings without making the trip of 10,000 miles as devolved upon me.

Regarding the street railway interests in general, your pages contain so many and such admirable articles upon the construction and work, that little is left for me to say.

I was pleased with the condition of the tracks generally, and the beautiful curves and switches. The rolling stock does not compare with ours in style and finish. Most of the horses appeared in admirable condition, and I found the employes polite and obliging, without a single exception. The zone system as used in Berlin, I believe could be introduced into America with greatly increased profits to our trunk lines. Mr. Whitney, in his very able address, which appeared in the June issue of the STREET RAILWAY JOURNAL demonstrated how largely the earnings of the West End company would be increased, could they apply the same rate of fare. Where a passenger gets

upon one of our lines, and is carried its entire length for a nickel, and sometimes, in Chicago, riding ten miles, it goes without saying that there is no money in it for the company. The person who has a long distance to ride, will be sure to get on the car, to the exclusion of the short rider, who would prefer to walk than to "hang on." If the fare were in proportion to the distance, I think we should have many hundred thousand more short distance riders.

If there is any additional information you would like, please command me.

Augustine W. Wright.

Concerning the Infringement of Corporate Rights.

New York, February 14, 1892.

Editors Street Railway Journal:—

Mr. G. Hilton Scribner, at each of the three last meetings of the American Street Railway Association, read an important paper relating to railway franchises and corporation taxes. His first paper was a masterly production, and was so recognized by the members of the Association who heard it; although in the last paragraph, relating to taxation, he was, I think, slightly in error. Mr. Scribner displays an unusual reasoning power all through his writings, and his ability in that particular belongs to a high order; and because he overshoots the mark in his last two papers on the New York State taxation issue, it is due to lack of knowing a few facts, rather than to any weakness of his logical ability.

Concerning the popular prejudice against corporations, especially those engaged in railway affairs, he most truthfully makes the following statement: "A corporation no sooner enters business than its stockholders, directors, and officers are made to feel in many ways, through the agency of the press, too frequently, and always by first contact with public officials, that it lives by sufferance; that its birth and being, though reluctantly permitted, is not approved by the public or by the state; that its methods and purposes are in some way inimical to the public, and that the rights of every other citizen making up the great public have been and are being infringed, in just the proportion that the corporation is prosperous; and lastly, that a very profitable business on the part of the corporation is a downright robbery of others, especially of those who are not engaged in the same line of business."

This is, indeed, an excellent summary of the railway situation so far as its relations to the public go, but it more particularly applies to the situation as it has been manifested in Western legislatures than in the State of New York, which his argument more particularly dwells upon. At the same time this feeling is prevalent enough even in New York, but it has not yet manifested itself in legislative action in the same degree, which particular takes away the edge of this issue in Mr. Scribner's argument. He quotes the New York *Tribune* in the following way: "It is not equal taxation to tax all the property of a company twice, once upon the entire value of securities representing it, and again upon the real and personal property which the securities represent." This is a sound view of the tax business, but Mr. Scribner misapplies it to the corporation taxation of New York. It does apply, however, to the taxation of real estate, and a second taxation of a mortgage on that same real estate, which indeed is a most unjust and burdensome matter. But it is not real estate which Mr. Scribner refers to; therefore he is in error by presuming the existence of a double taxation in the case of corporations, and basing a long argument on that presumption. Taxes are levied on corporations in as nearly a just manner as possible, except in one important particular, viz., where the corporation is permitted to "swear off" its liabilities against the assessment, regardless of the corporation's wealth; but this particular is against the state rather than against the corporation; or it may more properly be said, it is a premium upon a fraudulent evasion of taxation.

When corporations are assessed in this state their officers have a right to go to the tax office and make a declaration there of a true condition of their affairs; that done, all property they own which has been assessed and subject to taxation in another state, or is exempt from taxation under the laws of the United States, may be deducted from the assessment, which deduction comes under the head of "swearing off." The law of this state is very lenient in this regard, therefore there seems to be no great point in Mr. Scribner's denunciation of the injustice of the New York law in singling out corporations for unjust taxation when other owners of property are exempt. As a matter of fact other property owners are just as subject to the personal tax law as corporations; the latter are not singled out in any way in particular; every individual in the state is subject to the same taxation under the same law; although many individuals in the state do escape personal taxation, merely because the assessor cannot find out the existence of such taxable property, but this is an abuse of the law and has nothing to do with justice in dealing with corporations.

A large part of Mr. Scribner's second paper, and nearly all of his third paper, is based upon the imaginary injustice above described, which is a particular that makes an otherwise strong argument partially abortive. Of course the question of the propriety of any kind of a personal tax law does not enter the argument; that is an outside question; the statement made here is merely that the law as it stands does not discriminate against corporations. But his argument exceedingly well applies to the situation in numerous Western states, and in view of that application, if he would so put it, what he has to say is calculated to do a great deal of good; for in the West great harm has been done within recent years against all railway interests in the shape of special laws which are neither more nor less than modified forms of public confiscation of private property. In connection with this particular Mr. Scribner said a very wise thing, viz.: "But the ill treatment of corporations is also repeated with every session of legislature and court, with each issue of press and political platform, and, therefore, continual protest on our part, though that protest shall often but rehearse the story of kindred and like wrongs inflicted and borne before cannot be amiss. Petition and protest, patient and persistent, has often secured a hearing and effected a removal of undeserved political and social disabilities." That is a most true saying, and a matter which the press generally takes into too little consideration. The rule in such cases too frequently prevails, that when a protest has been once clearly stated, it is old news to say any more about it. This course of procedure highly pleases the malevolently inclined, who by persistence in their mischievous ways finally gain their purposes. Of course only important matters concerning large interests are alluded to, and this subject of public confiscation of private railway property, whether in the shape of taxes or adverse legislation, is one of them. I do not exactly agree with Mr. Scribner when he says in his third paper: * * * "that the majority would permanently hold the government and enjoy all its advantages, not the least among which would be this parasitical power of keeping its hands in the pockets of that minority class in which the prudent and thrifty are always found." While Mr. Scribner does not distinctly say that he believes the majority will develop into such parasites, in other words, that the country is going to the "demnition bow-wows," he hints that his fears lead to that conclusion; but I disagree with that supposition, because the history of the world shows conclusively that the inherent honesty of the people finally predominates over all other sentiments when the general public understands the true situation. History clearly shows that more crime is done because of ignorance on the part of the masses, than to any direct intent on their part to do unjust acts; and in this view the future security of the nation mainly rests in the publicity given of all wrongs and oppressions by the press of the country. When these wrongs are fully comprehended by the whole people, the days of the existence of those wrongs will be short lived.

J. B.

Accounts and Records.

In answer to the many inquiries we receive for simple and systematic methods of keeping accounts, we continue the lessons in book-keeping by presenting the following forms, which will be found admirably adapted for the purposes specified. These forms have been kindly furnished us by the superintendent of a railway company whose lines are remarkably well managed.

(A)

X. Y. Z. RAILWAY COMPANY.

Brownstown, *February 6th*, 1892.

Mr. *Samuel Jones*,

Foreman *First* Ave. Division.

Place bearer, Mr. *Paul Geary*, on with *Peter James*, *John Smith*, and *Henry Robinson*,

for instructions in the duties of *Conductor*.

B. G. Smith, Sup't.

To Sup't X. Y. Z. Railway Company:

Bearer *Paul Geary*,

has been under instructions with the undersigned for the number of days set opposite our names.

He is familiar with all rules and regulations, and with the streets along this route.

He is also familiar with all switches, curves and turnouts about the station, and the various branches connecting with this division, and I recommend him.

On with	*Peter James*	, 2	days.
"	*John Smith*	, 3	"
"	*Henry Robinson*	, 2	"

(B)

Brownstown, *February 13th*, 1892.

I, *Paul Geary*,

Born in *Brownstown*,

Age 30 Married.

Residence 2900 *Hill Street*,

Desire employment with the X. Y. Z. Railway Company

as *Conductor*,

at *First* Avenue Division.

I have been furnished with a printed copy of the rules and regulations governing motormen and conductors of this company, have carefully read the same, and agree to cheerfully comply with all of said rules, regulations and conditions contained therein.

Occupation during last two years as follows:

Driver, Suburban & Eastern Railway Co., 8 *months; Conductor, People's Railway Co.*, 16 *months.*

Respectfully,

[Signed.] *Paul Geary.*

Recommended by *Frank Brown of Sub. & E. Ry. Co., Thomas Smith of People's Railway Co.*

Deposit made and badge furnished.

Thomas Hall, Sec'y.

Mr. *Samuel Brown*, Foreman:

Please assign Mr. *Paul Geary* to a place on the "Extra" List.

B. G. Smith, Supt.

Reported for duty, *February 15th*, 1892.

Sam'l Brown, Foreman.

Record of Employes.

The following blank (form A), note size, is handed the applicant when he is engaged, and he is also furnished with a copy of the Rule Book, and with a copy of instructions to motormen, if he is to operate an electric car. When this form is returned and the report is favorable, form B is furnished the applicant, which, after it has gone its rounds, is returned to the superintendent's office, and the two forms are attached together with mucilage and filed away alphabetically in a case provided for the purpose. When an employe leaves the service he is required to present to the secretary and treasurer, a note from the superintendent (form C), and which, when it is returned, is attached to the other slips relating to the case, and thus a complete record is kept of the dates when the party entered and left the service, and also shows where the party may be found after leaving the service.

Accident and Damage Records.

A book of blanks (forms D 1 and D 2) is provided for the conductors, one of which he is required to

(C)

X. Y. Z. RAILWAY CO.

Brownstown, *Aug. 1st*, 1892.

John Jones, Treasurer:

Please pay (between the hours of 2 and 3 o'clock P. M.) *Paul Geary* the amount due him to date.

B. G. Smith, Supt.

Resigned to go to Chicago, Ill. Address, 541 Dearborn St.

(D1)

ACCIDENT REPORT BLANK.

Brownstown, January 1st, 1891.

On our 7:40 P. M. trip going East, at Broadway and Market Streets, a lady stepped off the car before the same was stopped. The bell was rung for the crossing, but she jumped off on the West side and fell. I stopped the car immediately and went back to her, but she was not hurt. Gave her name as Mrs. A. S. Goodmin, No. 3490 Belton Ave.

Witnesses: *N. Robins, 708 N. John Street.* / *G. J. Martin, 1240 Broadway.*

W. Jones, Motorman Car No. 20.
A. Smith, Conductor " "

(D2)

REPORT BLANK.

Brownstown, January 1st, 1891.

On our 8:10 A. M. trip going East, at Twelfth and Martin Streets, we collided with a wagon belonging to the Thompson Commission Co., of 1130 Jefferson Street, in charge of John Hopkinson, damaging the same slightly and bending the dash of our car, No. 84. The driver pulled directly in front of us, within ten feet of the car, not giving the motorman time to stop.

Witnesses: *Jas. Wright, 102 N. Fourth Street.* / *A. Peters, 4128 S. Broad Street.*

A. Wilkinson, Motorman Car No. 86.
P. Herbert, Conductor " "

fill out in case of an accident to persons or damage to property, the same blanks being used in both cases; the two forms, however, may be printed on different colored paper. When filled, it is torn from the book and sent to the superintendent's office. On being received at the office, type written copies are made, one of which is pasted to a manilla file wrapper having an item blank on the back. This being filled out, it is filed away for reference. The second copy is sent to the claim agent of the company, and if it is thought necessary for him to interview any of the witnesses at once, such names are indicated by a check mark.

(F)

189

MOTOR REPAIRS.

Shop Foreman's Daily Report of Motor Cars turned in for Repairs.

Car No.	Motorneer.	Cause of Damage.	Remarks.
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

Remarks. — Some Motormen take too many chances, thereby necessitating reversing motors to avoid collisions; others totally disregard Rule 1, of the Rule Book, relative to movement of switch handle, which, if moved too quickly, strains the armature. Foreman must note particularly, in each case, if damage is brought about by either of the above causes.

Method of Checking Armature Repairs.

The following (form E) is a copy of an eyelet tag which is provided for use as per directions on the reverse side. At the office a book properly ruled is kept, in which contents of card are copied. By this means the cause of damage is recorded and an accurate account is kept of all armatures repaired and by whom rewound.

Shop Foreman's Daily Report.

Form F is a blank for shop foreman's daily report. The blanks are about 9 x 12 ins., and are ruled with fifteen or sixteen lines.

Daily Power House Report.

The power house daily report is shown in Form G, and the sheets may be made of sufficient size to conform to the number of generators and engines in use. The foreman is also required to make a report of supplies drawn each day.

A large sheet is also provided (form H), on which is printed the names of all electrical parts, classified, and small car parts, on which the storekeeper of the motor repair department makes his report to the superintendent.

Window and Door Glass Record.

Form I is a blank 10 x 12 ins., which is designed not only for keeping a record of broken glass, but also for reducing breakage, and since this form was adopted on the above line the glass breakage, we are informed, has been reduced fifty per cent.

(Reverse—E.)

A tag must be attached to each Armature taken out, by the Foreman or some person designated by him, who must fill out the first six (6) lines.

The seventh and eighth lines must be filled out by Armature Winder repairing same, who must return the tag, securely attached, to the Armature.

The tag must be left on the Armature until the same has been placed in some car, when the Shop Foreman must fill out the last two lines and return the tag to the Superintendent's office.

B. G. Smith,
Superintendent.

(Front—E.)

1. Armature No. 6342
2. Extent of Damage *Bands on outside loose, also damaged commutator.*
3. Date Damaged *Feb. 5th*, 1892.
4. Cause of Damage *Worn out brasses.*
5. From Car No. 5
6. Motorman *H. Smith.*
7. Repaired by *Thomas Brown.*
8. Time Consumed 8 Hours.
9. Placed in Car No. 6
10. Date same was replaced *Feb. 10th*, 1892

(G)

December, 1891.

Machine No. 1. Time.			Machine No. 2. Time.			Machine No. 3. Time.			Voltage.	Average Amperes.	Average El. H. P.	Remarks.
On.	Off.	Run.	On.	Off.	Run.	On.	Off.	Run.				

Engine No. 1. Time.			Engine No. 2. Time.			Engine No. 3. Time.			Steam Pressure.	Average Eng. H. P.	Pounds Coal Received.	Remarks.
On.	Off.	Run.	On.	Off.	Run.	On.	Off.	Run.				

(H)

BROWNSTOWN, ... 189

B. G. SMITH, Sup't X. Y. Z. Railway Co.:

I herewith report the following material furnished from storeroom..... Avenue Division, this day and date.

Material.	Quantity.	Size.	Description.	For Car No.	For Car No.	For Car No.	For Car No.	For Car No.	For Car No.	For Car No.	For Car No.	To Whom Delivered.	Quantity Old Material Returned.
(1) Armatures:													
" Pinions													
" Pinion Keys													
etc.													

(I)

GLASS RENEWAL SLIP.

Day..... Date..... 189

Car No.	Conductor. Name.	Conductor. No.	Door Glass.	Side Windows.	End Windows.	Dome Glass.	Cause of Breakage.

REMARKS.—The foreman in charge must fill out car number and glass replaced, which information must be furnished him by the carpenter replacing same. This slip must then be posted in the conductors' waiting room not later than 5 o'clock A. M., and must be left there until 9 o'clock P. M. Conductors must fill out their name and number and cause of breakage.

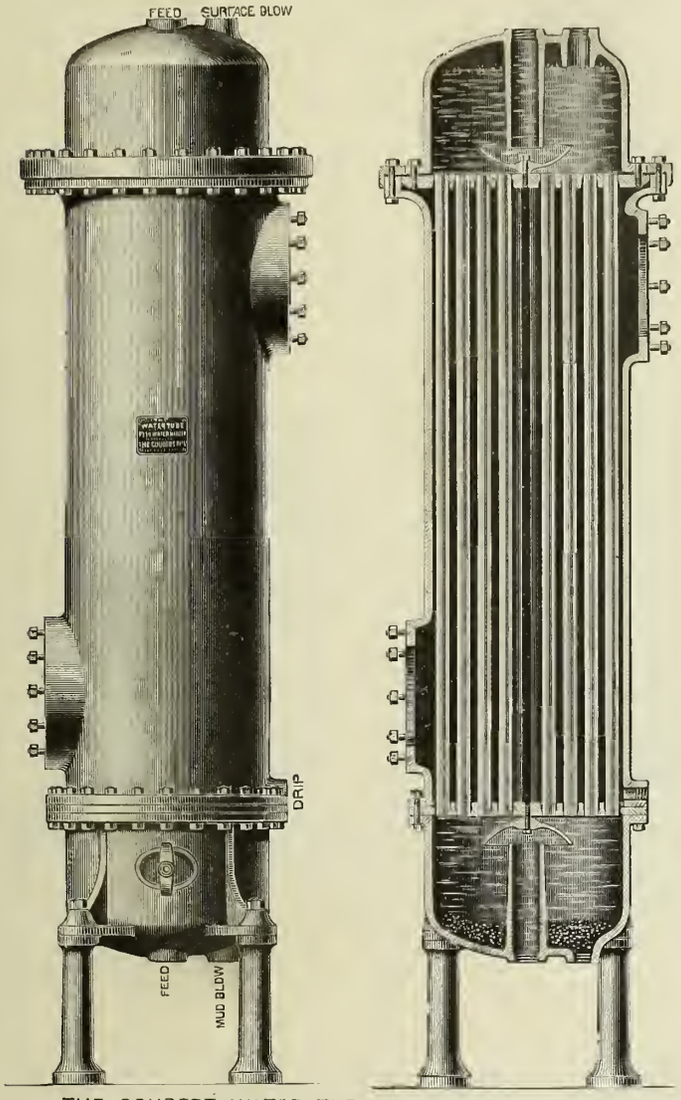
Statistics for Great Britain.

The following table gives the particulars of the street railways in Great Britain for the year ending June 30, 1890. By way of comparison the corresponding statistics for the year ending June 30, 1878, are also given.

	England and Wales.		Scotland.		Ireland.		United Kingdom.	
	1878	1890	1878	1890	1878	1890	1878	1890
Capital authorized (including stock, loans and debentures.....	£4,657,663	£14,398,692	£1,189,462	£1,687,223	£739,016	£1,717,166	£6,586,111	£17,803,081
Capital issued (including stock, loans and debentures.....	3,121,268	11,136,027	613,504	1,275,269	431,510	1,232,416	4,035,464	13,502,026
Length of line in miles.....	194	753	43	84	32	111	269	948
Number of Horses.....	6,269	21,681	2,122	4,126	831	1,912	9,222	27,719
Number of Locomotives.....	6	534	8	19	.....	22	14	575
Number of Cars.....	802	3,030	210	423	112	348	1,124	3,801
Number of Passengers carried.....	89,442,108	418,399,936	47,680,256	76,008,545	8,878,859	31,960,847	146,001,223	526,369,328
Gross receipts.....	£791,677	£2,573,535	£253,011	£417,350	£100,777	£223,858	£1,145,465	£3,214,743
Working expenses.....	579,471	1,932,444	212,960	296,493	75,884	173,863	868,315	2,402,800
Net receipts.....	166,012	641,091	40,051	120,857	24,893	49,995	230,956	811,943

The Goubert Water Tube Feed Water Heater.

The Goubert water tube feed water heater shown in the accompanying illustrations is composed of two cast iron water chambers connected together by a cluster of



THE GOUBERT WATER TUBE FEED WATER HEATER.

seamless drawn brass tubes, rigidly secured at their ends to the tube plates by means of a roller tube expander, in the same manner that boiler tubes are secured to the heads. These are the only parts of the heater under pressure. The lower water chamber rests on legs on the floor while the upper water chamber is free to move vertically as the tubes expand or contract.

The tubes are surrounded by a cast iron shell provided with inlet and outlet nozzles, to which are connected the exhaust pipes. This shell is bolted to the lower water chamber, but is free to expand independently of the tubes, its only connection at the top with the upper tube plate being made by means of a flexible corrugated copper expansion plate. This serves to close up the space between the upper tube plate and the shell, and has no pressure to withstand but that of the exhaust steam, although it is protected and backed up in such a manner as to easily resist any pressure that may come upon it.

At the extremes of temperature this corrugated copper expansion joint never has to spring more than three sixty-fourths of an inch either way and is practically indestructible.

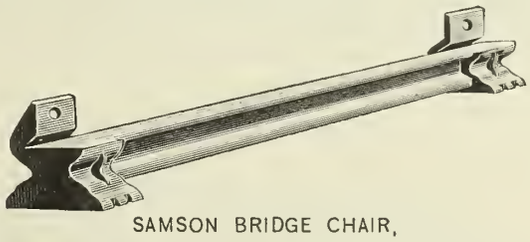
The water inlet and outlet pipes are made to project inside of the water chambers, and opposite them are placed dish shaped deflectors, the purpose of which it is to deflect the current and thereby promote the separation of scum and sediment. Suitable surface and mud blows and also a hand hole are provided for cleaning.

Among the advantages claimed for this heater may be cited the following :

The tubes are made of brass and free to expand ; the pressure being from the inside they cannot collapse, neither can they leak at the ends, as the greater the pressure the tighter it makes them. By simply removing the head all the tubes can be easily cleaned. The area for the passage of the steam between the tubes is from eight to sixteen times as large as that of the exhaust pipe, and consequently, it cannot cause back pressure. The water being divided up into small columns and in immediate contact with the heating surface, is quickly heated to the highest point. Being made entirely of cast iron and brass, it does not pit or corrode.

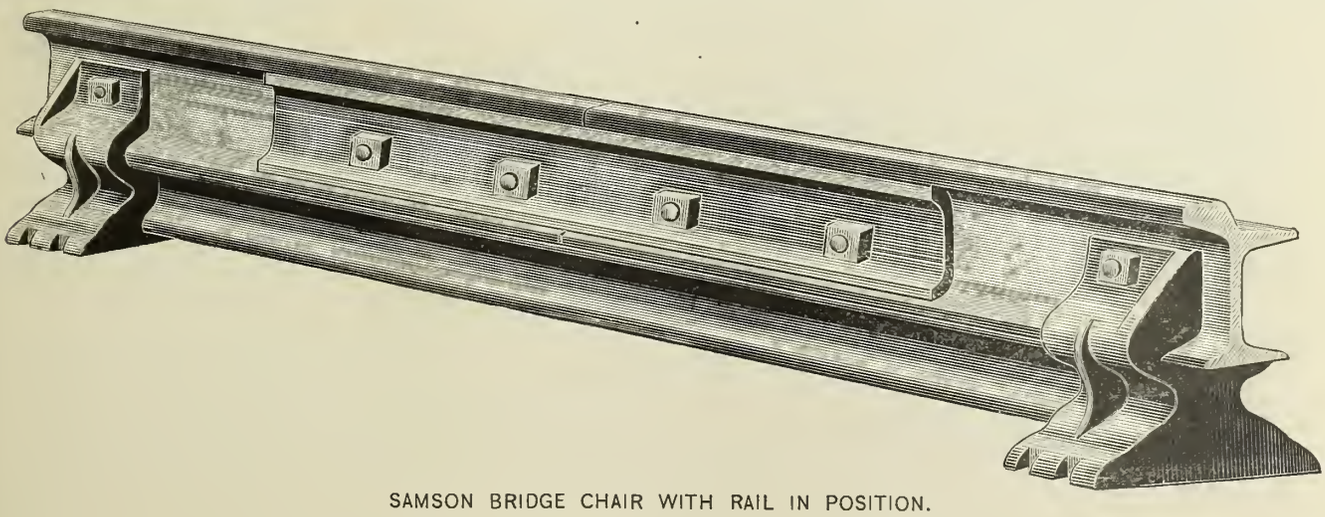
Samson Bridge Chair.

Many devices designed to support joints on street rails have proved ineffective because they have been too complicated or too light in construction. In designing



SAMSON BRIDGE CHAIR.

the bridge chair illustrated in the accompanying cuts, the Tramway Rail Co. of Pittsburgh, endeavored to reach a construction from which these objectionable features were eliminated. In the manufacture, a piece of T rail of sufficient length to reach from tie to tie is placed in the mould and upon each end is solidly cast of semi-steel the brace chair shown in the cut. In the form shown in the illustration this length is three feet. The semi-steel in cooling shrinks upon the ends and the result is a long bridge chair actually in one piece, with nothing whatever



SAMSON BRIDGE CHAIR WITH RAIL IN POSITION.

about it to work loose or break. Holes are left in the brace portion of the chair through which bolts pass for holding the rail securely against the brace and for preventing any lateral motion or tipping of the girder rail.

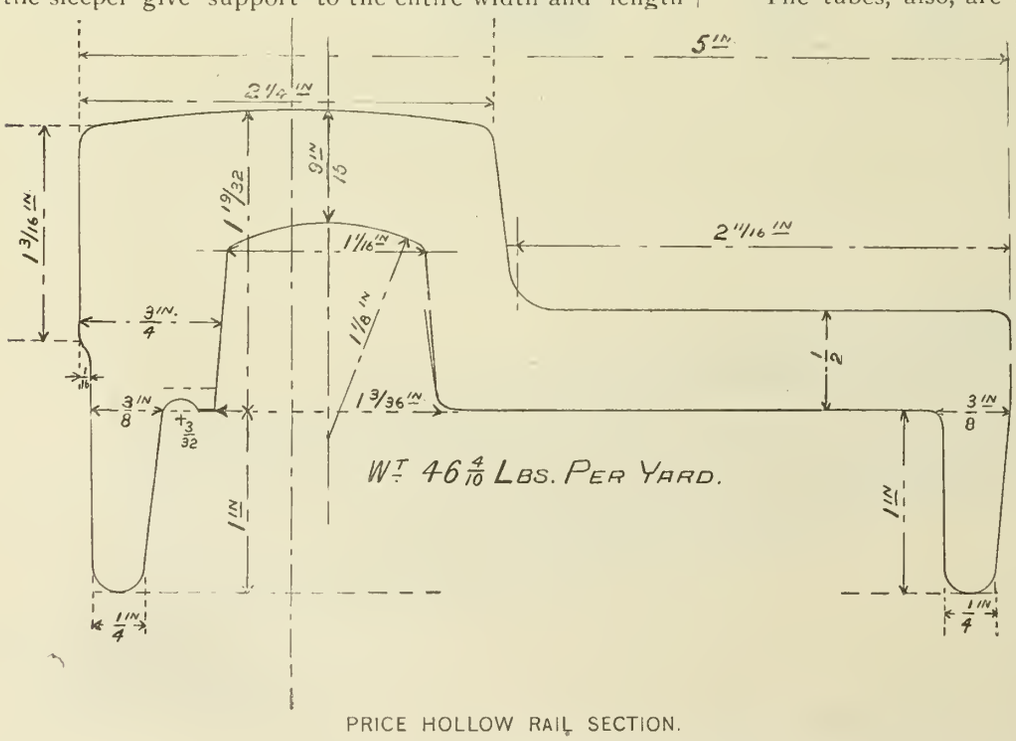
In practice the usual extra wide ties placed under the joint to receive the customary seven inch joint chair are done away with, and the ties are spaced precisely as if no joint existed. When the rails are placed in position the ends of the adjoining rails are caused to come in the centre of the bridge, and the heavy splice, having either four or six bolts, is adjusted precisely as if there were no chair underneath. The piece of T rail which forms the bridge of the chair being turned upside down furnishes a wide, level and unyielding support to the ends of the rails, and when the splice bar is properly bolted to its place it would be impossible to concentrate a sufficiently heavy weight on top of the girder rail to cause it to sink.

Great strength and simplicity are claimed for the chair, and the makers speak of it as an extremely economical device, because it takes the place of two ordinary chairs at no greater expense, and the use of the wide tie under the joint is rendered unnecessary.

The Price Hollow Rail Construction.

In this issue we present to our readers a new section of rail which, we understand, is about to be placed on the market by the Price Railway Appliance Co. of Philadelphia. In his anxiety to still further reduce the excessive proportion of ultimate waste in "scrap," Mr. James M. Price has widened the head of his solid rail weighing fifty-six pounds and so hollowed out its base as to reduce the weight of the rail by nearly sixteen pounds per yard. At the same time the arch which this section presents gives a strength equal, practically, to that of a solid rail, while a distinct increase of elasticity results. The hollow space beneath the head of the rail may find use as a channel to hold insulated wires.

It will be noticed that at the left the base of the rail is grooved. In this groove the upper edge of a plate of steel seven feet long is fitted. As with the Price solid rail construction described in our May issue of last year, these plates face each side of a wooden sleeper, and together with the sleeper give support to the entire width and length of the rail. Through the flanges of the rail frequent oblong oval holes occur coincident with others near the upper edge of these plates. Spikes through these bind together flange and plate, while a lower series secures the plates themselves firmly to the sleeper.



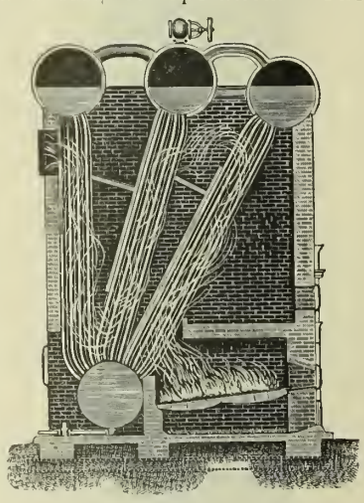
PRICE HOLLOW RAIL SECTION.

The inside face of the rear flange of this rail is not vertical but slanting. The purpose of this shape is to compress the top of the wooden sleeper and place the head of the rail almost directly over its centre, contributing much to the steadiness of the track. As with the solid rail, knees are used for securing the sleepers to the cross ties. These knees are for the most part short and touch neither plate or flange, thus avoiding concussion. Between the ends of the plates taller knees are used which fit the slant of the sleeper and with the braces act in lieu of tie rods.

It will be observed that this rail will tighten upon its supports as stringers wear, because of their wedge-like shape.

The Stirling Water Tube Boiler.

The claims made for the Stirling water tube boiler are durability, efficiency, and ease of operation. The general arrangement of the water tubes is shown in the accompanying illustration. As will be seen, there are four main drums, and the action of the fire is upon the tubes connecting these drums. The water is fed into the back upper drum, and during its passage to the lower or mud drum it comes in contact with the heated gas currents and becomes heated itself to a temperature of over 300 degs. At this temperature all the carbonate of lime, sulphate of lime, and other impurities are separated from the feed water and deposited in the mud drum where they are easily blown off, thus avoiding scale in the tubes exposed to maximum heat. As a result of this operation the two front banks of tubes are always filled with chemically pure water.



STIRLING WATER TUBE BOILER.

The tubes, also, are always practically clean on the outside as on the inside, because they are set at such an angle as to make it impossible for any amount of soot to collect on them.

The material for the drums and heads is made of the best open hearth flange steel. The material for the tubes is made of the best mild steel or the best charcoal iron. New tubes can easily be put in place if necessary.

THE increase of traffic on the State Street line, Albany, N. Y., per day during 1891, over 1890 was about 1,000 passengers. Christmas week gave the largest receipts that the Albany Railway Co. have ever taken in a week, with the exception of one week during the bi-centennial of the city. The record of Christmas week showed nearly 2,000 passengers more a day carried for the seven days than for the corresponding week the preceding year.

TEN new motor cars have been recently received by the Albany Railway Co. from the Gilbert Car Manufacturing Co.

A Milwaukee Street Car and Tower Wagon.

A private vestibuled car, Fig. 1, has recently been put in operation on the line of the Milwaukee Street Railway Co., which is attracting much attention on account of its handsome appearance. It is twenty four feet long over all, seven feet nine inches wide and ten feet six inches high. The main body of the car is sixteen feet long, and it has a seating capacity for thirty people. The windows are heavy beveled edge glass, and the transom lights are cathedral glass of artistic design. Heavy nickel trimmings have been used both inside and outside, and the gates are also nickel plated and handsomely designed.

On the interior and in the vestibules beveled edge mirrors have been used to heighten the effect of the high polish finish, and the result is striking. Full length mirrors are so placed at the ends of the car and smaller mirrors above the windows in the vestibules as to reflect the interior of the car. The latter is finished with birch paneling and mahogany trimmings, with quartered oak head linings. The cushions are covered with mahogany colored Brussels to match the trimmings, and a Brussels carpet covers the floor. The car is lighted by three electroliers, the lamps being hung in fluted milk glass globes, with elaborate nickel trimmings. Single lamps hang from the roof in the vestibules. The windows have parlor car curtains and twisted nickel handle bars. An idea of the careful attention which has been paid to the finish in detail may be got from the fact that the hand straps are of embossed leather and the stove pipe is encased in mahogany strips.



FIG. 2.—TOWER WAGON—MILWAUKEE STREET RAILWAY CO

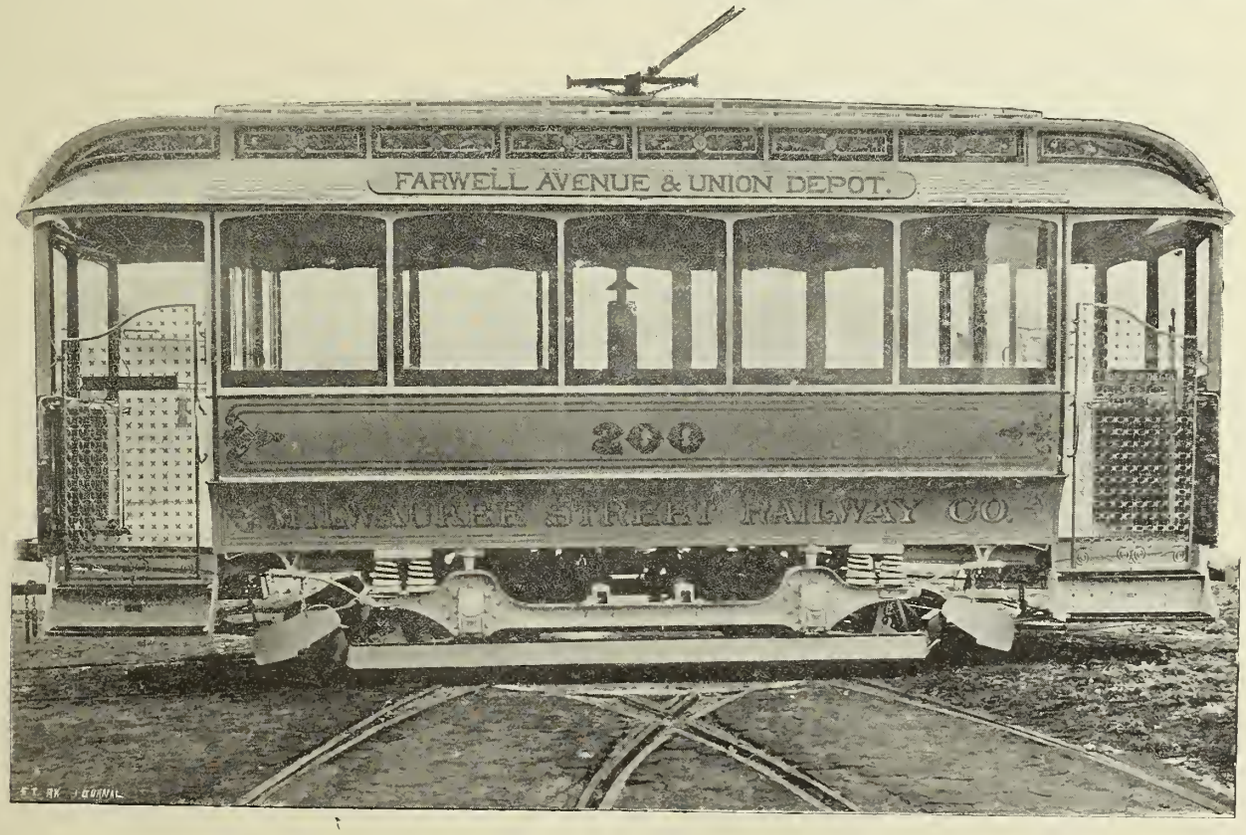


FIG. 1.—PRIVATE VESTIBULED CAR—MILWAUKEE STREET RAILWAY CO.

The same company have also in operation on their line, a neat tower wagon (Fig. 2), which is equally strong and durable. The lower part is rigid and is made of angle iron, which is also the material of the ladder. The cross piece at the top of the latter is very heavy, and the portion of the tower above that point is made of hickory and fits inside of the iron part of the tower so that it can be lowered like a telescope when not in use. The wooden part of the tower is manipulated by means of a crank and

the pulley which depends from the crosspiece. When the tower is raised to its full extent it is fifteen feet high.

Both the car and tower wagon were built by Superintendent Alex. Lynn of the railway company.

The Transportation Building at the World's Fair.

The extensive edifice now being erected at Jackson Park for the transportation exhibits at the Columbian Fair is now partially completed, and an idea of its massive proportions can be obtained by the visitor. Its appearance at present is shown in Fig. 1.

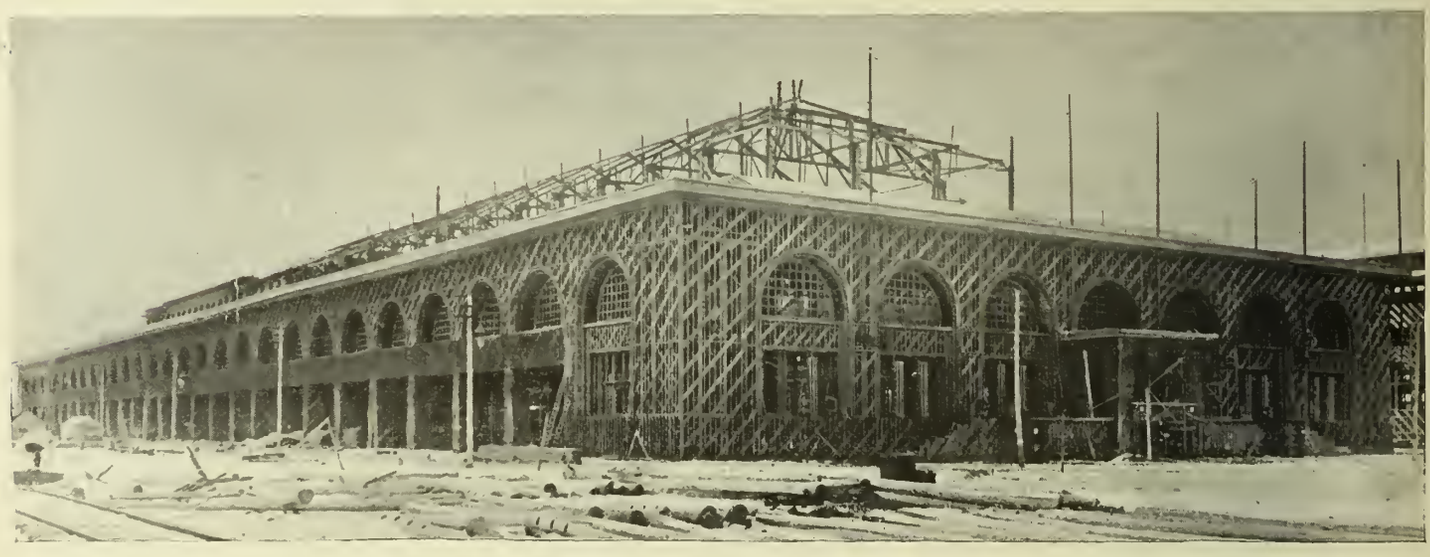


FIG. 1.—PRESENT APPEARANCE OF TRANSPORTATION BUILDING AT JACKSON PARK.

The main portion of the building measures 960 ft. front by 250 ft. deep. From this extends westward an enormous annex, covering about nine acres. This is one story only in height and in it will be placed the more bulky exhibits. The building is back of the Park and lies between the Horticultural and the Mines Buildings. Facing eastward it commands a branch of the lagoon.

The main entrance called the Golden Door will consist of an immense single arch enriched to an extraordinary degree with carvings, bas reliefs and mural paintings. The interior of the building is treated much after the manner of a Roman basilica, with broad nave and isles.



FIG. 2.—APPEARANCE OF COMPLETED TRANSPORTATION BUILDING AT WORLD'S FAIR.

The cupola, placed exactly in the centre of the building and rising 165 ft. above the ground, will be reached by eight elevators.

The Coming Convention at Cleveland.

A meeting of the Executive Committee of the American Street Railway Association was recently held at Cleveland. Subjects which will be brought before the October convention, were thoroughly discussed. The fact that preliminaries have been so carefully canvassed, will doubtless tend to make the convention of even greater interest than any previous meeting. None of the hotels in Cleveland has a hall sufficiently large for the sessions of the convention. The local committee on arrangements and the Executive Committee, considered the matter, and it was decided to engage Chase Hall for this purpose, which is a block distant from the Hollenden Hotel, the headquarters of the Association. For the exhibits, another hall, a block and a half distant from the hotel, was secured.

Cleveland will be an exceedingly interesting place for railway men to visit Besides the cable roads, at least three electric systems are in operation. The Cleveland railways are enterprising in trying new devices in connection with their roads, and many novelties are to be seen.

A New Jersey Street Railway Combination.

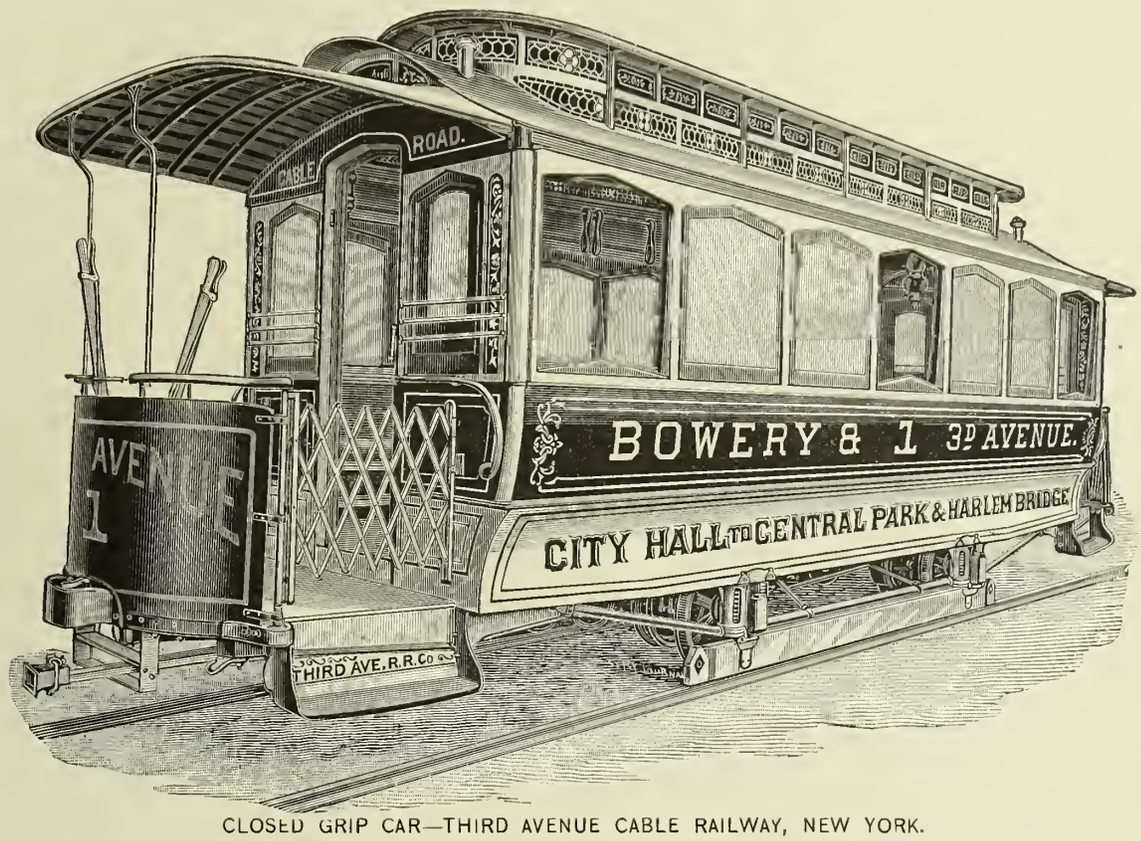
At a meeting of capitalists, held late last month, at the Essex Club in Newark, the New Jersey Traction Co. was formed, and under it all the street railroad companies in Essex and Union Counties except the South Orange li e of Newark will be consolidated. The new company will take charge of all lines and guarantee the stock and interest. The company is organized under the laws of New Jersey with a capital stock of $500,000, all of which has been subscribed. Among the cities affected are Newark, Elizabeth and Jersey City.

The special purpose of organization at present is to acquire control and possession of the entire Newark passenger railroad system, including any rights it may obtain in the operation of the new electric railroad to Jersey City, and to more fully equip and extend those lines and to operate them under one central organization. Stock in the new concern has been taken by the following, among others :

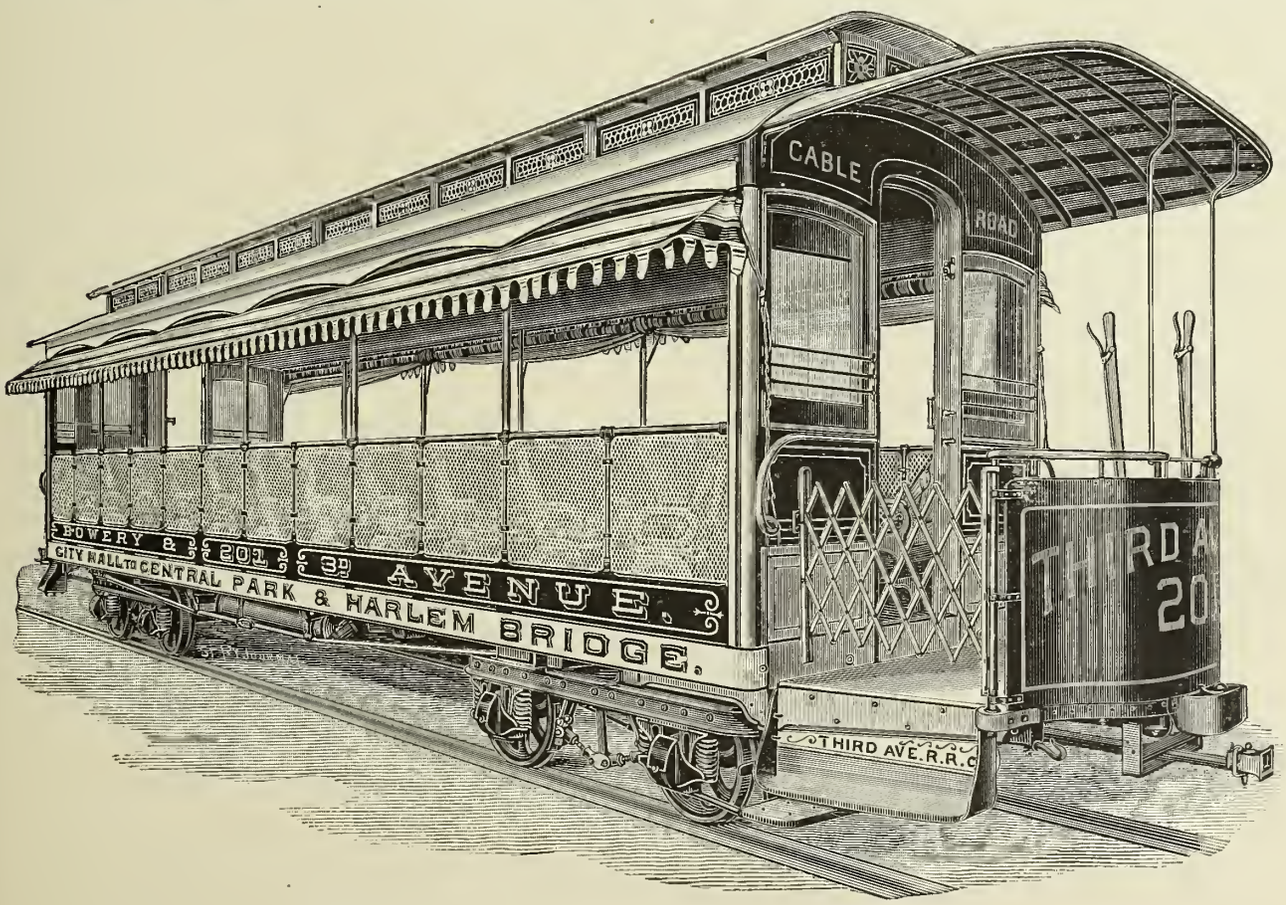
Benjamin F. Tracy, Secretary of the Navy ; John J. Waterbury, President of the Manhattan Trust Co. of New York ; Frederick Frelinghuysen, George A. Halsey, Bernard M. Shanley, Gottfried Krueger, Chandler W. Riker, Peter Hauck, Thomas C. Barr, A. Q. Keasbey, John H. Ballantine; Edward E. Denniston, Edward J. Moore, Philadelphia.

Third Ave[redacted]Cable Cars.

We take pleasure in presenting in this issue views of the two grip cars built by the Laclede Car Co., of St. Louis, for the Third Avenue Railway Co., of New York, and which were fully described in our last issue. The cars immediately impress the observer with their durable and handsome appearance, and reflect great credit on their manufacturers. Of the entire order of 375 cars, 200 will be closed and 175 open.



CLOSED GRIP CAR—THIRD AVENUE CABLE RAILWAY, NEW YORK.



OPEN GRIP CAR—THIRD AVENUE CABLE RAILWAY, NEW YORK.

A New Pinion for Electric Railways.

For street railway service every conceivable kind of pinion has been tried, including those cast from iron, steel and bronze, or gun metal; those with teeth cut from blocks of cast iron, steel and bronze; those made of rawhide treated in various ways; those made of rolled steel plates, bolted or riveted together, and those made of alternate layers of steel plates and rawhide, or some other non-resonant material, bolted or riveted together. Cast

pinions have given way to cut pinions, and of cut pinions, bronze, solid steel and steel plate or laminated pinions are about the only forms of metal pinions which survive; rawhide is largely used. Bronze, while having the merit of being the most quiet of all-metal pinions, is costly and the shortest lived. Cast steel lasts longer than bronze and costs less, but it is noisy.

Steel plate or laminated pinions have been found to outwear any other form of all-metal pinions, but they are almost as noisy as solid steel and about as costly as bronze, without its advantage—a market for the old metal.

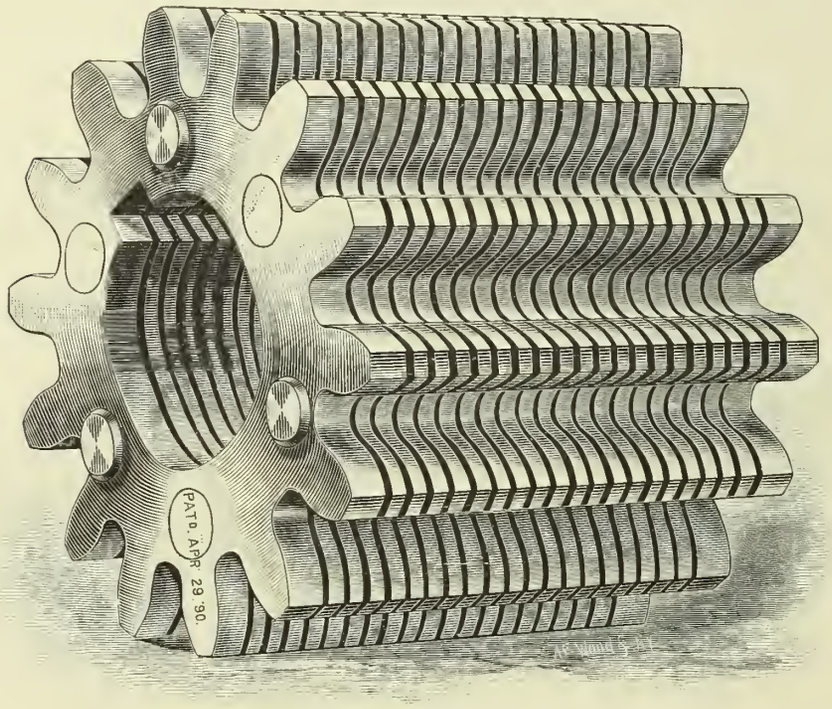


FIG. 1.—COMPOSITE PINION—SIDE VIEW.

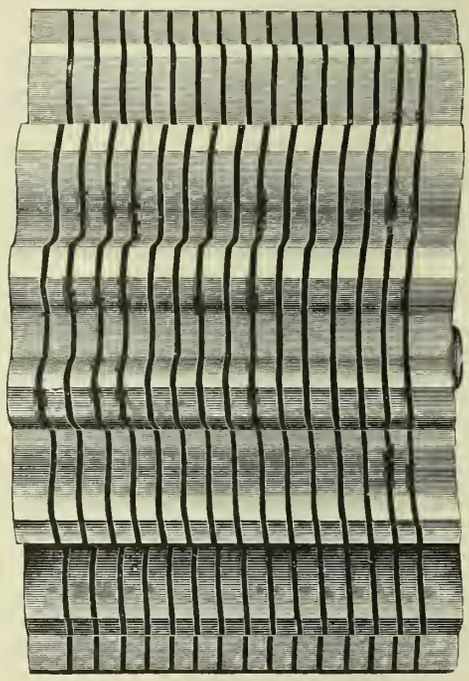


FIG. 2.—COMPOSITE PINION—FULL FACE VIEW.

At the beginning of active electric railway work (in 1888), composite pinions, made of rolled steel plates interposed with rawhide and closely riveted or bolted together, were largely used. They combined the strength and durability of the steel plates with the noiseless feature of the rawhide, and were thought to be all that could be desired, but they were abandoned after a time, owing to the fact that, the plates being flat and at right angles to the axis, the steel portions of the teeth traveled constantly in the same plane, gradually wearing grooves into the face of the intermeshing gear and the ridges thus left upon the gear in turn cut into and destroyed any new pinions used.

To obviate this uneven wear, the Chamberlain composite wave pinion has been put on the market. The invention is the outgrowth of a large practical experience in electric traction and the result of many painstaking experiments looking to the preservation of the well-known noiseless feature of the composite pinion, and the elimination of its tendency to cut and groove the intermeshing gear. It is made of rolled steel plates interposed with a non-resonant, fibrous material, closely riveted together under a hydraulic pressure of 4,500 lbs. to the square inch The non-resonant material is treated with oil so as to be impervious to moisture; it is compressed over fifty per cent. and will neither expand nor contract in use. The plates, instead of being flat, are crimped so as to present the appearance of having been warped or bent into three elevations and three depressions, radiating from the centre, like the spokes of a wheel or the blades of a screw propeller. This crimping or bending shapes the edge or periphery of the plates (on which the teeth are cut) into the form of a reverse curve or sinusoidal line.

The assembling of these crimped plates, with alternate layers of non-resonant material, will, as it may be readily seen, produce a pinion which, in its revolution, will present to the engaging gear, at any given point of contact, the surface of a metal plate and the surface of the non-resonant material three times each in one revolution. The metal and the non-resonant material, both describing a sinuous or wave line, produce on the engaging gear the same effect as though the pinion, while revolving, traveled at the same time laterally back and forth on the face of the gear with a wave motion.

The invention may be said to consist of a pinion so constructed that it will present to any given point on the engaging gear different parts of the pinion laminations; so that, in effect, each pinion lamination travels back and forth over a portion of the surface of the gear.

Figs. 1 and 2, full face and side views taken from photographs of one of the standard sizes, show the sinuous or wave lines.

Fig. 3 has been introduced to show the principle. In this, however, flat plates are shown to simplify the description. This is a sectional cut, the shaded spaces representing the metal plates, and the white spaces representing the non-resonant material. It will be noticed that the metal plates are slightly canted to the left (A, A). Now, if the pinion be given one-half a revolution, the metal plates will be inclined or canted to the right (see dotted lines B, B). It will readily be seen that a pinion constructed on this principle will, when in motion, present to any given point on the engaging gear with which it is in contact the surface of a metal plate and the surface of non-resonant material alternately, once in each revolution, and at the same time produce the same effect on the engaging gear as though it traveled laterally back and forth. The plates as manufactured are, however, so crimped that they present metal and non-resonant surfaces three times each in one revolution.

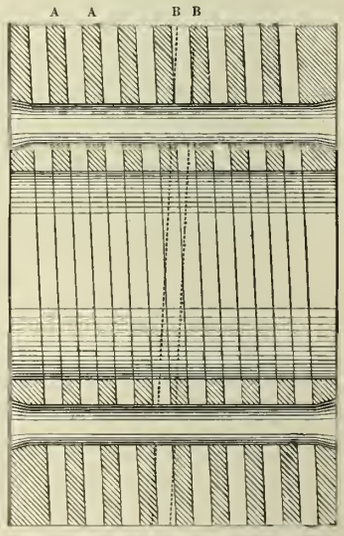


FIG. 3.—COMPOSITE PINION—SECTION.

It has been demonstrated by actual use, that a pinion constructed in this peculiar manner distributes the wear evenly over the entire surface of the intermeshing gear, so that the teeth of the gear are worn perfectly smooth and straight faced, all grinding action is absolutely avoided,

and wear, both of the pinion and gear, reduced to a minimum. The life and efficiency of the gear is increased, the whole face of its teeth being available as long as the gear is used, and the non-resonant fibre makes the pinion less noisy than solid metal; it has the superior wearing and strain-withstanding power of rolled steel presented edgewise to the work, and, it is claimed, comes nearer than any other form of pinion to filling all the requirements of the arduous service for which it is designed.

The Davis & Cowgill Iron Works, of Omaha, are the manufacturers of this pinion, and supply the Western trade. J. C. Chamberlain & Co., of New York, supply the Eastern trade.

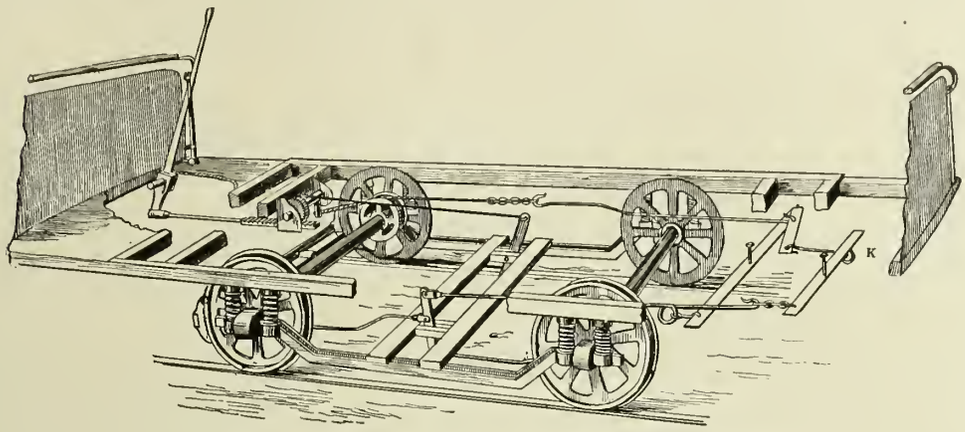


FIG. 1.—TRUCK EQUIPPED WITH CROSSLEY FRICTION BRAKE.

The Crossley Friction Brake.

A new brake which is claimed to be effective, and at the same time cheap to install and keep in repair, has recently been put on the market by the Crossley Friction Brake Co., of Cleveland, O. This brake has been in use on the Broadway & Newburg Street Railway of Cleveland since November 27, and the officials of that road speak of the results attained by it on their motor cars in the highest terms. The weight of the brake equipment complete is only 150 lbs. per car.

As will be seen from the engraving, one axle of the car carries a drum or spool about which a turn is taken of a tarred manilla rope. The outer end of this rope is connected with a simple mechanism under the car platform, shown in Fig. 2, by which the rope can be tightened about the spool by moving a lever on the front platform. The other end of the rope is fastened to a short lever at the centre of the same side of the car as the spool which operates the brake shoes in the ordinary way.

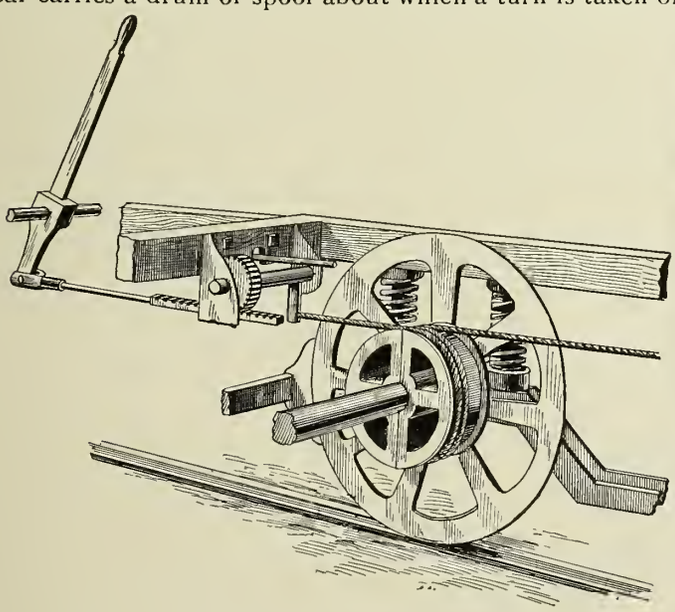


FIG. 2.—DETAIL OF CROSSLEY FRICTION BRAKE.

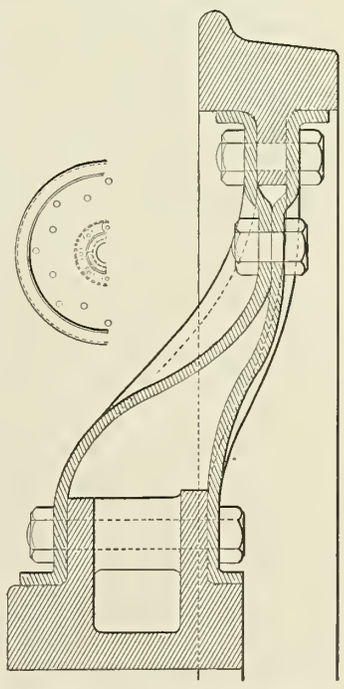
The equalizing lever, which is under the back platform of the car, has pivoted to one of its ends a short lever to which is fastened a rod or chain K. This rod, when a trailer is in use, is connected with the brake mechanism of the rear car, which is equipped like the motor car in every respect, except that there is no platform handle. On the end of rod K is a hook, so that, if there is no trailer, the rod can be hooked into the under side of the second lever under the back platform at the extreme end.

The operation of the brake will now be readily understood. When the brakes are not in use the rope lies loosely around the spool and there is no tendency to tighten. When, however, the motorman moves the platform lever and takes up the rope slack, the momentum of the car helps to set the brakes on the wheels. The same movement of the brake lever will set the brakes on the trailer, if one is in use, by moving the rod K—in this case the second lever under the back platform is not in use. The brake makes no noise in setting or letting off, both of which movements can be done quickly and with a single movement of the platform lever.

It might be supposed that the rope would wear out rapidly, but during a service on the Broadway cars at Cleveland of over two months, the ropes have shown no appreciable deterioration. The cost of replacing a worn rope is only about twenty cents.

Boies Steel Wheel.

The combination wheel which is illustrated diagrammatically in the cut was designed to insure constant contact of metal under all strains, and thus to prevent unnecessary wear and consequent looseness of parts. The wheel is so constructed that the rolled steel tire is joined to the cast hub by two corrugated steel plates of such shape as to oppose an elastic resistance in every direction. The fracture of the plates is prevented by the tensile strength and elasticity of the metal. It is claimed that the vibrations caused by the continual pounding of the tread of the wheel on the rails are absorbed in the spring of the curves, and that, therefore, one of the most potent causes of the crystallization of axles is eliminated. The curve in the plates takes up the expansion upon the application of the brakes and the subsequent contraction. It is, therefore, stated that the bolts do not become loose, and the strength of the wheel is not impaired. The tire is shrunk on and is firmly bolted to the plates by an internal flange so that it cannot be forced off the wheel by accident. This construction not only makes unnecessary the weakening of the tire, by grooves or slots, but, it is claimed, reinforces it to such an extent that it can be worn or turned down to the extreme limit of service, and in case it should break, the parts would still be held firmly in place by the bolts. The inner or central flanges of the plates are shrunken on each end of the hub supporting the weight, and there are also steel bands strengthening and binding the hub to the axle. The thrust of the axle is expended upon an arched spring of a strong curve in the



BOIES STEEL WHEEL—SECTION

opposite plate. The wheel is composed of only four principal parts, the tire, two plates and the hub. The tires are rolled from open hearth steel, and are matched in pairs of the same metal, so as to wear equally, and when worn out can be quickly and easily replaced in any properly equipped shop. The plates are of mild steel, formed hot by hydraulic pressure and annealed. The wheels have been used on cars of the People's Street Railway Co., of Scranton, Pa., and the management speaks of them in the highest terms. The wheel is made by the Boies Steel Wheel Co., of Scranton, Pa., and the New York selling agents are Coolbaugh, McMunn & Pomeroy.

High Speed Electric Railway Between Chicago and St. Louis.

A company, organized to build an electric line, connecting the cities of Chicago and St. Louis, has been incorporated in the latter city, under the title of the Chicago & St. Louis Electric Railway Co. The plan proposed is to install a high speed passenger service, by which 100 miles per hour can be attained. Three alternate routes have been proposed, as shown in Fig. 1, all of which show a straight or nearly straight line. Important towns near the line of route are provided for, connected with the main line by means of sidings. A sketch of the principal points of the proposed road, furnished by Dr. Wellington Adams of St. Louis, is as follows:

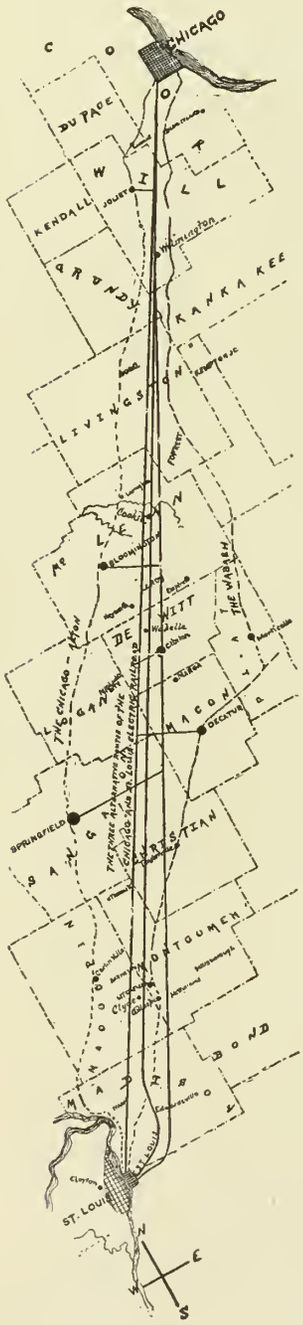


FIG. 1—CHICAGO - ST. LOUIS RY.

By the schedule time the trip from Chicago to St. Louis can easily be made in from two and one-half to three hours. It will not be necessary to travel at night, therefore no through passenger cars will be run after nine o'clock P. M., the tracks being reserved at night for high-class freight, mail and express matter. This does away with the necessity of running Pullman cars, and the expense to the company as well as the traveling public.

The character of the electric carriage or car is shown in Fig. 2. It is long, low, compact, light, but strong, having two pairs of driving wheels, each driven by a separate and distinct electric motor. The whole weight of the car with its passengers and of the two electric motors comes upon these two pairs of driving wheels and is, therefore, all available for traction or adhesion between the rails and the wheels, through the agency of which the car is propelled. The top of the car stands only nine feet from the rail, which is three feet lower than the ordinary street car. This brings the centre of gravity very low and near to the track. It has a wedge-shaped nose or front for cutting the air, which has the effect of decreasing the air resistance (a most important factor in high speed locomotion) and of helping to keep the car down upon the track. The motorman stands immediately back of this wedge-shaped point, and between his department and the rear wheels is the compartment for the accommodation of passengers. In the rear of this is a separate compartment for mail and high class express. The driving wheels are six feet in diameter and are capable of making 500 revolutions per minute. The weight of the entire car, with its motors, is but ten tons, while a steam engine to make the same speed, if it were practicable, would have to weigh ten times ten tons.

These electric cars will be both illuminated and heated by electricity, and will contain all modern conveniences for comfort. There will be no conductors or brakemen. It will be possible to stop the cars within half a mile by means of the motors themselves and auxiliary brakes. "Through" cars will be run at intervals of an hour, or oftener, as the requirements of traffic demand. Accommodation cars will run every half hour, stopping at all points along the line. The "accommodation" cars will be differently constructed from the "through" cars, the same requirements not being necessary.

One central power station, six or eight miles from Clinton, De Witt County, Ill., will operate the whole road. It will be at the mouth of a coal mine owned and operated by the company by means of electric mining locomotives, electric drills, electric cutters and electric lights. This plan greatly cheapens the present cost of mine operating.

A number of prominent St. Louis capitalists are said to be back of the enterprise.

Committees Appointed.

At a meeting of the Executive Committee of the American Street Railway Association, recently held in Cleveland, three special committees were appointed, as directed by the convention at its last meeting. The following are the subjects and names of the committees, with the exception of the names of the first committee:



FIG. 2.—CHICAGO - ST. LOUIS RAILWAY.

ON STANDARDS.—Committee to be announced later.

ON POWER HOUSES AND ENGINES.—T.W.Wrenne, president of the United Electric Railway, Nashville, Tenn.; L. H. McIntire, engineer, Harlem Bridge, Morrisania & Fordham Railway Co.; F. S. Pearson, engineer electrical department, West End Street Railway Co. of Boston.

ON RELATIVE COST OF OPERATING HORSE, CABLE AND ELECTRIC ROADS.—Wm. M. Ramsey, superintendent, Federal Street & Pleasant Valley Railway Co., Pittsburgh; F. R. Greene, secretary, Chicago City Railway Co.; John L. Heins, superintendent, Brooklyn City & Newtown Railroad Co.

The regular subjects and committees will be announced later.

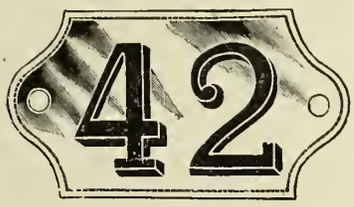
A resolution was passed at the meeting asking Mr. D. F. Longstreet, of Denver, Colo., to prepare a paper to be read at the next convention, on the history of events leading up to the organization of the American Street Railway Association.

While in Cleveland the committee conferred with the local committee regarding arrangements for next meeting, and secured a hall in the Case block, for holding the meeting, and also a building with ample space for exhibiting the supplies. Headquarters of the Association will be at the Hollenden, and the usual rates only will be charged.

The World's Fair Committee of the Association are making some progress in their work, and will soon issue a circular to supply men in regard to exhibits. Space for exhibits is to be free, and all exhibits are to be classified, so that all appliances of the same kind, from whatever nation, will be in one department.

Employe's Badge.

A neat type of employe's badge is shown in the accompanying cut of one manufactured by V. H. Blackinton & Co., of Attleboro Falls, Mass. The badge is made with black enamelled figures on a gold plated ground and is designed for roads having less than 100 men. The cut shows the exact size.

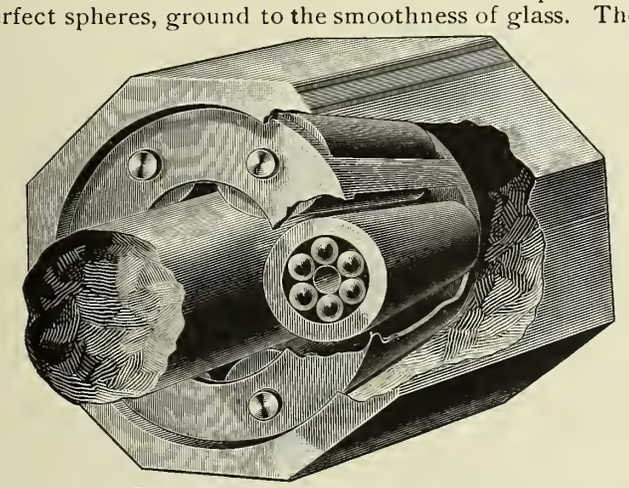


EMPLOYE'S BADGE.

A New Roller Bearing.

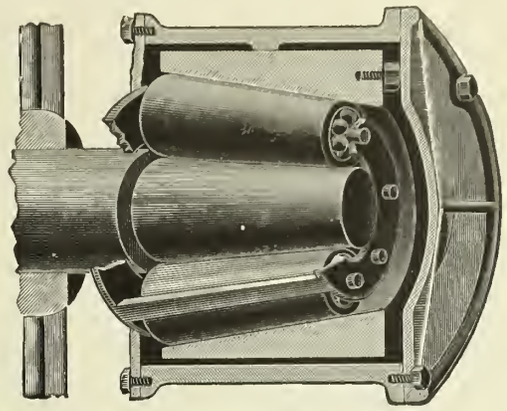
There is probably no one in the mechanical world who has not, at least once in his life, had his attention called to roller bearings, so that the general principles of roller bearings are quite well understood. A roller bearing which has a number of novel points, however, in regard to the position of the rollers, their shape, and the use of balls, has recently been put in the market, and is illustrated herewith.

As will be seen by Fig. 1, the axle is entirely surrounded at one end by a rigid cage containing the rollers. These rollers are placed at regular distances from each other, and are held in place by means of spindles which pass through the centre of each. The place of contact between the axle and the rollers is a continuous line, extending throughout the length of the roller, and as the axle revolves the rollers turn upon the axle, giving only a rolling friction. The axle is tapered where it comes in contact with the rollers, the latter being also tapered, a form of construction which greatly facilitates adjustment. The rollers, it will be observed, are counter-bored, and in the spaces thus formed are placed a number of balls, which are made of hardened steel and are practically perfect spheres, ground to the smoothness of glass. These


FIG. 1.—MOFFETT ROLLER BEARING.

balls surround the spindle at each end, thus giving a perfect ball bearing for the roller to play upon, and preventing a sliding friction between these two parts. The only other place where a sliding friction is possible is between the ends of the rollers and the sides of the cage, but this difficulty is overcome by allowing the balls to project slightly beyond the rim of the rollers, and so coming in contact with the cage. Fig. 2 shows how the end thrust is taken up and how adjustment is obtained. The end thrust of the axle is caught upon the tapered rollers, the latter, as has already been stated, being truncated cones. The result is that the rollers take the end thrust from the axle, the box takes it from the rollers, the box being held firmly by its housing. The adjustment is obtained through forcing the box against the rollers by the turning of a screw, as shown in the engraving. It must be admitted that there is a slight friction on the balls in the counter-bore at the ends of the rollers, which would be serious enough to require lubrication were it not for the fact that at no time do the balls or the spindle support any weight except the actual weight of the cage, the weight of the car being transmitted directly through the roller to the axles.

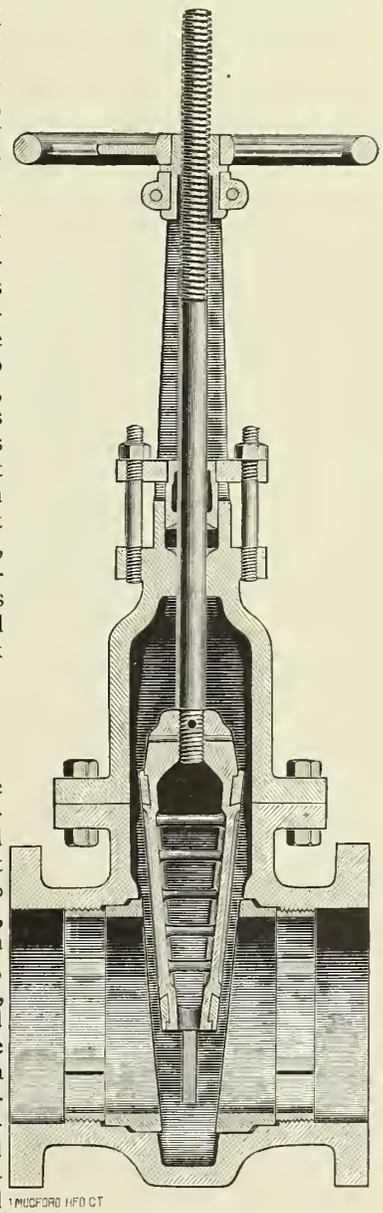
Among the claims of this device to popularity over all others are the following: That it is mechanically perfect; economy of expenditure, as it requires no lubrication of any kind and if applied would be detrimental; a great economizer of power, the saving claimed in case of electric motor cars being fifty per cent. in starting and thirty per cent. when the car is in motion; that the bearing is adjustable, and that it can be easily applied to any of the present types of street cars.


FIG. 2.—MOFFETT ROLLER BEARING.

This bearing has been tried practically on a passenger car of the Burlington Railroad, where it has run 29,000 miles successfully. From four to five hundred of them have also been running for a year, and are still in use on cars at the Madison Car Co's works, at Madison, Ill. It has also been in use on the Lindell Electric Street Railroad at St. Louis, Mo., with most satisfactory results. The manufacturers are the Moffett Journal Bearing Co., 516 Phœnix Building, Chicago.

The Chapman Valve.

Recognizing the large demand for a strictly first-class valve, to withstand the hard service incident to plants carrying from 150 to 200 lbs. steam pressure, or more, the Chapman Valve Manufacturing Co., of Indian Orchard, Mass., have recently patented and put on the market a line of steam valves for extra heavy pressure and superheated steam, with a removable bronze seat and extra heavy shells, so constructed as to avoid all tendency to springing, thus overcoming the difficulty incident to expansion and contraction of long lines of pipe under high pressure.


THE CHAPMAN VALVE.

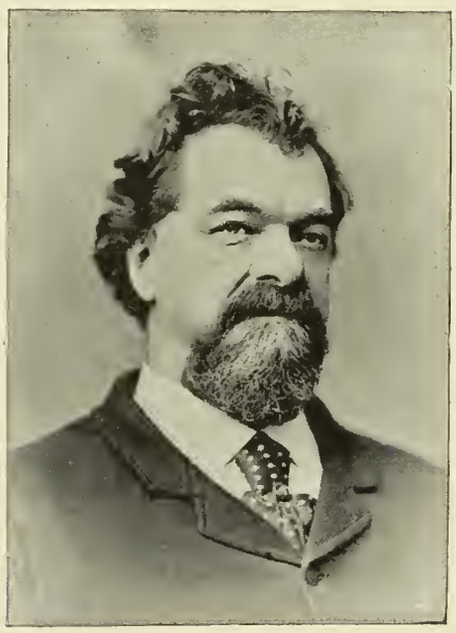
The construction of these valves, as will be seen by sectional view, comprises the following cardinal features: A plug or gate in one piece, guided closely in body of

shell by means of the ribs or splines and taking all strain upon the splines instead of coming in contact with the faces of the seats until the plug is seated, thereby insuring a true and easy vertical movement of plug, as against any other form of plug. The seats are made from hard gun metal bronze for steam, or from any other metal for gas, acids, etc. These seats are pressed into their proper positions in the body of shell, and are held to their exact line by means of the screw gland inserted through the pipe ends, which can be worked forward and back by means of spanner, coming in contact with splines in the inside of screw gland.

These seats are interchangeable and removable. By means of taking off the cap and removing the plug, the seats may be forced toward the inside of valve by means of the screw gland until they are released and another can be inserted, and is the only valve built with metal seats that are strictly removable.

Calvin A. Richards.

We are pained to record the death, on February 15, at his home in Boston, of Mr. Calvin A. Richards, fourth president of the American Street Railway Association, ex-president of the Metropolitan Railroad of Boston, and one of the best known street railway men in the country.



THE LATE CALVIN A. RICHARDS.

The cause of his death, which was instantaneous, was heart disease, from which he had long been a sufferer.

Mr. Richards was born in Dorchester, Mass., March 4, 1828. His boyhood was passed in and around Boston, and he received his education in the public schools of that city. At the age of thirteen he went into business with his father, and early exhibited the wonderful executive ability which was so powerfully shown throughout all his after life. On February 17, 1852, he married Ann R. Babcock, daughter of Dexter Babcock of Boston. Two children were born of this union, a son who was instantly killed by lightning in 1863, and a daughter who survives him. In 1861 he commenced business for himself, and during the next ten years amassed the bulk of his fortune.

In 1875, at the solicitation of directors and stockholders of the old Metropolitan Railroad, who felt that a radical change in the policy of the road's management was necessary, Mr. Richards assumed the direction of the road's affairs, and by his prompt and vigorous policy, and the energy he displayed in the improvement of every department of the service, he succeeded in re-establishing the former success and prestige of the Metropolitan company. He remained at the helm until the Metropolitan road was assimilated by the West End Railroad, when, after a short period of further service as general manager of the new company under President Whitney, he resigned his position and established an office in the Richards building on State Street, making a specialty of the construction and equipment of street railways with cable, electric or horse power. He was also interested in the Boston Steam Heating Co. and several other enterprises.

Mr. Richards was also a member of the Common Council of Boston in 1858–59 and '61, and in 1862 was an alderman. This parliamentary experience he valued and he was a most energetic after dinner speaker, being always eagerly sought for by all dining clubs, and he could easily move a large assembly to tears or laughter as was his wish, but his rare wit was always present.

In 1885 he became president of the American Street Railway Association, and it is in this capacity that he is probably best remembered by our readers. He was a strong believer in the Association, was most regular in his attendance at the annual meetings, and made himself a power by his executive ability and foresight, with which was joined a keen sense of the humorous. He was one of the first to predict the success of electric power for street cars, which he did in a thrilling speech at the Convention banquet held in the Fifth Avenue Hotel, New York, in October, 1884, which those who were present will not soon forget.

The following is a quotation from the address delivered by Mr. Richards as president upon the opening of the 1885 convention at the Southern Hotel, St. Louis:

The convention to which you have been summoned, presents to us among its many benefactions nothing richer, nothing better, and nothing of deeper import and more lasting value, than the opportunity it offers for the permanent enrichment of those social bonds that have in the past, and will in the future, do so much to encourage, cheer and benefit in every way these toilsome lives of ours. Indeed, I may say, that in the cluster of advantages that frame these annual gatherings, the social ties that are formed are more productive than anything else of good work in which we are engaged. Let me hope that the cordial and friendly greetings you have exchanged together, and the kindly emotions of friendly fellowship, will remain with you as the most pleasant events of this occasion. It has seemed to me, the last few hours, that the severance between the rails of all our companies are now connected, and the electric current from the batteries within our breasts had flashed from rail to rail, until we are all united in one grand and glorious network of brotherhood, each and all glad and ready to receive and impart the teachings of our experiences during the time that has passed since our last parting words were said.

The street railway is a domestic institution; it is used around and about our homes; it needs no exhaustive inquiries to ascertain its prosperity or its adversity. The public contribute to its gains every day, and all days, as they go from their homes to the scenes of their daily employment. The constant dropping of the regular and ever increasing receipts into the treasury can be seen, contributed to, and understood by all. Again the street railway comes as a benefactor; its mission is to create, not to destroy. It is the pioneer which causes the outlying and waste places to spring up into life. It furnishes an incentive for the ambition, and goes hand in hand with the progress of every city and town—hand in hand, did I say? No, not that, it marches ahead of the column and flourishes, with drum-major pomp, its invitation to follow. It beckons on the twin brothers, prosperity and progress.

The day has passed and vanished forever into the dark night of error, when our business can be derided and put aside. It now belongs to all classes, and especially to the poor. It needs not greater age than mine, nor of the majority of you here to-day, to recall the early history of the street railway car. In those days a ride for a poor man was almost unknown; its cost banished it from amongst his pleasures or his necessities. Even the rich rarely rode then for pleasure. Locomotion other than walking was the exception, never the rule. Look at the difference to-day; the horse car has been well named; it *is* "the poor man's carriage." The poor, aye, the very poor can now ride for pleasure. The introduction of the open car has developed and opened the door, and has given to the poor man a blessing that comes into his everyday life, to bestow a benificent privilege. No longer must he and his family be shut up in the hot and crowded city, away from all those sweet and health giving blessings that Nature has so freely given for his welfare.

Is there a man here to-day who can contemplate that phase of his business and not feel that he is assisting, as an instrument, in the design of a kind Providence, who careth for and provides for the poor and lowly, as well as for the rich and prosperous? Often have I felt this emotion as I have been riding out into the country on a pleasant spring Sunday, and have seen the seats of the car filled with the class of people I have spoken of. Here was the father, toilworn and careworn; here the mother, sickly and shrinking from the unaccustomed situation; and here the little family of children, clean, neat, and oh! so happy, all so pleased to simply see the green grass and the blue sky; to hear the birds sing, or to gather the simplest wild flower of the field. Proud, pleased, and gratified beyond measure was I that the means were thus provided that this pleasure, and this health giving privilege, are within the reach of all. And I repeat, it is because of this and the many other advantages to the daily life and wants of the whole community that makes the street railway a grand factor in the prosperity and progress and perpetuity of our modern civilization.

National Electric Light Association.

The annual convention of the National Electric Light Association attracted a large gathering to Buffalo, February 23, 24 and 25. The convention was interesting and profitable, and from the point of view of business, President Huntley said it was, without doubt, the most successful meeting in the history of the organization No general exhibit of apparatus was made, but in the rooms about the Hotel Iroquois samples of different kinds of electric merchandise were displayed.

In his opening address President Huntley made this remark about franchises: "I have had time enough to observe that the whole vast industrial development that has added so enormously to the comfort and happiness of life has come from the investment, under public franchises, of private capital, skill and enterprise. The public has thus been made the partner in all the great works of the age, and has thus gained infinitely more than it could have secured if it had raised an equal amount of money by taxation, and had placed the proceeds in the hands of a vast body of office holders for the same purposes."

J. R. Craven, of Buffalo, read a paper, an abstract of which is given below, on

UNDERGROUND CONSTRUCTION OF THE BUFEALO RAILWAY CO,

Underground construction for railway use is becoming every day a more prominent feature of railroad construction. Overhead mains and feeders will not much longer be tolerated, especially in the larger cities, where already the common councils are making it part of a railroad franchise that feeders, at least, shall be buried. The trolley wire, being bare, is of necessity left overhead, as safer and more economical, but it behooves us to meet this popular demand of placing all wires possible below the surface, otherwise we may be compelled to put the trolley wire itself there. Such an order would put the electric railroad industry back for quite a number of years, for not only would it be expensive, but, to my knowledge, no commercial underground trolley system has yet been put on the market.

Underground construction for railroad use brings us many problems to solve. Whilst not using a high tension current, we have one side of our system always grounded, so that between the many miles of cables in use and the earth we have a difference of 500 volts; thus you see at once the necessity of having and keeping up the highest insulation possible. This question of ground return requires that the insulation resistance of a railway circuit be twice that of an arc or incandescent underground system, where you have a metallic circuit; then there are the constant and excessive strains that one does not meet either in arc or incandescent lighting, due to the throwing off and on of the cars. It is almost impossible to figure your feeders to carry the maximum current, so that at any time you are liable to have your cables overloaded, bringing very heavy strains upon them.

Another question is the one of connecting overhead with underground wires. This brings lightning to the field to be guarded against, for the large surface of trolley wire offers an attractive path for lightning, and how to protect the underground feeders and mains has been quite a problem. Lightning has little regard for insulation, seeming to want a path only to earth; this path is offered by the underground cables, so that we have to introduce some arrester at the junction of the underground and overhead wires to give it some other path.

The lightning arrester is placed inside a watertight box on the top of a pole whenever a tap is made with overhead wires. The box also affords a good place where overhead and underground wires can be connected and keep moisture from the cables; this is accomplished by wiping a three inch lead cup on to the lead of the cable and filling it with insulating compound.

We have in this city about eleven and one-half miles of subways divided into two trunk lines which branch off, carrying feelers to the outlying districts. Our conduits are laid in cement, thirty inches below the surface of the street. They are crowned in the centre, so that the water will drain to the manholes, which in turn drain to the city sewers, with a bell trap to prevent sewer gas coming back.

Lately, on account of natural gas finding its way into subway and manholes, we have found it necessary to attach a blower at the station, which ventilates the whole system. Manholes we have placed every 400 ft., and have tried to make that distance standard, as pulling a greater distance brings an excessive strain on the cable when drawing in.

After careful consideration before this work was started, we decided to depend upon our cable for insulation, not on conduits made of insulating material. To me it seems impossible to prevent moisture from penetrating the latter system, thereby lowering the insulation. We depend on our ducts for mechanical protection alone.

The cables in use here are lead covered, provided with an exterior fibrous jacket or covering saturated with pitch, the purpose of which is to protect the cables whilst being drawn in the duct. We have some forty-five miles of cables, which have been in use since July last. These are of two classes: One for insulation depends on pure Para rubber, the other on a composition, our shortest feeder being two and a half miles in length, some of the longer ones reaching a distance of eight miles, yet the insulation on none at the present day is below 120 megohms, the short ones testing as high as 1,100 megohms. In laying this cable all tests were made in the testing room at the station; this was made feasible by the use of a telephone circuit throughout the underground system, so that a workman making a joint in a manhole was in communication with the man making the test and could always find out if his work was satisfactory. The joints made were the standard joints used by the companies from whom the cable was bought.

We are obliged to test at night, when the load can be thrown off one feeder and on to another; then it is disconnected by means of a switch where it connects to the overhead, and the test is then made. It is rather a slow process, but the only one left open to us.

Thus far we have looked upon the difficulties and disadvantages of the underground system. No arguments have been advanced in its favor, but I think you will agree with me that it has some. First, it does away with the public objection of disfiguring the streets, obstructing firemen in their duties, and, in the case of high tension currents, a menace to life itself; and then the liability of wires falling, causing a suspension of traffic, and, in case of a storm, causing a delay and loss of thousands of dollars to the company themselves.

Charles A. Schieren read a paper on

FROM THE TANNERY TO THE DYNAMO.

It may be of interest to engineers, and the electric light fraternity in general, to learn something of how leather is tanned, and the various processes through which a hide passes before it is tanned and curried ready to be put into belting. Naturally, the first question will be, "Where do all the steer hides comes from?" Principally from Chicago, because within its city limits there are four large slaughtering establishments where thousands of cattle are slaughtered daily, the hides of which are carefully taken off and assorted for whatever purpose they are best suited. The hides which are heaviest and most perfect in point of freedom from cuts, brands and other blemishes, are selected for belting leather. These hides are put up in bundles, packed into a freight car, and shipped to the tannery.

We propose to follow one of these freight cars loaded with belting hides to its destination. After a journey of about 600 miles, the car arrives at the little station of Adamsburg, Pa., right in the mountain region, a spur of the Alleghenies, where the tannery is situated.

Oak tanneries are generally placed near the bark region of the mountains, where the rock oak tree predominates, the bark of which is universally conceded to be the best for making the finest grade of leather. It is interesting to watch the mountaineers fell the huge oak trees, and skin the bark from the same. This is generally done in the spring time, and tanners have to purchase their year's supply during the bark peeling season, which is from the middle of May to about the middle of June, according to the condition of the weather; the season seldom lasts over six weeks. If the sap rises into the leaves the bark cannot be taken off, and, therefore, oak trees are only cut down in that period.

The peeling of the bark is done wherever the trees are felled; the bark is gathered together in small stacks and covered to protect it from getting wet; it must also be carefully guarded against mildew.

However, our car of belting hides has arrived at the station, and we will watch the process of tanning. The hides are examined and weighed, and put into the shed; an equal number of hides are taken out daily (whatever the capacity of the tannery may be), and placed in a large vat of pure cold water, generally good spring water. After the hides are thoroughly soaked and the dirt washed out, they are laid across a beam and, with a blunt fleshing knife, the surplus fat or meat still remaining is taken off; then they are placed in a vat of weak lime-water, and are hauled up daily and the lime strengthened until the hair gets loose, which action takes about eight days. After this the hides are cleansed once more in pure water and placed over the beam and, with a blunt knife, the hair is removed; this part of the work is done in what the tanners call the beam or lime house, and very much depends upon the successful liming process in making good leather.

After the hair is off the hides are washed again and thoroughly cleansed and purified, to remove every particle of lime, after which process they are taken into the handlers. These are composed of large vats about seven by nine feet, and six feet deep. The hides here are laid across sticks side by side, as close as possible, and hung about three inches below the top of the vat. These vats are generally connected so that when the first vat is fed the tannin liquor will pass through every vat until they are all filled, and cover the hides completely. In the handlers the hides receive their first bath of tannin liquor, which is very weak at the start, and gradually strengthened. During this first stage of tanning the hide plumps up, and is prepared for the lay-aways; this process also opens the pores and swells the hide, which gives thickness and firmness to the leather. If the hides cannot be made thicker at this period of the tanning, they will never be made heavier afterward; this is the critical point and has to be watched closely; much depends upon the character of the tannic acid; if too strong, it tends to make the leather brittle and harsh; if the tannic acid should be too sour, it tends to make the leather soft and flabby.

Some tanners use a rocking process to keep the hides in motion, thereby opening the pores of the hide quicker to receive the tannic acid: however, opinion differs as to the utility of the rockers; some claim (and justly) that the rocking motion loosens the fibre of the hide, and softens the leather too much. The best process is to simply hang them in the vats and cover them with the tannin liquor, and raise them a few times during the day, or draw the liquor through them, which some tanners are now doing with success.

The tannic acid in the handlers generally has a strength of from five to fifteen, very seldom over twenty, degrees. The hides remain in that process from ten to twelve days; they are then taken up and, if they are to be used for belt leather, the flanks (bellies) and heads of the hides are cut off and tanned separately; the remaining butt part

receives an extra layer of bark to tan it more thoroughly and make it firmer.

From the handlers the hides are packed away in vats, called lay-aways; these are large vats seven by nine feet, and six feet deep, having a capacity of from fifty to seventy-five hides each. The vats are not connected with each other, but only with the pump to change the liquor. The hides are laid nicely one on top of another, and loose ground bark spread between each hide, and when the vat is full it is filled with tannin liquor of from twenty-five to thirty degrees in strength. The hides intended for belting receive at least six layers of bark, or in other words, are changed six times in the lay-aways; the first time they are changed after lying ten days, and then five days are added after each layer, so that the hides in the last or sixth layer will take forty days to absorb the tannin liquor and penetrate the leather. Each time fresh ground bark is spread between the hides and then covered with tannin liquor.

The leaching and grinding of the bark is an important factor in a tannery. The large pieces of bark taken from the oak tree are thrown into a hopper-shaped mill or grinder, which resembles a coffee grinder on a large scale. The ross on the outside of the bark creates a great deal of dust, and contains little or no tannin, but it cannot be severed from the rind which really contains the acid; from the bark mill the ground bark is elevated into large tubs which have false bottoms, or receivers underneath to take up the tannin liquor. After a tub is filled with ground bark, a rotary sprinkler is set in motion to saturate the bark with a spray of water or liquor, which percolates through the ground bark, and on its way to the bottom catches up the tannic acid contained in the bark; at times warm water is used to facilitate the operation, also weak tannin liquor is used sometimes with good effect; however, old school tanners prefer cold water, which they claim makes purer and sweeter tannin liquor. After the receivers at the bottom of these tanks are filled, the contents are pumped into large supply tanks, from which the liquor is distributed through the tannery as required.

The leaching process is the most interesting and valuable operation in the tannery, and upon its skillful management depends the financial success of the business; opinion differs very materially as to the best method. The large, round leach tubs, such as described, are the most popular now in use; however, many tanners still adhere (and some with success) to the old square pressed leach tubs, in which the ground bark is simply soaked or steeped in water and left for a length of time, until the tannic acid is extracted from the bark. Opinion also differs as to using steam or hot water; however, all have their merits.

Very strange and erroneous ideas prevail among those who use leather, and have no knowledge of the art of tanning; certainly it is an art, and one of the oldest handed down to us. The general opinion prevails that leather made in "ye olden time" is superior to ours of the present time, but such is not the case; in fact, the fundamental process of tanning to-day is precisely the same as that of a thousand years ago, except that we enjoy improved machinery and appliances which further the process and improve the material. What took our forefathers from fourteen months to about two years, we accomplish in from four to six months, and the quality of leather is as good, if not superior to the leather made a hundred years ago; with the aid of steam and power we can facilitate the process and shorten the length of time to produce the leather. The "olden time tanneries" had the lay-away vats in the yard exposed to the elements, and in rainy and inclement weather, as well as during the winter, the tanners could not do any work, and left the leather lying in the vats; generally to the detriment of the stock. In our present improved and model tanneries everything is done under cover; even the bark is put under sheds to keep it dry, and good leather is tanned within four months; however, belt and prime harness leather generally takes six months.

When the leather is taken from the last layer of bark, it is oiled on the grain and hung up in a darkened room to dry; to obtain a nice clear russet color the place must be kept at an even temperature, and very little heat used. After the leather is thoroughly dried it is put up in rolls containing five butts (hides) each, and whenever a car load is ready it is shipped to New York; here it is again examined and weighed, and all butts not suited for belting are thrown out and finished into sole leather for shoe purposes.

The perfect hides for belting are soaked in warm water, and the centre part cut out and used for prime belting; the waste or offal is finished and rolled for shoe purposes. When the pieces are thoroughly scoured and cleansed they are oiled on the grain and hung up to dry, and when in a semi-dry condition, they receive a coat of stuffing made of equal parts of cod oil and beef tallow. This is done to preserve the leather and make it pliable for the transmission of power. After the stuffing has entered the pores, which takes about twenty-four hours, the leather is subjected to great strain in large stretching machines; great care and good judgment must be manifested in this part of the process; each piece of leather must receive an equalizing strain because of the peculiar formation of the hide, the fibres being very fine and closely knit together on the back of the animal, and running coarser and thicker towards the flanks. It is of the highest importance, for belts intended for electric light plants, to have an equal tension over the entire surface of the belt; therefore, the stretching process of belt leather needs the utmost care, and should receive the closest attention. After the pieces of leather are thoroughly stretched, they are worked smooth on the grain side, and both by hand and machine labor are set down as solid and compact as possible; then they are put into a drying room and thoroughly dried. Afterwards one edge of the pieces is straightened, and they are then cut into whatever width of belt they are best suited for; the pieces of each width are matched accurately as to thickness, and then the laps (joints) are cut by a machine, the edges of the laps are feathered, and the joints cemented (glued) together, and pressed under a hydraulic press, which pressure is considered the best by all first-class belt makers.

Rivets are now rarely put into belts; a double belt well cemented is good for all ordinary purposes, and rivets are superfluous; however, certain fastenings, such as endless copper wire screws, which do not obstruct the surface or unnecessarily stiffen the belt, are a benefit; especially when the belt comes in contact with water or too much oil, this fastening prevents the belt from coming apart, and holds the leather firmly together.

All main driving belts over forty inches in width have to be made in sections, consisting of two or more pieces of leather cemented together; the average hide for belting does not contain more than forty inches in width of solid leather suited for belting, very rarely over that; therefore, wide main belts are made in sections. Ordinarily the pieces are not lapped parallel, but simply butted. For example, a sixty inch double belt receives two thirty inch pieces for the first layer, laid side by side, and a thirty inch piece over the centre of the two lower pieces to break the joint, and two fifteen inch pieces on top of each edge of the lower layer to complete the width; thus the belt is cemented together. However, for electric light plants where belts are run at high speed and with variable power (which produces sudden strain), the seam of these butted joint belts, in several instances, broke, doubled up and destroyed the belts completely. To guard against such a calamity it is considered advisable to make wide main driving belts with parallel joints. For example, a sixty inch double belt will be made of two thirty-three inch pieces joined parallel, with a three inch lap, making one solid piece sixty inches in width, and on the upper part put a thirty-three inch piece in the centre, and two eighteen inch pieces on the edges, all joined with parallel laps; this cemented together will make a sixty inch double belt with unbroken surface, and as one solid piece of leather having a uniform tension and able to withstand an equal strain over the belt transversely as well as parallel, and thus will prevent such large, heavy driving belts from collapsing at the parallel joints. Every one must admit that main belts made on this plan are superior, and more reliable, and would come into general use if it were not for the additional cost of labor and material in making them.

Leather being by nature an absorber of moisture, belts must be guarded against exposure to oil. In electric light and power plants much mineral oil is used, and the great velocity at which the belts are run seems almost imperceptibly to suck or draw the oil from the journals of the engines and dynamos, and allow it to be absorbed by the belts, which get completely saturated with oil, and in a short time rot and destroy the fibre of the leather. Various methods have been used to overcome this difficulty, One of the most successful is a certain composition or belt dressing which is rubbed over the surface of the belt, and closes the pores of the leather. No foreign substance can penetrate a belt treated with this compound, and the belts last much longer and give better service. With perforated belts this compound does not seem to be so effectual, because the perforations naturally expose the inner part or the heart of the leather, which is very porous; however, the surface of the belt being covered it shields that part of the leather which comes in contact with the pulleys, and the current of air passing through the perforations protects the belt to a certain extent, and that class of belt runs smoother, with less friction and is more reliable.

And now, gentlemen, we have reached the point where another curious and erroneous idea prevails among many engineers, namely, that belting should be made of pieces only four feet in length, as if all hides were of the same length and texture. It will surprise these men to learn that there are no two hides alike; they vary in some particular point. Hides exist which will make almost six feet of sound solid leather below the shoulder, and again, some hides will not make four feet of solid length; the only safeguard is to specify belting made of leather cut below the shoulder of the hide, irrespective of length.

The following is an extract from a paper read by Allen R. Foote on

MUNICIPAL FRANCHISES FOR QUASI-PUBLIC CORPORATIONS.

How supremely ridiculous a city council would appear that should vote that a street railroad company might use horses to draw their cars, but should not use the best horses they could buy. How strange it would seem if a state legislature should enact a law that a company might generate and distribute gas for the purposes of light, heat and power but they should not adopt the best gas making methods. * * * These things are all as consistent as laws providing for the supplying of municipal needs by mentioning the methods to be used and thus limiting municipal franchise corporations to the use of the methods named instead of requiring them to adopt the best known methods at the time of the incorporation or that may thereafter become known. How strange it appears in the light of the requirements of true economic science that municipalities have supposed they could obtain a supply for a perpetual need requiring expensive plants, conductors through all streets, service connections to make the supply available in every building, and have the service wholesome, reliable, safe, and rendered at the lowest possible price in the way in which they have undertaken to secure these advantages. They have limited the right to do business to a comparatively short term of years. They have allowed others to build, as it were, on the same piece of real estate. They have limited the methods to be used so that when the discoveries of science and invention have made better methods available, existing corporations could not use them, thus compelling the organizing of other corporations and a duplication of plants. * * *

The services rendered by municipal franchise corporations are assistants to industry, promoters of comfort and inducers of prosperity. Any unnatural restriction placed on them is as fatal to the welfare of society as an unnatural obstruction to the inhaling of air, or taking of food is to the health of the physical body. Any tax levied upon them

is as fatal to the best interests of industry as the extraction of blood is to the physical strength. Obstructions and taxes laid upon quasi-public services are like rust upon a plow or a hole in a grain sack. * * *

A perfect franchise is the exact equivalent to a perfect title to real estate; it conforms fully to the conditions that give economic value to all property. It is in accord with ethical and economic laws that proclaim and establish the dignity and freedom of labor. It conveys and guarantees unrestricted, exclusive and perpetual possession, subject to such use and control as shall best serve the public welfare.

Notes on the Short Railway System.

The Short Electric Railway Co. are now pushing their shops to the utmost on large factory orders for gearless and single reduction motors, which have been recently received. Shipments of single reduction motors have been made to Wilkesbarre, St. Louis, Ashtabula and other places, and a large consignment will be made shortly to Trenton. The gearless motors will begin to come from the factory about the first of March, and shipments to Minneapolis, St. Louis, Grand Rapids, Brooklyn and elsewhere will then be commenced. The thirty H. P. single reduction motors are well under way, and shipments will be made to Jamestown and elsewhere before the first of April.

The shops are now far behind on generator shipments, owing to the unusually large demand for the new types, the advantages of which have met with instant recognition. Ten of the new 200 H. P. generators are now in operation in Rochester, and three more will be shipped shortly to provide for large extensions to this road, to be made in the spring. The management of the Rochester railway speak in the highest and most unqualified praise of these generators. Their high efficiency is shown from the fact that the wire system runs almost cold, the brushes work without a spark on the immense commutators, and the machines are as fine specimens of generator work as has ever been turned out. Four of these machines are to be shipped to Trenton, others to Johnstown, East Liverpool, Wilkesbarre, etc.

The new 300 H. P. generator is nearly completed, the first shipment to be made to Jamestown, N. Y., and it is confidently expected that these will prove as much of a success as the 200 H. P Some idea of the character of these machines may be had from the statement that the armature is fifty inches in diameter, and the commutator thirty inches, while the whole machine stands in a space 5 ft. 3 in. × 9 ft. The pulley is forty-eight inches in diameter, with a thirty-seven inch face, and the machine is run at a speed somewhat less than 300 revolutions per minute.

Col. Lewis Perrine, of Trenton, is making vigorous efforts to get his road into operation by electricity. He expects to start up in April. The station is well under way, the pole line is nearly completed, the Short company are about to ship the motors for the equipment of the trucks at the Brill works, and have promised the generators for the first of March. The road will start up with fifteen cars, equipped with the Short single reduction motors and four 200 H. P Short generators.

The Short Electric Railway Co. have equipped the Harvey road in the city of Chicago, which is running perfectly and with the utmost satisfaction to the railway company. The cars are thirty feet in length, with double trucks, and at present are equipped with the Short double reduction motors, which will later be exchanged for the gearless.

The Atlanta & Chattahoochee Street Railway Co. are building their new lines as rapidly as the weather will permit, and will soon order forward the Short single reduction motors and generators, which are to form the equipment.

It is stated by authority that the Short Electric Railway Co. are not included in the consolidation of the various electrical interests, but maintain their present independent position.

The Ninth Ave., (N. Y.) Railway Co. have recently renovated and painted up twenty-one of their cars, an improvement which is noticeable and appreciated by the residents along the line.

A Dinner to Street Railway Employes.

Through the courtesy of Mr. C. Harvey Herring, traffic manager of the Birmingham (Eng.), Central Tramways Co., Ltd., we are enabled to give in this issue some particulars of the annual dinner given February 5, by the company to their employes. The latter number 750 men, a large proportion of whom were present. Besides the employes there were at the tables a number of guests and officials of the road, among whom were: Mayor of Birmingham, Lawley Parker, Joseph Ebbsmith, chairman of the Birmingham Central Tramways Co., and who presided, W. Carruthers-Wain, managing director and president of the Tramways Institute, Lieut. Harvey Herring, A. Dickinson, and W. E. Whytehead.

The proceedings were of a thoroughly festive character, the hall was decorated with the flags of all nations, the police band played in the balcony, ladies graced the occasion with their presence, and a thoroughly good time seems to have been enjoyed by all.

Perhaps, the most interesting observation made in the course of the fulfillment of a lengthy toast list was the remark of the chairman, after alluding to the loyalty of the company's servants, to which he attributed a large amount of the success, that though not quite so large a financial success as was first thought, the Birmingham Central Tramway Co. had been converted from a disaster to a success, until at the present time it ranked excellently among the tramway systems of England.

Sydney Tram Roads.

With two exceptions, all the tram roads of New South Wales are operated by steam motors. The exceptions are the Waverley and Randwick, single track roads a mile and a half in length, on which the Thomson-Houston overhead system has been installed, and the North Shore cable system which is a mile and a half long. In Sydney and its suburbs there have been laid thirty-three and one-half miles of track which includes the electric road, but not the cable line. In addition there is a line connecting Newcastle and Plattsburgh, seven and one-half miles in length, which makes the total forty-two and one-half miles. All the lines are owned and operated by the government and are under the control of a board of three commissioners.

The roads are divided into sections, on some of which the fare is a penny, and on others two-pence by ticket, or two-pence and three-pence cash. Trains are composed of one, two or three cars, each with a seating capacity of seventy passengers, five to each seat. Stops are made only at prescribed stations. Electric and cable cars make stops wherever desired.

Entrance to the cars is on each side from a step running the whole length similar to that on an American open car, but the cars are much more cumbersome and heavy and are run on two bogies. Their weight is from six to seven tons. Until recently a large number of double decked cars were used. These have been gradually replaced and are now used only on rush days.

The steam motors, most of which were supplied by the Baldwin Locomotive Works, weigh about ten, twelve and fourteen tons, and are fitted with vacuum brakes.

The total cost of the lines open for traffic was £1,004,212, upon which amount they earned interest last year of 5.32 per cent. against 4.81 per cent. the year previous.

The rolling stock for the year ending June 30, 1891, consisted of 106 steam motors, 198 cars, sixteen freight trucks and five water tanks. North Shore cable: Eight grip cars and fourteen trailers. Electric railways: Three motor cars and one trail car.

Electric cars were installed in November, 1890, as an experiment. The track is the worst in the whole system, having eighteen curves in one and one-half miles and gradients as high as one in sixteen. The single stretch of level straight track is only 300 yards in length. The Thomson-Houston system is employed, and at the power station is one eighty H. P. generator, and an Armington & Sims 100 H. P. engine running at 300 revolutions with a

steam pressure of 110 pounds, supplied by two old locomotive type boilers.

The cars, which were built by the John Stephenson Co., are operated by two fifteen H. P. motors. So far not an armature or a field has been lost, and the electrical repairs have been almost nothing.

At present the government is not in a financial condition to extend the system of tram lines, but in two years the subject will be brought up again and extensions will be made. Either electricity or cable will be probably adopted as motive power on the steam lines.

Street Railway News.

General.

Albany, N. Y.—The Watervliet Turnpike & Railroad Co. have leased their road to the Albany Railway Co. The lessees guarantee the payment of the interest on the first mortgage bonds and the interest and principal of the second mortgage bonds, and pay a rental equivalent to a dividend of one-half of one per cent. upon the stock. Ten extra large excursion cars similar to those in use on the West End road in Boston, will be placed on the line next summer. The tracks will be relaid, and the distance from State Street, Albany, to the intersection of Congress and River Streets, Troy, be covered in thirty five minutes, including stops. Motors will run every fifteen minutes. The present power house on South Pearl Street will be made the central station, the plant on Broadway being held in reserve.

Alexandria, Va.—Work will soon be begun on the Alexandria & Fairfax Passenger Railway. Electric power will be used, and the road will be ten miles in length.

Albany, Ga.—The last legislature of Georgia passed an act providing that separate accommodations should be provided on street cars for white and for colored persons. It has not been rigidly enforced, but a local paper says its provisions will now be carried out.

Ann Arbor, Mich.—By the decision of the Supreme Court of Michigan the Ann Arbor & Ypsilanti Street Railway has stopped operations. The employes have been discharged and the rolling stock stored. Mr. Charles D. Haines of New York, is largely interested in the line, and about $60.000 has been invested. The cars were put in operation about a year ago, and since that time a large number of passengers have been carried over the lines. In securing the right of way the consent of all the property owners was obtained with the exception of that of the heir of one estate. This heir, Mrs. Dr. Granger, petitioned the Circuit Court for an injunction, claiming that the road injured her property, but an injunction was refused by the Circuit Court. Upon appeal to the Supreme Court the decision was reversed and an injunction served on the railway company to stop operations. It is generally considered to be an attempt to blackmail the company, as the petitioners for the injunction refuse to sell the property except at a much higher price than its market value.

Auburn, N. Y.—At the meeting of the directors of the Auburn City Railway Co., held in this city February 1, Chas. E. Eddy of Boston was elected president instead of G. F. Wells, resigned, and Geo. Underwood of Auburn was elected vice-president instead of G. W. Allen, resigned.

Baltimore, Md.—The City Passenger Railway Co. have awarded the contract for cabling the Blue line to Contractor E. Saxton, who guarantees the completion of the road before the end of the year.

THE Walker Manufacturing Co. of Cleveland, O., have secured the entire contract for the cable driving machinery for both stations of the Baltimore City Passenger Railway Co., including five sets of machinery, in all of which the Walker differential winding drums will be employed.

CONSTRUCTION work on the Curtis Bay electric railway is progressing rapidly, after a suspension of operations due to the bad weather last month.

THE Johns Hopkin's University trustees and the Belt Railroad Co. have finally come to an agreement over the price to be paid for a portion of the Clifton property condemned for the use of the railroad; about fifteen acres were taken for which the sheriff's jury awarded $40,250 damages. The trustees excepted to the award. By the terms of the agreement the railroad company was to pay the trustees $65,000 for the land taken. The trial of the case has been in progress since January 19, before Judge Duffy without a jury. The agreement was reached while the argument was in progress and put a sudden stop to the proceedings.

Beatrice, Neb.—The Beatrice Rapid Transit & Power Co. have purchased all the privileges and property of the Beatrice Street Railway Co.

Birmingham, Ala.—The Birmingham Railway & Electric Co. have put into service cars which they have recently received of the J. G. Brill Co.

Bowling Green, Ky.—The scholars and teachers of day schools and Sunday schools have had issued to them tickets which cost only one cent a ride.

Bucyrus, O.—The bid of the Suburban Electric Railway Co. for the construction and maintenance of a street railway was considered at a recent meeting of the City Council, and the contract was awarded to them.

Charlottesville, Va.—The car stables of the Street Railway Co. were destroyed by fire early last month, and six mules and all the cars were burned. The loss was about $1,200.

Chicago, Ill.—The Illinois Electric Material Co. made an assignment February 8, to Frank Hamlin. The assets and liabilities were said to be about $10,000 each. H. S. Winston was president of the company and Ernest Horfer, secretary.

Two cartridges were placed on the car track on Randolph Street near La Salle Street on February 1, by a lad. A car wheel caused one of them to explode, and a passenger, Mrs. Sigmund, was wounded by the bullet, but not seriously.

CHARLES W. RIGDON has commenced a suit against the Chicago City Railway Co. He is a stockholder in the company, and in his bill he asks for the appointment of a receiver to take possession of $500,000 of bonds and 38,530 shares of the stock of the Chicago & South Side Rapid Transit Railroad Co. which was purchased by the Chicago City Railway Co. He complains that the investment is illegal. He was defeated in a similar proceeding before Judge Horton recently, the court deciding that the Chicago City Railway Co. had a right to purchase bonds but not stock; that buying stock of another corporation was against public policy and also in violation of its charter. But Rigdon is now insisting that both the purchase of stock and bonds is unlawful, and he wants them sold and the proceeds distributed among the stockholders.

THE Calumet Electric Street Railway Co. have accepted the ordinance of January 18, giving them the right to extend their line on numerous streets south of Seventy-fifth Street. Perkins Bass has just brought suit to enjoin the company from building under the ordinance. Mr. Bass represents that he owns property fronting Sixty-seventh Street on the north, Stoney Island Avenue on the east and Madison Avenue on the west, and he says the company never obtained his consent to construct a railroad. He claims that the City Council passed the ordinance without securing a majority of the property frontage, and that, therefore, the ordinance is void.

The West Chicago Street Railway Co. have sent a check for $4,587.18 to City Collector Amberg in payment of the license of $12.50 a quarter collected by the city for every street car operated by the company. The payment shows that the company are running eight cars fewer daily than during the corresponding quarter a year ago. The Chicago City Railway Co. paid $4,330, a decrease of six cars, and the North Chicago Street Railway Co. $2,451.25, an increase of twenty-three cars.

Cincinnati, O.—The Cincinnati Street Railroad Co. have paid something over $18,000 into the city treasury upon what they estimated to be the car license for 1892 and the two and a half per cent. on the gross earnings for the quarter ending December 31, 1891, as they estimated them.

Cleveland, O.—The City Council has passed an ordinance forbidding the use of salt on the tracks.

IT is shown by the lists filed with the City Clerk that this year the East Cleveland company will pay $2,000 and the Woodland Avenue & West Side Co. $1,110 for street car licenses. Last year the total for the two companies was $1,200.

Columbus, O.—The House of Representatives has passed the Llewellyn bill which provides that whoever willfully disturbs by disorderly conduct, obscene language or otherwise unlawfully interferes with the peace and comfort of passengers upon any passenger train or street railway car, shall be fined not more than $25 or imprisoned not more than ten days or both.

Dayton, O.—The ordinance extending for a period of fifty years, the ordinance of the Dayton Street Railroad Co. has been adopted by the Council.

Decatur, Ill.—The two street railways have been consolidated, and are now operated by the City Electric Railway Co.

Dubuque, Ia.—J. H. Rhomberg, of the Dubuque Street Railway Co., is in the East inspecting the different types of railway motors and the company contemplate electrical equipment on the overhead system soon. In the meantime they continue to operate their present storage battery cars. Iron poles with brackets will be used.

THE United States Electric Light & Power Co., have been awarded the contract for 200 arc lamps for city lighting. This company commenced tearing down their old power station last month to make room for a more modern type of station. This will be equipped with two Corliss engines 250 H. P. each, to be supplied by E. P. Allis & Co. The company have recently filed a bond for $1,000 as guarantee to the acceptance of the proposal.

Erie, Pa.—The Erie Electric Motor Co. have purchased two new generators of the Edison company and have ordered thirteen new open cars. The Erie City Iron Works will furnish the boilers for the new power house and the Ball Engine Co. will supply the engines.

Fond du Lac, Wis.—Haines, Bros. & Co., of Kinderhook, N. Y., have bought the horse railway system of Fond du Lac, and will change it to an electric line.

Galt, Ont.—The Galt & Preston road, which at one time was strongly agitated, will probably not be built for some time at any rate.

Hamilton, O.—The Hamilton & Lindenwald Electric Transit Co. have driven two four-inch wells, which have been put in adjacent to the power house, and the company, in addition, propose to immediately sink, at least, five or six other similar wells in the same locality. This done, the people will be amply supplied with water, and in a measure protected against fire.

Hartford, Conn.—A new schedule has gone into effect on the

Wethersfield electric road, which provides thirteen additional trips daily.

Holyoke, Mass.—The directors of the Holyoke & Westfield railroad have elected Timothy Merrick, president; James W. Clark, vice-president and C. F. Smith, treasurer.

Hot Springs, Va.—In all probability the "Happy Hollow" street railroad will be in operation some time in March.

Kansas City, Mo.—The Kansas City Cable Co. will use a cable which they have imported from Hull, England.

The Kokomo, Ind.—The Kokomo Street Railway Co. have made a special rate of three cents for laboring men between 6 A. M. and 7 A. M. and 5 P. M. and 6:30 P. M.

Lansing, Mich.—Commissioner of Railroads Whitman, has issued a circular addressed to street car companies calling their special attention to the Act 222 of the laws of 1889 requiring drivers of street cars to bring cars to a full stop before going upon a street railway crossing of the tracks of a steam railroad, and to make sure that no engine or cars are approaching such crossing before they proceed to go upon the same.

Lebanon, Pa.—Jacob M. Shenk has been elected president, Samuel L. Brightbell and George D. Rise treasurer of the Labanon & Myerstown Street Railway Co.

Lima, O.—William M. Brown of Newcastle, Pa. Mr. Hazzard of Cleveland, Mr. Kimble of Cincinnati and Mr. Townsend of Pittsburgh have bought the Lima, O., electric road.

Los Angeles, Cal.—On September 15, 1890, the bank of California advanced $12,000 to the Pacific Railway Co. to pay the coupons due that day on $838,000 of first mortgage bonds issued by the Los Angeles Cable Co. The embarrassment of the Pacific company prevented the payment to the bank, which is the owner of about $150,000 of the bonds. Recently the bank filed a petition with Judge Wade, asking him to order the receiver to pay the $12,000 out of the funds in his hands. The Court directed the receiver to file an answer to the petition, in the course of which he says: "We allege that it is absolutely impossible out of the earnings of the road to pay the interest due on the bonds issued under the deed of trust hereinbefore mentioned, and thus prevent a foreclosure in the near future of one or the other or both of said deeds of trust; and to pay at this time the amount asked for by petitioner would render it impossible for the receiver to carry on the business of the road and keep the property in repair without borrowing money."

Lowell, Mass.—The street railway company have placed an order for ninety-five tons of trolley wire with the Washburn & Moen Co. Work upon the power house is being pushed rapidly forward. The roof is already on the building and the laying of the foundations for the eighteen engines and generators has been commenced. The company propose to extend their track to the Yellow Meeting House in Dracut as soon as the grade of Bridge Street, near the town line, is established.

Lynn, Mass.—Work is now progressing satisfactorily on the new power house of the Lynn & Boston Co. Three 400 H. P. engines have been purchased. It is expected power will be furnished from the new power station about May 1. Ground has been broken in Chelsea, on the wharf property purchased by the Lynn & Boston road, just this side of Chelsea Bridge, for another power house which will be fitted up and be capable of furnishing 5,000 H. P. This will give the road power enough to operate all their lines by electricity.

Manchester, Va.—James F. Bradley has been elected president and W. C. Seddon secretary and treasurer of the Richmond & Manchester Railroad Co.

Marietta, O.—H. B. McMaster has assumed the position of superintendent of the street car line.

Massillon, O.—W. J. McClymonds has been awarded the contract by the Council to build an electric road on the principal streets and to Canton.

Memphis, Tenn.—Electric cars have replaced the mule cars on the Shelby and Madison Street line.

Milwaukee, Wis.—The Milwaukee & Wauwatosa Rapid Transit Co. have elected the following officers: President, Charles Stickney; vice-president, Julius Wechselberg; secretary and treasurer, Gustav Pabst; general manager, E. D. Hoyt. Manager Hoyt reported that the roadbed had been completed and that bids had been received for equipping the road.

Natick, Mass.—J. F. Shaw has recently equipped the Natick Electric Street Railway with Burton heaters.

New Haven, Conn.—The following officers were elected at the annual meeting of the West Haven Horse Railroad Co., President, Israel A. Kelsey; secretary and treasurer, Samuel A. Stevens, superintendent, W. W. Ward.

New Orleans, La.—The suit of the New Orleans City & Lake Railroad Co. against the city of New Orleans, La., has been dismissed by the court, and judgment rendered in favor of the defendants. The question involved was whether certain franchises of the plaintiff were exclusive and the court answered it in the negative.

AN ordinance was recently introduced in the City Council providing that it shall be unlawful for any street railroad company to run any car on the streets of the city unless it is provided with ventilators affording a ventilation of at least four square feet.

New York, N. Y.—A bill has been introduced in the legislature by Assemblyman Roche which provides that one road may use the tracks of another for the purpose of connecting with a ferry.

CITIZENS of Washington Heights recently met and adopted resolutions to the effect that the elevated road should be extended to accommodate them.

AT the annual meeting of the Sixth Avenue Street Railway Co. the old directors were re-elected.

Newark, N. J.—A bill to secure the Newark Passenger Railroad Co. from all interference with their electric overhead system was introduced in the legislature. The bill seeks to nullify the decision of the courts in the suit brought by George A. Halsey. It sets forth also that the Board of Works of Newark may, by a two-thirds vote of its members, give authority to run cars by electricity, chemical motor or grip cable, say where and how poles shall be placed and direct other necessary details.

Newburgh, N. Y.—At the annual meeting of the Newburgh Street Railway Co. the directors of last year were re-elected. M. H. Hirschberg was elected president and John C. Adams vice-president.

Newport, R. I.—It was stated at the annual meeting of the Newport Street Railway Co. that 808,150 passengers were carried by the line during the past year, against 781,038 during the year previous.

Norfolk, Va.—On February 13 a disastrous fire occurred at the stables of the Norfolk City Railway Co., by which the stables were burned to the ground. Ninety of the best animals perished. The loss is estimated between $40,000 and $50,000 and said to be covered by insurance.

Oakland, Cal.—The following officers were elected at the annual meeting of the Oakland Consolidated Street Railway Co.: G. W. McNear, president, and J. E. McElrath, vice-president; R. C. Beggs continues as secretary. The rumor that the Southern Pacific company have tried to secure possession of the property is denied by the company.

MAYOR CHAPMAN has signed the ordinance permitting the Oakland Railroad Co. to use electricity on their Telegraph Avenue line.

Orange, N. J.—The electric line running between Orange and Newark was opened February 1. The officials of the road met to celebrate the event, and a pleasant evening was passed.

Palatka, Fla.—At the annual meeting of the directors of the Palatka & Heights Street Railway Co., held last month, W. P. Craig was elected president; Marcus Loab, superintendent; W. C. Snow, treasurer and general manager, and H. B. P. Calhoun, counsel.

Peoria, Ill.—Capt. John Hall, president of the Fort Clark Railway Co., has recently made a formal announcement to the effect that he has made a contract with the Thomson-Houston company for the equipment of the system with fourteen electric cars. He expected to use storage battery cars, but he is convinced, he says, that the expense to maintain them is prohibitory. Work has commenced, and the road will possibly be in operation by the latter part of May.

Philadelphia, Pa.—The use of the electric trolley system by the Traction company in the operating of street cars was determined upon recently at a meeting of the stockholders of the Twenty-second Street & Allegheny Avenue Passenger Railway Co., held at the office of the Traction company on Walnut Street.

SPEED on several of the cable lines has recently been increased.

THE Philadelphia Traction Co. in January paid into the city treasury $28,200 for licenses for 517 cars to be run this year on the various divisions, as follows: Catharine and Bainbridge Streets, fifteen; Philadelphia & Gray's Ferry, seventeen, Philadelphia City (Chestnut and Walnut) fifty-five; Union, 267; West Philadelphia, 130; Empire (Twelfth and Sixteenth), thirty-three. The sumpaid last year was $22,578.13.

Pittsburgh, Pa.—The power house of the West End Electric Railway will be located on West Carson Street. The car sheds will be near the Luckey school, in the Thirty-fifth ward. The company are anxious to commence changing the motive power to electricity as soon as possible, and work will be commenced in a few weeks. A great effort will be made to have the cars running by electricity by July 4.

The Central Traction Co. will have their Centre Avenue branch in operation as an electric line by April 1. Poles have been put up along Centre Avenue and down Wylie to High Street and thence to Grant.

Portland, Ore.—It is understood that all opposition against the construction of the G Street electric line will be withdrawn by the property owners who were preparing to sue the company for damages.

The Multnomah Railroad Co. have just placed six forty foot new cars on their line. These cars are furnished by the J. G. Brill Co.

THE Suburban company expect to have their Third and G Street lines in operation by May 1.

Pottsville, Pa.—Officers and directors of the Schuylkill Electric Railway Co. have been elected as follows: President, J. K. Sigfried; vice-president, F. G. Yuengling; secretary, J. H. Zerbey; treasurer, J. F. Zerbey; superintendent, Luther K. Hannum; electrician, Chas. E. Swan.

Racine, Wis.—The Belle City Street Railway Co. have filed a bond of $10,000 with the city clerk, as a guarantee that they accept the new ordinance and that they will carry out all its provisions.

Redlands, Cal.—The new track to Terracina has been built and cars are running.

St. John, N. B.—A consolidation of the electrical interests in this city has been effected by the organization of a new company known as the Consolidated Electric Co., Ltd. This company have taken over the Eastern Electric Co., Ltd., the New Brunswick Electric Co., Ltd. and the St. John City Railway Co., and so become one of the largest companies in Canada. The new company will have a ca-

pacity of 6,000 incandescent lights and 300 arcs. They have the contract for the lighting of the city, and anticipate a large increase in both lighting and motor business. The officers of the company are John F. Zebley of New York, president; H. B. Zebley of New York, secretary and treasurer; Chas. D. Jones of St. John, manager, backed by a strong board of directors composed of New York and St. John gentlemen.

St. Joseph, Mo.—Dr. James W. Heddens resigned his position as president of the road January 26, and James T. Gardner was elected to fill the vacancy.

ON January 22 incendiaries made an attempt to burn the Frederick Avenue barn of the People's Street Railway Co.

St. Louis, Mo.—The directors of the St. Louis County Street Railway Co. have elected the following named officers: M. B. Greensfelder, president; George Autenreith, vice-president; J. B. Greensfelder, secretary; F. W. Rauchenstein, treasurer; Eugene Benoist, superintendent. They expect to extend their tracks from the present terminus at Eden over Lucas and Hunt Avenue to Normandy during the coming summer.

San Francisco, Cal.—It is stated that the preliminary work of grading along the line of the new electric road of the Market Street Co. through the Heights to South San Francisco, will be completed about July 1, when track laying will be begun.

CARS will be running on the extension of the McAllester Street cable line by the middle of march.

Saratoga, N. Y.—To satisfy a judgment on foreclosure in favor of the American Loan & Trust Co., the Saratoga Electric Railroad Co. was sold at public auction last month to C. E. Arnold of Albany, who represented the Union Electric Railroad Co., for $35,000. The Union company intend to run a new line to Saratoga Lake and through several of the streets about town.

Savannah, Ga.—An agreement has been reached by the Electric Railway Co. and the Savannah, Florida & Western Railway in reference to the Gwinnett Street crossing, whereby the electric railway will cross at grade. The electric line assumes the cost of making the crossing, and also assumes all liabilities resulting from any accident that may occur on account of crossing at grade.

Rome, Ga.—The contract has been let to the Thomson-Houston Electric Co. for the construction of the Rome electrical street railroad.

Shenandoah, Pa.—The construction of the M. C. S. G. & A Street Railway is progressing rapidly toward completion. The cars have arrived and one of the large generators is in place. The line will probably be opened for traffic between Shenandoah and Lost Creek by March 1. C. R. Eberle is general manager and A. W. Gilbert has charge of the electric works for the Thomson Houston company. The line when completed will be twenty miles in length.

Staten Island, N. Y.—Judge Cullen has granted an order permitting James D. Van Hoevenberg, receiver of the Staten Island Belt Line Railway Co., to discontinue the operation of the road and sell the horses.

Toronto, Ont.—The mayor has received an important letter from James Gunn, secretary of the Toronto Street Railway Co. in which the writer states that the street railway company are anxious that the city should take action in regard to the proposed measure allowing them to install an overhead electric system. The proposals under which the company undertook the operation of the road were with the understanding that overhead wires should be installed, and as delay results in pecuniary loss to the company, the purchasers look to the city to indemnify them against all loss.

Washington, D. C.—The annual report of the Capitol, North O Street & South Washington Railroad Co., was presented to the Senate recently. The receipts from passengers for the fiscal year ended April 30, 1891, amounted to $125,768.57; receipts from other sources brought the total up to $157,567.86. Total expenditures, of which $27,909.19, were for permanent improvements, aggregate $156,380.22. During the year 2,808,027 passengers were carried.

SENATOR HANSBROUGH by request has introduced a bill to require the Washington & Georgetown and the Metropolitan railroad companies to inaugurate an all-night car service, the cars to run in each direction every half hour between the time for stopping and beginning the regular service. In view of the approaching use of cable and electric power on these two roads the bill will provide that on these "night liners" horse power may be utilized.

Wilmington, Del.—The Front & Union Streets railway has been leased by the Wilmington City Railway Co. for a term of years, and hereafter the entire railway system of the city will be under the same management.

Yonkers, N. Y.—The Yonkers Electric Railway have awarded to the Edison company the contract for two generators. The cars will be supplied by the John Stephenson Co., the motors of the Eickemeyer type and the boilers of the Stirling type.

Extensions and Improvements.

Asbury Park, N. J.—The officials of the electric railway company have agreed to spend $75,000 on improvements and to pay $3,000 per year to the borough during the life of the present franchise and at its expiration to pay $4,000 per year if the franchise is satisfactorily extended.

Baltimore, Md.—At a special meeting of the directors of the City Passenger Railway Co. it was decided to cable the Blue Line immediately. This was recommended in the president's report at the annual meeting, but was not acted on before on account of the absence of of Director Clark who owns a large amount of the stock of the company.

ON account of the Baltimore Traction Co. having secured a controlling interest in the North Baltimore Passenger Railway Co., the main lines of that system will probably be cabled, and electricity adopted on the subsidiary lines.

Beatrice, Neb.—The Beatrice Rapid Transit & Power Co. will extend their electric road to all the leading parts of the city, including the West Side, soon. The company have also made arrangements for a complete electric light plant.

Berkeley, Va.—In the spring the Berkeley Street Railway Co. will extend their line three-quarters of a mile, build new barns, and purchase new cars. Thirty pound T rail will be used on the extension.

Biddeford, Me.—The Biddeford & Saco Railway will probably be equipped with electric motors in the spring. Poles are already erected.

Bridgeport, Conn.—The Bridgeport East End Railway Co., will install four open eight bench cars shortly.

Brookline, Mass.—The West End Railway Co., of Boston, have petitioned for right to extend their electric system over a number of streets in this town.

Butte, Mont.—The Butte Consolidated Railway Co. contemplate extensions in several directions the coming spring.

Centralia, Ill.—The Centralia & Central City Street Railway Co. will lay another mile of track the coming spring and purchase more cars and mules.

Charlottesville, Va.—The Charlottsville & University Street Railway Co. will probably soon extend their line.

Cleveland, O.—A request from the Broadway & Newburgh Street Railway Co. for permission to relay their tracks on Broadway from Davies Street to Union Street has been referred to the Department of Public Works.

THE Alliance Street Railway Co., will probably add trailers to each car in the spring.

Columbus, O.—An ordinance has been passed by the Council giving the Columbus Consolidated Street Railway Co. the right to extend their tracks from High to Fourth on Chestnut and thence north over the Fourth Street viaduct to Chittenden Avenue. The ordinance provides that the company shall pay to the city $250 a year for the franchise. The company will begin work, at once, on the extension.

Dayton, O.—The Oakwood Street Railway Co. expect to substitute this year a sixty pound, or heavier rail, for their present thirty pound rail. They will extend their line about half a mile, and make other improvements.

Defiance, O.—The Defiance Light & Power Co. will build one or two miles more of track in the spring.

Denver, Colo.—The Tramway company are reported to be planning some important extensions in the spring.

Ft. Wayne, Ind.—The Citizens' Street Railway Co. have asked for the required permission to operate their lines by electricity.

Hamilton, O.—The Hamilton & Lindenwald Electric Transit Co. expect to build one and one-half miles of extension during the spring.

Holyoke, Mass.—The stockholders of the Holyoke Street Railway Co. have voted to approve the recommendation of the directors that the lines be extended to Springdale in South Holyoke, and to Oakdale by the way of Sargeant Street. The directors have been also authorized to lay heavier rails on about three miles of the present roadbed where the old fashioned strap rail is now used. A new power house will be built.

Jamestown, Va.—The Jamestown Street Railway Co. are doubling their power capacity and have added six new cars. It is also thought the line will be extended from Lakewood through to the Chautauqua Assembly grounds, for which surveys were made last fall.

Kansas City, Mo.—The L road will probably extend in the spring. The adoption of electric power is being discussed.

Lancaster, Pa.—The street railway company have asked for right to make extensions on certain streets.

Lansing, Mich.—The Continental Trust Co. of New York, several months ago acquired a controlling interest in the Lansing City Railway Co. A. G. Davids has been selected to take charge of that company's interest.

Lewiston, Me.—The Lewiston & Auburn Horse Railroad Co. are said to be contemplating the construction of a connecting line between Main and Cedar Streets, along Lincoln.

Louisville, Ky.—Some improvements are contemplated by the Louisville Railway Co. in the near future.

Lynchburg, Va.—The Rivermont Electric Railway Co. have an extension under contemplation, it is said.

Mansfield, O.—The Citizens' Electric Railway, Light & Power Co. propose to make extensions involving three or four miles of new lines, connecting their system with the Sherman-Heineman Park and the Ohio Reformatory.

Marlboro, Mass.—The Marlboro Electric Street Railway Co. have petitioned for leave to extend their tracks to Westboro and Hudson.

New Haven, Conn.—At the annual meeting of the West Haven Horse Railroad Co. it was voted to extend a branch line from Congress Avenue through Howard Avenue to Sea Street in the spring.

THE West Haven Street Railway Co. have petitioned for the privilege of using electric power, and hope to have cars running this summer.

Newark, O.—The Newark City Railway Co. have made application for right to extend their road on a number of streets.

Norwich, Conn.—The Norwich Street Railway Co. have contracted with Henry Lyon of Lisbon to furnish them 700 poles and 6,000 ties for the building of the electric road. The managers hope to have have the trolley system in operation on the main line by the first of May.

Oakland, Cal.—A franchise has been granted by the Board of Supervisors to the Oakland Railroad Co. giving them the right to construct an electric road on Telegraph Avenue. The county surveyor has been instructed to establish the grade on the avenue at the expense of the corporation. It is said the work of changing from horses to electricity will soon be commenced. The competition of the Oakland & Berkeley Rapid Transit line makes this necessary.

Quincy, Mass.—A petition has been submitted by the Quincy & Boston Street Railway for the privilege of extending their tracks into Boston, Weymouth, Braintree and Milton.

San Francisco, Cal.—The Geary Street cable line will be extended soon. The gauge is to be changed so as to conform with the Market Street system in order that the cars can continue on from the present stopping place on Kearney Street down Market to the ferry landings.

AN order before the Board of Supervisors, granting the Metropolitan Railway Co. a supplementary franchise allowing of the extension of the road along Eddy Street between Powell and Mason Streets, has been passed.

THE Presidio cable line is being extended.

THE Metropolitan Railroad Co. have applied to the supervisors for additional privileges of erecting poles to maintain electric wires east of Van Ness Avenue; also for an extension of franchise on Eddy Street, between Powell and Mason. The road is now partly constructed.

Springfield, Mass.—The street railway directors are not content with the seven mile extension already proposed and mentioned in these columns, and have decided to recommend to the stockholders other extensions of six miles, one line on Liberty Street to the Camp Ground, and another line on State Street to Indian Orchard.

Washington, D. C.—The Eckington & Soldiers' Home Railway Co. have applied to Congress for permission to extend their line.

Wilmington, Del.—The Wilmington City Railway Co. have petitioned the Street and Sewer Department for permission to lay tracks for an electric railway from Ninth and Market Streets to Church, to Eleventh, to Walnut, to Ninth, a distance of about a mile. The Maryland Avenue cars are to cover the route.

Winnipeg, Man.—At a meeting of the Civic Works Committee last month the tenders for the electric street railway franchise, submitted by the Ross-McKenzie company and the Winnipeg Street Railway Co. were fully discussed, and it was decided to recommend to the Council that the offer of the Ross-McKenzie company be accepted.

York, Pa.—The York Street railway company have been granted permission to equip with electric power.

The York Street Railway Co. have been granted permission by the Council to use electric power.

Youngstown, O.—The Youngstown Street Railway Co. may extend their line to Poland, provided the right of way can be secured without taxation or litigation.

New Roads.

Americus, Ga.—It is stated that a company is to be organized here for the construction of a street railway within the next sixty days.

Atlanta, Ga.—The Atlanta, East Lake & Decatur Street Railway Co. will soon build three or four miles of road. The president of the company is A. C. Bunce.

THE Peachtree Electric Street Railway Co. have been organized by H. L. Harralson, P. H. Harralson, P. B. Lawrence, W. S. Turner and others. Burton Smith is attorney for the company. They have petitioned the City Council for privilege of using Pryor, Church Cain, Williams, West Peachtree and other streets. The lines, as planned, will run almost parallel to the consolidated lines in North Atlanta.

Baltimore, Md.—It is said that an elevated road will be built here by the North Avenue Electric Railway Co.

APPLICATION for an electric railway franchise has been made by the Baltimore, Canton & Point Breeze Railway Co. The incorporators are: Robert Baldwin, John S. Lusk, W. R. Cole, J. V. Campbell and H. W. Rusk.

Brigham City, Utah.—An electric line between this city and Hot Springs is being strongly agitated. A committee composed of Jacob Jensen, A. E. Box, Wm. Horsley, C. W. Knudson and L. P. Johnson has been appointed to promote the road.

Bridgeton, N. J.—The proposition for an electric road in this town is being revived. Mr. Oberlin Smith, of the Ferracute Machine Co., is interested.

Brooklyn, N. Y.—A certificate of organization of the Coney Island, Fort Hamilton & Brooklyn Railroad Co. has been filed with the Secretary of State. The road will be a double track street surface railroad for the transportation of passengers and freight. The capital stock is $500,000, and the principal office will be in New Utrecht. The directors include Patrick H. Flynn, Peter E. Tynan and Michael Murphy of Brooklyn; Richard Bergen of Patterson, N. J., and J. K. Sherwood of Glenhead, L. I.

Carbondale, Pa.—An effort will be made, it is said to re-equip the abandoned road between Carbondale and Jermyn.

Catlettsburg, Ky.—The County Court has granted a franchise for the construction of an electric road between this place and Ashland, a distance of five miles.

Champaign, Ill.—The Champion Rapid Transit Co. have been incorporated to operate a street railway. Capital stock, $50,000. Incorporators, C. C. Rush, S. A. Power, John Ahern.

Chicago, Ill.—The Chicago Central Construction Co., with a capital stock of $500,000, was incorporated last month. In a general way it was organized to construct street railways, surface and elevated, to be operated either by horse, cable or electric power. No detailed plans of the company have yet been made public. Robert S. Hill is one of the incorporators.

THE Siemens & Halske Electric Co. of America, with headquarters in Chicago, have been incorporated to manufacture electrical devices; capital stock, $300,000; incorporators, O. W. Meysenburg, Edwin F. Bayley and Otis H. Waldo.

AN ordinance granting a franchise to the Chicago & Evanston Electric Railway Co. was introduced in the City Council February 1. The road is to run north to Evanston from the intersection of Southport Avenue and Clybourne Place. The overhead system will be adopted if the franchise is granted. Permission has been given the company to put up at the intersection of Lincoln and Southport Avenues two sets of poles similar to those intended to be used by the new company. The company propose to erect the poles so that those who are objecting to the construction of the line on Southport Avenue may see how the structure would look.

THE Chicago Central Construction Co. have been formed to build surface and elevated street railways; capital stock $500,000; incorators, Judson G. Sherman, Arthur Cox and Robert S. Hall.

THE Chicago & Plainfield Overland Electric Railroad Co. have been incorporated; capital stock $600,000; incorporators, Daniel W. Gale, Edwin A. Moulton and William Cummings.

Clarkesville, Tenn.—The new Providence & Clarksville Street Railroad Co. have petitioned for right of way. The incorporators of this new company are Wm. McDaniel, H. C. Merritt and E. C. Morrow of Clarksville, and J. J. Garrett, I. T. Gold and R. J. Ellis of New Providence.

Columbus, Ga.—New York capitalists have signified their willingness to build an electric car line from Marietta to the Chattahoochee river, provided citizens of Marietta contribute about $12,000 and the citizens along the line will contribute land to the amount of $35,000.

Connellsville, Pa.—Work on the Connellsville Electric railway will be begun May 1.

Covington, Ky.—A street railroad has been projected, to connect with the proposed College Hill & Mt. Airy Electric Line at Cumminsville.

Detroit, Mich.—A petition for a street railway franchise has submitted to the City Council by Fred. C. Whitney, E. A. Rouff, Augustus Rouff, John Pfeffle, George Dingwall, Matthew Finn, C. W. Casgrain and J. H. Lesher. The streets for which they ask a franchise are Larned Street from Woodward Avenue to the easterly city limits; Russell, from Larned north to Canfield, and Canfield to the city limits. They offer a three cent fare.

Grand Rapids, Mich.—Percy T. Cook has filed a petition for a franchise for a street railway. His route, as asked for, covers Ionia, Spring, Monroe, North Division, Pearl and Coldbrook Streets and Plainfield Avenue.

Greensboro, N. C.—The Greensboro Street Railway Co. have had a survey of their road made, and construction will probably be begun soon.

Hamilton, Ky.—The Hamilton Electric Street Railway Co., Ltd., have applied for incorporation. Among those interested are: George Roach, J. M. Lottridge, Robert Thomson and J. V. Teetzel, of Hamilton, and H. M. Pellatt, of Toronto. The purpose is to build a street railway from the city to Barton.

Hamilton, Ont.—The Hamilton, Grimsby & Beamsville Electric Railway mentioned last month, is to be twenty-four miles in length. The capital stock is $200,000. A forty pound T rail will be used. Adam Rutherford, Edward Mitchell and Stuart Livingston are interested.

Hopkinsville, Ky.—An electric road is to be built here in the spring.

Indianapolis, Ind.—Joseph R. Robinson has sent a communication to the Board of Public Works making a proposition for a street railway franchise on all the principal streets of the city.

DR. LIGHT and other citizens of Broad Ripple have asked the Board of Commissioners for a new franchise to build an electric line to Broad Ripple.

Kansas City, Mo.—Articles of incorporation of the South Suburban Railway Co. were lately filed. The stockholders are Ira C. Hubbell, Clarance A. Ross, D. J. Haff and Robert E. Shryock of Kansas City, and George K. Wheeler of Chicago. The capital stock is $2,000, all paid.

A NEW street railway company, the Stock Yards & Northwestern, are seeking a franchise to build a road from the stock yards to the

northwestern part of the city. It is understood to be an extension of the West Side electric line.

Two belt line projects are also up for consideration before the Council. One of these is the old McAlpine scheme which has been discussed often. The project is about as far along as it was two years ago. The E. L. Martin belt line also want a franchise covering practically the field the McAlpine project would like to fill The company are apparently in deep earnest, as a branch switch is now being constructed back of Fowler's to connect the Second Street depot with the Northwestern and Maple Leaf roads and give them entrance to the other side, and possibly to the Union Depot.

Knoxville, Tenn.—The route of the South Knoxville Street Railway is being surveyed by J. K. Payne and construction will probably be commenced soon.

Lebanon, Pa.—The Lebanon & Myerstown Street Railway Co. with a capital stock of $100,000 have filed an application for a charter. The charter members include the following: J. M. Shenk, Lyman Nutting and C. Shenk, of this city; H. H. Kreider and S. L. Brightbill, of Annville, and Adam Behny, of Myerstown. The route will be on Walnut, Fourth, Guilford and Front Streets and the turnpike to Myerstown. The new company is not antagonistic to the Lebanon & Annville Street Railway, but is intended as a feeder to the former. The charter members, with several exceptions, are interested in the former. This line will be ten miles long and will operate eight cars.

Lima, O.—W. L. Parmenter, Wilbur Fisk, Thomas Duffield, Theo. D. Robb and F. Langan, have asked for a franchise for an electric railway.

Lynchburg, Pa.—The Lynchburg Edison Electric Co. with P. J. Oley, R. L. Miller, F. P. Christian and others as incorporators, have applied for a charter. The company are authorized to construct and operate electrical railroads.

Manchester, Va.—A bill to incorporate the River View & South Side Railway Co. has been introduced in the State Senate. The incorporators in the bill are James H. Dooley, W. G. Taylor, R. B. Chaffin, H. C. Beattie, W. L. Moody, J. H. Middendorf, Thomas Barry, E. A. Saunders, Jr., Matthew Gilmore, and others. The company desire a charter to build a bridge across James river above Manchester. The object is to have a belt line street railway through Richmond and Manchester. The erection of such a bridge as is proposed, would mean the connecting of the River View Street Railway of Richmond with the Richmond & Manchester Street railway.

Mauch Chunk, Pa.—The Carbon County Electric Railway have been chartered, with a capital of $60,000, to connect Weissport, Packerton, Mauch Chunk and Glen Oaks. The incorporators include Ambrose B. Clemmer, Richard Greenwood, Barnabas Dewitt and Harvey Barton, of 338 N. Water Street, Philadelphia.

McKeesport, Pa.—The Union Passenger Railway Co. have been organized to build four miles of double track, which will reach from the centre of McKeesport to outlying districts, Christy Park, Riverton and the hill district. The charter has been granted, and the line, it is stated, will be built in the summer.

Meadville, Pa.—F. R. Shryock and others have presented a petition asking for a franchise along Water Street and the Terrace through Vallonia to the driving park and then to add other routes. The Water Street line they hope to have in operation by May.

Mobile, Ala.—James H. Wilson, of this city proposes to establish three lines of electric railway and has asked for the necessary franchises. He has agreed, in consideration for the franchise, to furnish to the city of Mobile 200 arc lights of 2,000 C. P. each, the lights to burn all night and every night—bright moonlight nights excepted—at the rate of eighty-five dollars per year for each light for the term of five years. Others interested in this project are John Wilson, president of the Western Manufacturing Co., of Leavenworth and G. C. Rogan of the Waco (Tex.) Electric Light Co., and who lives in Waco.

Montgomery, Ala.—A. W. LeBron, Phares Coleman and R. P. Dexter, have been granted a franchise to build an electric railroad.

Mt. Holly, N. J.—An electric railway, two and one-half miles long, is proposed. $15,000 has been raised to carry out the project.

Nashville, Tenn.—F. W. Hunter & Co. are interested in the construction of a new line to Glendale Park.

New Berne, N.C.—The proposed electric road here will probably be built this spring. Wm. C. Clark of Wakefield, R. I., is interested.

Newton, Mass.—The Newton & Boston Street Railway Co. hope to have their line in operation the early part of July. The company contemplate an extension to Newton Highlands, and have already petitioned the aldermen for location through Walnut Street to Lincoln Street, Newton Highlands.

Olympia, Wash.—The recent sale of the Olympia Light & Power Co's bonds will, should the company meet with the expected support of the people, insure for Olympia a well equipped line of electric railway.

Pasadena, Cal.—George H. Riggs has asked for a franchise on certain streets.

Petersburg, Va.—Those interested in the Richmond, Chesterfield & Petersburg Street Railway Co., say the road will certainly be built. Electricity will be used.

Phillipsburg, Pa.—An electric street railway, connecting this place with the mining districts, is under consideration.

Pittsburg, Kan.—The construction of an electric road is now assured, and the projectors are figuring on the cost of materials.

Pittsburgh, Pa.—The Granview Traction Co. will begin work on their ten miles of road in the spring. On one mile of the road, where there is a heavy grade, cable will be used, and on the remainder electric power will be employed. The electric system is not yet decided upon. W. B. Lupton is president of the road, and F. R. Gordon, secretary.

WORK will commence on the proposed new incline from South Tenth Street to Allentown in the early spring. H. Sellers McKee is the president of the company.

Plainfield, N. J.—City Clerk Frank W. Runyon, has been authorized by the Common Council to advertise for proposals to construct an electric railway in Plainfield.

Pueblo, Colo.—B. F. McDaniel has applied for a street railway franchise between Pueblo and Overton.

Punxsutawney, Pa.—A charter has been issued to the Punxsutawney Street Railway Co. of Jefferson County, to connect Punxsutawney and Clayville. Capital $18,000. J. K. North is the president.

Redlands, Cal.—I. N. Hoag has asked for a street railway franchise on Orange and other streets.

Richmond, Va.—The Richmond, Chesterfield & Petersburg Street Railway Co. have applied for a charter. The incorporators include J. M. Harris, Freeman Epes, E. A. Catlin and C. A. Epes. The company are required to commence the construction of their railway within two years from July 1, 1892, and complete three miles of same within five years thereafter.

Rockland, Me.—Geo. E. Macomber, of Augusta, and W. B. Ferguson, of Boston, with others, have purchased the street railway franchise here and propose to build an electric road from the railroad wharf up Mechanic Street, Main and other streets to Camden, work to begin as soon as the frost is out of the ground. Thomaston will probably not be reached this year. The charter requires the construction of a mile and a half of road in the city by July 1, 1892. Bids for construction and equipment are wanted. Nine and one half miles will be built. Address Geo. E. Macomber, president.

Salem, Ore.—E. F. Parkhurst and associates have been granted the right to operate a railway line on the county roads leading from Salem to Jefferson, Lake Labish, Silverton, the Blair-Forward coal mines in the Waldo Hills. The franchise gives permission to maintain either a single or double track, the passenger and freight cars being hauled by electricity or other motive power. Mr. Parkhurst is the recent purchaser of the Salem Street Railway Co.'s franchise, and his associates are Eastern capitalists.

San Francisco, Cal.—J. W. Hartzell of the San Francisco & San Mateo Railway Co., with others, has asked for an elevated railway franchise. Electric motors are to be used. The petitioners agree to pay the city two per cent. of their gross receipts and ten dollars a year license fee for each car used. The franchise is to last for forty-nine years, two miles of the road to be constructed in two years and all of it in three. At the end of forty-nine years the city is to have the right to purchase the system at an agreed price.

Scottdale, Pa.—An electric railroad between Scottdale and Broad Ford, in Fayette County, seems assured. The estimated cost is $30,000 nearly all of which is subscribed. N. Miles is president of the company, J. E. Byrne secretary and W. N. Porter, treasurer. The line will be five miles long and the gauge five feet two inches. The projectors hope to have the road in operation by July 1.

Springfield, O.—John A. Blount has made application to the Council to construct an electric railway.

South Bethlehem, Pa.—The projectors of the South Bethlehem & Saucon Electric Street Railway Co. are confident that they will secure sufficient encouragement to assure the construction of the proposed road.

South Norwalk, Conn.—A project for building an electric railway to Wilson Point, Bell Island, Roton Point and Five Mile River, is under discussion.

Tacoma, Wash.—Col. Frank C. Ross expects to build a line to Sumner this summer.

Waltham, Mass.—A stock company is being organized to construct an electric street railway between Waltham and Watertown. Those most prominently interested are Francis Buttrick, of Waltham, and S. S. Gleason, of Watertown.

Washington, D. C.—The district commissioners have recommended the incorporation of the Northeastern Street Railway Co., the Washington & Brookland Railway Co., and the Washington Central Railroad Co.

West Memphis, Ark.—The West Memphis Railway Co. have been incorporated at Little Rock, Ark., with a capital stock of $10,000. The company propose to construct a railroad one and one-half miles in length, in the town of West Memphis. The incorporators are Chas. H. Organ, Chas. B. Bryan, Chas. W. Hunter, John S. Toof and Wm. Randolph.

Wheeling, W. Va.—The Mozart Park Association are said to be considering the construction of a street railway to Mozart Park.

Winnipeg, Man.—The electric railway franchise, which has been long under discussion, was finally awarded last month to a company, of which the following are provisional directors: W. C. Van Horne, James Ross, Montreal; William McKenzie, Toronto; Peter McLauren, H. Morrison, Montreal; George H. Campbell, Winnipeg. Work on the railway is to be commenced immediately.

Worcester, Mass.—William P. Searles, president of the North End Street Railway Co., has petitioned the Clinton selectmen for right of way in that place. The proposed route of this road has recently been surveyed by A. W. Woods, civil engineer.

Obituary.

We regret to announce the death last month of Henry Church, manager of the Phœnix Iron Works, Meadville, Pa. Mr. Church was born in Meadville in 1842, and at the time of his death was in his fiftieth year. He had been connected with the Phœnix Iron Works for the last twenty years, was business manager of the company for a long period and had a wide circle of friends.

Transmission of Power by Electricity.

The transmission of power in mills by means of costly belting, pulleys and shafting, and, in hundreds of cases, by steam pipes radiating from a boiler house to scattered auxiliary engines has long been considered a costly and more or less unsatisfactory method. This consideration is becoming stronger and more widespread as the adaptation of electricity for the transmission of power progresses towards further development and becomes better known. The problem is of especial interest to the street railway manager on account of his exceptional opportunities to distribute electric current for power purposes. The Edison General Electric Co. seems to have the honor of being the first to solve the problem in a comprehensive manner. The transmission of power from one central power house, containing all the boilers and engines, to the forty and more different buildings which go to make up the Schenectady Works of the Edison company and at which over more than 3,500 men are employed, has attracted attention from all sides. A New York publication, *Power*, chiefly devoted to mechanical interests, considers the matter of so great importance, that, in its February issue, it gives a full and graphic description of the manner in which the elimination of the various defects, mentioned above, is effected.

The power house is situated almost in the middle of a piece of land twelve acres in extent, and is surrounded on all sides by the different buildings to which it supplies the necessary power. This house contains a battery of boilers of over 2,000 H. P. capacity, the necessary engines to drive the electric generators and the generators themselves. Radiating in all directions run the conductors through special underground tubes to the different buildings, where they are connected to Edison motors, which in turn are connected by belts to the shafting serving to operate the machinery. By the adoption of this method the general aspect of the interior of the buildings is entirely changed. The power engine connected by steam piping to the boiler house is now replaced by a small electric motor, switchboard and a regulator occupying, perhaps, less than one-fourth the space. One throw of a small switch lever, the motor is running noiselessly, and the whole machinery is in motion. There is no trouble, no engine on centre, no steam, no smell and no dirt. The attention required by the motors is very slight.

Electricity is also conveyed along the wires to the different testing rooms, where all kinds of electrical power apparatus is continually under delicate test. In addition, the two largest machine shops, properly so called, where the big Edison dynamos and their smaller brothers are assembled, and the foundry, are each equipped with traveling cranes, which are operated exclusively by means of electrical motors.

In addition, *Power* gives the following facts in figures: The power plant comprises an Armington & Sims 10 × 11 engine of 150 H. P., driving on 100 kilowatt railroad generator and two 100 kilowatt standard generators, and another Armington & Sims engine of same proportions, in reserve, coupled to one fifty kilowatt and one 100 kilowatt generator. A small engine of same make of twenty-five H. P. drives three 8.5 kilowatt generators. There are also two 300 H. P. Edison triple automatic engines, each driving two of the new Edison 100 kilowatt multipolar dynamos, and a 150 H. P. triple automatic engine driving two sixty kilowatt generators of former standard Edison type. The boiler battery consists of three boilers of 500 H. P. each, and three of 250 H. P. each, making a total of 2,250; this will eventually be raised to 3,000 H. P. when the three additional 250 H. P. boilers are put up. The present generator or dynamo capacity is about 1,000 kilowatts. This will be increased to 1,400 kilowatts as soon as possible and the normal capacity of the power station will then be 1,900 H. P. The normal output is about 950 H. P. at the present moment, but this is increasing as the new shops go up. The present floor area of the Schenectady Works is 11.84 acres. Current is distributed to forty-three motors of standard Edison type which would represent a capacity of 1,324 kilowatts if run to their full capacity. About 20,000 ft. of single conductor wire is used to convey the power from the central house to the motors and this does not include the wiring of the buildings or the conductors laid in Edison underground tubes. The voltage of the motor circuit is 250 volts, the lights running on 125 volt circuits. The loss of power in transmission is small when compared with the enormous loss when steam was conveyed to the small independent engines in the scattered buildings.

The Wilmington (N. C.) Street Railway.

Work on the electrical equipment of the street railway is being pushed rapidly forward by the contractors, J. G. White & Co. of New York, and will probably be finished by April 1. The present rolling stock of the company consists of seven closed and four open cars, and the line is four miles in length, laid with thirty-three pound girder rail. One mile of forty-five pound Lewis & Fowler rail is being laid, and the overhead system is being constructed for the five miles of track. The company are also building one and one-half miles of freight track in which sixty pound rail is to be used, and a steam dummy. Six open and two closed electric motor cars have been ordered and the company will retain four of their present open cars as trailers.

The contract has been let for two 100 H. P. boilers and two 150 H. P. Ball engines. The location of the power station, car sheds and offices is at the corner of Water and Orange Streets. The capital stock issued and fully paid is $100,000. All the old issue of bonds is now in the company's treasury. The architect of the power station is Clarence S. Luce.

Detroit Railway Equipment on the Merrimack Valley Road.

In the summer months the Andover and Lawrence branch is the most popular line of the Merrimack Valley Street Railway Co. The line was patronized so extensively last Summer that a record was made of 140 fares collected on an open car designed to seat forty persons. The equipment was furnished by the Detroit Electrical Works. Each car is provided with a forty H. P. standard motor.

The road is one in which the Detroit company take no little pride. For four months, they state, these unusually heavy loads were carried without the loss of armature or field coil. The statement holds good up to January 1. The mileage of the car was then over 110,000. The clean record was made in the face of obstacles. The road is almost a continuous grade, which averages seven per cent.; but at points it is nine and one-quarter per cent. On account of the small feeder capacity and the great increase in the service beyond the original plan, the loss on the line was extremely great. The average voltage at the steepest grades was, it is claimed, not over 250, and at times it ran down to 190.

Electric Consolidation.

The consolidation of the Edison General Electric Co., and the Thomson-Houston Electric Co. in regard to which negotiations were commenced several years ago, but were afterwards broken off, seems now certain of consummation.

It is proposed to form a corporation with a capital stock of $50,000,000, divided into 500,000 shares of $100 each, of which not more than 20 per cent. may be preferred stock. The preferred stock is to be entitled in each year to receive dividends amounting to 7 per cent. cumulative, but without any further right of participation in the profits, and without preference as to principal.

Shares of the stock of the Edison company are to be exchanged in full payment for shares of common stock in the new corporation, share for share.

Shares of preferred stock of the Thomson-Houston company are to be exchanged in full payment for shares of preferred stock of the new corporation, at the rate of four shares of the old stock (par $25 each) for one share of the new (par $100 each).

Shares of common stock of the Thomson-Houston company are to be exchanged in full payment of common stock of the new corporation at the rate of five shares of the old stock for three of the new.

This provides for a total stock of $33,400,000 and a balance of $6,000,000 preferred, and $10,600,000 common stock in the treasury.

Each subscriber is to deposit with the New York Guaranty & Indemnity Co. of New York, or the Old Colony Trust Co. of Boston, his stock in exchange for suitable trust receipts, which are to be surrendered upon the issue of new stock.

This plan of consolidation is to be carried out under the direction of the following committee: J. Pierpont Morgan, D. O. Mills, H. McK. Twombly, Frederick L. Ames, T. Jefferson Coolidge, and Henry L. Higginson.

It was first said that C. A. Coffin of the Thomson-Houston company would be general manager of the new company, and that H. McK. Twombly would be its president. Later rumors state that Mr. Twombly has declined to serve as president and that office will be filled by Mr. Coffin.

Annual Report of the Edison General Electric Co.

The third annual report of the Edison General Electric Co. given to the stockholders last month showed among other things that the gross business of the company was $10,942,640, on which the profits, including the $271,592 written off against the cost of the manufacturing plants, were $1,666,535. To this amount must be added the general receipts at the main office, $83,013, making total net earnings of $1,749,549.

Deducting from the net receipts of the company, exclusive of those of the Edison Electric Light Co,, the sum of $271,592, charged off on manufacturing plants, and $286,477 charged off against liquidation, materials in stock and experimental account, there remain $1,191,479 as the net result of the year from the business of the Edison General Electric Co. alone. Adding $1,100,432, surplus profits carried over from the preceding year, we have a total of $2,291,912 profits available for distribution. After paying $1,031,845 in dividends, $1,260,067 is carried forward into the new year.

The Edison Electric Light Co. received during the year $631,672 in bonds and stocks as license fees from licensee companies, worth at a moderate valuation, say, $500,000, of which the General company is entitled to over ninety per cent., or, say, $495,000, which is equal to, say, 3.16⅔ per cent. additional on the capital stock.

The general balance sheet shows a footing of $21,507,284 for 1891, against $17,958,852 in 1890, an increase of $3,548,431.

The gross sales of the company reached nearly $11,000,000; the bills and accounts receivable increased only $261,663 during the year, showing the promptness with which the collections were made.

In regard to their electric railway department the report of the second vice-president to the president states: During last summer we were compelled to put on the market a single reduction motor to meet the demands of the street railway companies for a motor, the wearing parts of which would not suffer such rapid deterioration. While a great deal of experimental work had to be done to bring this new motor up to the high standard attained by our double reduction (Sprague) apparatus, we happily passed that period some months ago, and our single reduction motor is, we have reason to believe, from tests made by our customers, of very substantial construction and more economical of operation than any similar apparatus now offering. There is every indication that there will be a large increase of business in this department also.

The same officers as before were elected with the exception of S. Spencer, trustee, in place of J. B. Williams, trustee. In his letter accepting the presidency Mr. Villard stated that he accepted the office only on the understanding that the appointment was temporary and that he would be allowed to resign before April 1.

Personal.

Mr. L. E. Meyers, special agent of the Detroit Electrical Works, is located at 431, the Rookery, Chicago.

Mr. Norman McD. Crawford, has been appointed electrical engineer of the Jersey City, (N. J.) & Bergen system.

Mr. M. C. Sullivan has accepted the position of New York agent for the New Process Raw Hide Co. of Syracuse, N. Y.

Mr. Francis G. Daniels, formerly of the Short Electric Railway Co., is now connected with Messrs. Barry & McTighe of New York.

Dr. Louis Bell has resigned as Editor of the *Electrical World* of New York. He will be succeeded by Prof. Carl Hering of Philadelphia.

Mr. C. J. Field, of the Field Engineering Co., gave a talk on "Electric Railway Construction" at Sibley College, Cornell University, February 12.

Messrs. Augustin W. Wright and H. M. Kibby, cable engineers, of St. Louis, have recently made a visit to New York and Boston, for the purpose of studying transit problems.

Mr. J. S. Sloan and Mr. D. S. Taylor, representatives for Europe of the Short electric railway system, have opened an office in the Gresham Buildings, Basinghall Street, London.

Mr. Gilbert Wilkes has resigned as the district engineer of the Eastern District of the Edison General Electric Co,, in order to take charge of the electrical work at the Detroit Electrical Works, as chief engineer.

Mr. D. F. Lewis, president, and Mr. E. W. Bliss, director, of the Brooklyn City Railway Co., have recently returned from an extended trip which was made for the purpose of inspecting the methods of electric traction in different cities, with a view of selecting the best system and appliances for the equipment of their extensive lines with electricity. The route included the cities of Pittsburgh, Cleveland, Chicago, Minneapolis, Buffalo, Rochester and Boston.

Mr. George W. Pierce, superintendent of the Concord (N. H.) Street Railway Co., was a welcome visitor at the office of the STREET RAILWAY JOURNAL during the last month. Mr. Pierce reports that the lines carried last year over 365,000 passengers, the population of the city being only 17,000. Notwithstanding the fact that good sleighing has prevailed in the city since a week before Christmas, the electric cars have not missed a trip on account of snow.

Mr. H. S. Farquhar, connected with the engineering department of the Baltimore City Passenger Railway Co., has recently been in New York inspecting the work of the Broadway and Third Avenue cable lines. Mr. Farquhar confirms the report that the above company have decided to cable their Blue Line during the coming season, in addition to the work already under way. This will require two additional power houses, and will make an aggregate of twenty-six miles of cable construction.

Mr. Alexander B. Allen, representative of George Cradock & Co., wire rope makers, of Wakefield, Eng., having completed his tour around the world in the interests of his company, is again on a visit to this country, presenting to street railway men the merits of the Lang lay rope. Mr. Allen is confident that when our people learn how to splice and handle this type of rope that it will be extensively adopted by cable railway managers. Referring to particulars, Mr. Allen states that with a seven wire rope it is highly important that the rope be carefully inspected, and as soon as a broken wire appears the exposed ends should be cut off, for the wires being large and strong are apt to catch on the grip, and may result in pulling the car along or loosening a strand of the rope.

Mr. M. W. Hawks, representative of the St. Lawrence Ropery, Newcastle-on-Tyne, Eng., has recently arrived in this country from Australia, and is now engaged in interesting cable railway men in the merits of the Lang or long lay rope. Mr. Hawks is spending some time in Providence, R. I., where one of the ropes manufactured by his firm is now in use, and is instructing the manager in the method of splicing and care of the rope. One secret in the splicing in this type of rope, we are told, is untwisting the strands at the point where they cross before tucking, in which case, the wires being straight, pack close together and prevent any enlargement of the rope at this point. Mr. Hawks reports an interesting fact in relation to the driving of ropes by the figure 8 method, as employed on the Melbourne, Australia, lines. The winding drums being lined with wooden blocks the rope is sometimes liable to slip, but by cutting a slit in the bottom of the groove with a saw the tendency to slip is entirely obviated.

New Publications.

The Electrical Railway Inventions of George F. Green, is the title of a pamphlet which has just been issued by Oliver S. Kelly, of Springfield, O., who owns the Green patents.

Decennial Number of the Electrical Review, published in honor of the Buffalo Electric Light Convention, by the *Electrical Review* Publishing Co., N. Y. This issue celebrates the tenth anniversary of our contemporary's birthday and chronicles the progress of electrical industries during that time, as well as giving much interesting and pertinent matter about the present convention and convention city. The number is finely illustrated and printed, and reflects great credit upon its publishers.

The History of the West End Street Railway, etc. Edited and published by Louis P. Hager, Boston. Price, $1.00. In this volume are collected, together with a history of the West End Street Railway, sketches of the early street railways of Boston and account of their consolidation, a number of the speeches of Pres. H. M. Whitney, and notes on different supply houses. A number of advertisements are also included. There are also a number of illustrations. To those interested in the road the volume has many attractions, giving, as it does, the fine record in the line of advance made by the road in the past. To all the book presents much valuable matter, and many will appreciate the convenience of finding in handy form the important addresses of President Whitney.

Annual for 1892. Published by the Merida, Yucatan, Street Railway Co. The Street Railway Co., of Merida, Yucatan, has a capital of $400,000, thirty-eight cars in daily operation and a length of line 25,375 metres. Their method of publishing annually a "Directorio," would in this country be considered quite an innovation. The pamphlet is a small paper covered volume containing sixty-two reading pages with about the same number of advertising pages, and gives a sketch of the history of the road, time table of operation and names of officers, as well as considerable lighter reading such as acrostics, puzzles, proverbs, and short pieces of poetry. To interest the readers still further in the local advertisements a short notice at the end of each acrostic or riddle informs the reader at the store or office of which advertiser the solution can be learned upon inquiry.

Practical Electrical Engineering: A Complete Treatise on the Construction and Management of Electrical Apparatus as Used in Electric Lighting and the Electric Transmission of Power. By W. W. Beaumont, C. H. W. Biggs (editor), C. Capito, G. Kapp, A. Reckenzaun, P. Sellon, J. Swinburne and H. Swan. London, Biggs & Co.; New York, J. A. Penman. Published in 18 monthly parts, 10 x 13 ins. Price, 75 cents per part, and in two vols. at $7.50 per vol. The purpose of this treatise, of which the first nine numbers have been issued, completing Vol. 1, is to consolidate the knowledge that applies directly to the production and use of electric light and power apparatus. With this end in view, in addition to the general principles of electrical generators and motors, the laws governing the generation of steam in boilers and the transformation of its latent powers into mechanical energy in the steam engine are carefully treated, with an accompanying chapter on heat. Assuming then that the engines, boilers and dynamos are in order, the subject of switches and switchboards is taken up in Chap. XII, and several plans are given of latest types of switchboards installed by English engineers in lighting stations. Methods of measurements are taken up in Chap. XIII, and Electric Light Mains is the subject of Chap. XIV. The section on Tramway or Street Railway Work will appear in the second volume, and will be contributed by Mr. A. Reckenzaun, who will also write upon secondary batteries and their applications. The work is fully illustrated and handsomely printed.

The Tramway and Railway World.—A monthly review of current progress in steam, electric, cable and other traction, Vol. 1, No. 1, published monthly by the Tramway and Railway World Publishing Co., 53 and 54 Chancery Lane, W. C., London, Eng. We are pleased to chronicle the issue of the first number of the *Tramway and Railway World*, a paper devoted to the street railway interests of Europe, a prospectus of which we have already published. The management of this paper is in the hands of Mr. Frank X. Cicott, a gentleman already favorably known to street railway and electrical fraternity in this country and abroad by his contributions in the STREET RAILWAY JOURNAL and otherwise, and who is eminently fitted for the task he has selected, the publication of a high class periodical relating to street railway affairs. The first issue contains many handsome illustrations and much interesting reading. Among the principal subjects treated are, Electric Rapid Transit in Rochester, the Mt. Vesuvius Cable Railway, Electric Traction at Leeds, Walker's Patent Differential Drums and Two New Forms of Tram Cars (the Sessions and Pullman double decked). The object of the paper will be "to introduce to the notice of engineers and others in England the many improvements both in system and appliances which have for some time been successfully operated in other countries, and especially those methods which are likely to be introduced into the English market to meet the requirements of local conditions." That the paper is regarded with commendation in its chosen home and that it fills a long felt want is evidenced by the many favorable notices which it has already received from the British press.

The Electric Railway in Theory and Practice, by Oscar T. Crosby and Louis Bell, Ph. D. Published by W. J. Johnston Co., Ltd., New York. Price, $2.50: We are often asked by our readers for some work from which they can learn the cost and details of construction and operation of electric street railways. We take pleasure in referring them to the above work recently issued. It is true that the answer is not altogether satisfactory, or rather, some of the chapters are not written in a style to be read with facility by the average street

railway man, but a reader who seeks practical information on the essential features of electric traction (and there is no manager or electrical engineer who should not), and is willing to read slowly and thoughtfully and with study, will find in the "Electric Railway" a very serviceable treatise. It will not so much give him a "ready-made" system, as it will enable him to study out the best practice to be adopted under the peculiar conditions with which he may have to contend. That is not always the best book that thinks for one, but that which makes one think. This is practically true of the above work.

The matter is divided into twelve chapters with five appendices. The chapters relating to the Line, Track, Station and Commercial Efficiency, are the most important, and are exceedingly interesting and practical. We suggest to the purchaser not to begin reading the work at the first chapter but rather at the fourth, seventh, or ninth, for there is a certain indefinable difficulty with the style of the first chapter that is likely to discourage the reader so that he would lay the work aside and thus remain ignorant of the very valuable matter contained in the subsequent chapters. The character of this chapter, we suspect, is deliberate and intentional—the result of a purpose to make clear to the constructing electrical engineer only the essential line of practice to be followed to produce an efficient generator or motor. It presumes a large previous knowledge of the fundamental principles of electricity.

Both authors by their study and practice have become eminently fitted for the production of such a treatise. Mr. Crosby has had actual experience in constructing and operating electric railways, and his position as manager of a great electrical company has given him a rare opportunity of becoming familiar with the advantages, as well as the shortcomings of electric traction. Notwithstanding the fact that Mr. Crosby is interested in the manufacture of particular motors, there seems to be, throughout the book, an unbiased expression of opinion regarding the merits of different motors. Dr. Bell, late editor of the *Electrical World*, is a thorough student in electrical matters, and his position has also brought him in frequent contract with the managers of electric lines, so that he has been able to confirm his opinions by the experience of others. No one interested in the operation of an electric line, and no one who contemplates adopting this method of traction can afford to be without this work.

The book contains 400 pages, and 179 illustrations, is well printed, handsomely bound, and carefully indexed.

Equipment Notes.

Haines Bros. & Co., of Kinderhook, N.Y., have bought the horse railway system of Fond du Lac, Wis., and will change it to an electric line.

The Pennsylvania Iron Works Co., Philadelphia, have opened offices at 11 Wall Street, New York, and in the Drexel Building, Philadelphia.

The R. D. Nuttall Co., of 179–189 Grant Avenue, Allegheny, Pa., have just issued a calendar for 1892 which is extremely ornamental and tasteful.

H. N. Bates & Co., of Boston, Mass., have just issued a new edition of their illustrated catalogue and price list. It is a handsome volume of nearly 200 pages.

The Bridgeport Machine Tool Co., E. P. Bullard, proprietor, are receiving a large number of orders for their special tools. Among the customers are electric manufacturing companies and street railway companies.

Westinghouse, Church, Kerr & Co., have issued a small pamphlet, recently, on power plants, which contains much valuable information. A larger pamphlet will probably be issued by the same company within the next year.

The U. S. Steam & Street Railway Advertising Co., Carleton & Kissam, proprietors, have added twenty more cars of the Newark Passenger Railway Co. to the long list of cars in which they already control the advertising privileges.

The Wright Engine Works, of Newburgh, N. Y., will be located in their new quarters in the northern part of the city in the early summer. The new plant will be complete in every respect, and will greatly increase the facilities of the company.

Beecher, Schenck & Co. are the successors of Beecher, Schenck & Benedict, managers of the American Casualty Insurance & Security Co., of Baltimore, Mr. Benedict having withdrawn from the firm. This company are making a very satisfactory record in insuring street railway property.

The Pratt & Whitney Co., of Hartford, Conn., have recently completed a number of gears for sweepers for the Thomson-Houston Electric Co. They are also making a number of large milling machines. The extensive factory of the company is crowded to execute the large orders recently received.

The Eddy Manufacturing Co., of Windsor, Conn., owing to the large demand for their motors in New England, have opened a branch office at Oliver St., Boston, which will be in charge of Edwin R. Gilbert. Mr. Gilbert has had an excellent experience both in the manufacturing and selling departments of the motor business.

The Thomson-Houston Electric Light Co., of Pittsburgh, Pa., have moved their office from the German National Bank Building to 44 Wood Street, where they have the entire building of five floors and basement, 30 x 120 ft. in dimensions, and where a complete stock of electric lighting, railway and power supplies is kept on hand.

Barbour, Stockwell & Co., of Cambridgeport, Mass., manufacturers of track material and supplies for street railways, switches, frogs, gutters, knees, tie rods, and the Dowd gravity track cleaner, have opened an office in New York at Room 149, *World* Building. Mr. H. R. Luther will have charge of the New York business of the firm.

The Gilbert Car Works, of Troy, N. Y., have recently been obliged, on account of large orders, to enlarge their shops. They have therefore decided to convert the sheds at the back of Cannon Street into a workshop, where partly constructed cars can be finished. They have also recently completed an addition to their foundry.

The Tripp Manufacturing Co., of Boston, number among recent shipments of their standard roller bearing trucks, a number to the Central Electric Railway Co., of Sacramento, Cal. The operation of these trucks has been so satisfactory that a neighboring road, the Oakland, San Leandro & Haywards Railway of Oakland, have ordered twelve similar trucks.

The Mather Electric Co., of Manchester, Conn., have recently closed a large contract with the Blatz Brewing Co., of Milwaukee, Wis., for the equipment of their new works with electric power apparatus complete, 350 H. P. of generators and 400 H. P. of motors. The generators will be of 175 H. P. each, and the motors will range in size from ten to fifty horse power.

The Goubert Manufacturing Co., of New York, will hereafter be represented in Pittsburgh by Mr. W. A. Giles, with headquarters at 416 Lewis Block. Mr. Giles is a prominent contracting electrical and mechanical engineer of that city. His territory will include eastern Ohio, western Pennsylvania and Virginia. A large sale of the company's feed water heaters is expected.

The Stratton Separator Co., of New York, have received an order from the Columbia Iron Works & Dry Docks Co., of Baltimore, for several large separators for use on the new cruisers, Nos. 9 and 10, now in course of construction for the government. These separators will be of the naval type especially constructed for the United States Navy and will have steel shells and brass heads.

A. & J. M. Anderson, of Boston, have recently received orders from the West End Street Railway Co., of Boston, for several thousand pieces of their well known Ætna insulating devices for overhead line work. The same company have also received several recent orders of ample dimensions from the Newark Passenger Railway Co., the Paterson Street Railway Co., and the Trenton Railway Co.

The Stratton Separator Co., 32 Cortlandt Street, New York City, have recently furnished to the Columbian Iron Works & Dry Dock Co., of Baltimore, Md., several large separators for use in the new cruisers Nos. 9 and 10 which the latter company are now constructing for the government. These separators are of the naval type, especially constructed with steel shells and brass heads to meet the requirements of the United States Navy.

Charles A. Schieren & Co., of New York, have, through their Chicago agent, E. A. Burrell, secured a large order for belts for the Benton-Bellefontaine Railway's new power house at St. Louis. Two fifty inch, double belts, each 116 ft. long, will be installed in this power house. The same company have also recently closed a contract with the Columbus Consolidated Street Railway Co., of Columbus, O., for four thirty-four inch, double electric belts, each 100 ft. long.

The Interior Conduit & Insulation Co. of New York, are making large shipments of their new Johnson switches to their agents and the principal central stations in the United States. They are already some thirty days behind time with their orders. One illuminating company have ordered 1,100 of their well known switches in two days. The company have in preparation a handsome illustrated catalogue, setting forth the good qualities of this switch. This catalogue will be issued together with a revised edition of their well known No. 4 catalogue, in the course of the next ten days or two weeks.

The Standard Underground Cable Co., of Pittsburgh, in their annual report show that the capacity of the company's factory at Sixteenth Street and Allegheny Valley Railroad is equal to turning out $1,000,000 to $1,250,000 worth of product per annum, if run night and day, while with day turn alone a capacity of from $600,000 to $750,000 worth is assured. The machinery of the company is of the most modern style, and is made almost exclusively from designs and patterns made at the company's works, and under patents owned by the company. The financial statement was very gratifying and is given in another column.

The Lewis & Fowler Girder Rail Co., of Brooklyn, have much favorable testimony from managers of roads where their girder rail has been installed. Among other places where it has been used is on the Winston & Salem, N. C., railway, where it has given such satisfaction, that Mr. E. L. Hawks, who is interested in that road and is also president of the Wilmington, N. C., railroad, has adopted the same rail on the latter, on account of the satisfactory results attained in Salem. In a recent report made by Mr. J. C. Wrenshall, of the Union Railway Co. of Baltimore, upon the Winston & Salem road, Mr. Wrenshall also speaks in the highest terms of the Lewis & Fowler rails.

The Providence Steam Engine Co., of Providence, R. I., whose engines for electric light and railway service have been adopted in many cities, have recently completed a compound engine which runs at 108 revolutions a minute, and develops from 500 to 1,000 H. P. This engine will be installed at the Thomson-Houston Works in Lynn, and will be used in the testing room of the large dynamos which are being constructed by that company for the West End Railway Co., of Boston. The Providence Steam Engine Co. have also installed recently a number of their engines for electric work with a number of companies, including the following: The United States Electric Co., Washington, D. C.; West End Electric Co., Philadelphia, Pa., and the Diamond Electric Co., of the same city.

The New Process Raw Hide Co., of Syracuse, N. Y., send us a copy of a letter recently received by them from A. H. Underwood,

secretary of the Auburn City Railway Co. of Auburn, N. Y., written under date of Feb. 4. In his letter Mr. Underwood says: "We wish to state to you our approval of the patent raw hide pinions furnished by you and now running on our motors here. We had a nine months experience with them and find they fill all requirements. Motors equipped with them run much more quietly, and with ordinary care the gears outlast the metal gears used. They require to be kept free from oils, and the ordinary car equipments can be kept much cleaner in that respect in consequence. You are at liberty to use our recommendation and may refer any parties to us whom you may see fit."

The Ball Engine Co., of Erie, Pa., write us that the Hygeia Hotel, Old Point Comfort, Va., is just installing a sixty horse power Ball engine, being the third furnished this hotel by the Ball Engine Co. The 150 H. P. engine furnished the Kittanning Electric Light, Heat & Power Co., Kittanning, Pa., was started a few days ago by F. R. Dravo & Co., Pittsburgh agents of the Ball Engine Co. The engine gives universal satisfaction. Lockport Gas Light Co., Lockport, N. Y.' have added another 100 H. P. Ball engine to their present very complete electric light plant. The same company have recently shipped to the Westminster & Vancouver Tramway Co., Vancouver, B. C., three 150 H. P. engines, and to the Commonwealth Iron Co., Commonwealth, Wis., a thirty-five horse power engine.

The Boies Steel Wheel Co., Scranton, Pa., have received a letter from J. H. Vander Veer, general manager of the People's Street Railway Co. of Scranton, Pa., in which the latter says: "In reference to the steel wheels of your make in service on our road, would say that the first pair, put in service Sept. 1, 1889, under a thirty foot car, six feet wheel base truck, is now running against the fourth pair of 250 lb. chilled wheels. This pair of steel wheels is wearing true and bids fair to last two years yet. This past summer we equipped twenty sixteen foot cars with your wheels, and are more than satisfied with them. I consider the traction qualities better with the steel wheels, aside from the fact that the car does not lose time from having to haul it off to replace wheels every eight or ten months."

The Joseph Dixon Crucible Co., of Jersey City (established in 1827), who own the largest graphite works in the world, and whose reputation as manufacturers of graphite, plumbago, and black lead is world wide, make a silica graphite paint which they particularly recommend for roofs, wood or iron bridges, car houses, fences, etc. This paint has been in the market for over twenty years, and during that time has proved its efficiency and desirability for the work mentioned. Tin roofs well painted with this substance are said not to require repainting for ten or fifteen years. The paint is equally useful for the other uses mentioned and has shown equally good records there. The same company manufacture a graphite grease for wire ropes, cables, gears, car boxes, etc., which is reported to be giving very good satisfaction.

The John Stephenson Co., Ltd., of New York, have in their shops at present, among other cars, a number of the order of twenty cars which they are finishing for the Fourth Avenue line in New York City. These cars are being painted a handsome wine body color and present a striking appearance. The order for 100 cars for the Broadway line which, as mentioned in our last issue, was awarded to the Stephenson Co. will add to the already large number of Stephenson cars which are in operation in this city. Some details of this order are given in another column. The grip cars recently built at the factory of this company for the Washington & Georgetown Railway Co., have been shipped to Washington and are giving great satisfaction. Among other orders recently received by this company is one from Yonkers, N. Y., for cars to be fitted with Eickemeyer motors.

The Edison General Electric Co., of New York, have closed, among other orders, two in Uniontown and Erie, in Pennsylvania. The former is with the Uniontown Street Railway Co., and is for 275 H. P. dynamo and station outfit complete, as well as motors for six cars. The Edison system was in use before the fire which destroyed the previous plant of this company. The second order is for two railway dynamos aggregating 560 H. P. capacity. The Edison company have recently put upon the market a constant current transformer or motor-generator. This is wound for any two voltages, and the manufacturers think will find wide use in street railway circuits where it can be operated from a 500 volt circuit, and will give currents of lower voltage for lighting, electro-plating or other service where electric current is useful, but where a 500 volt circuit could not be used.

Alfred F. Moore, of Philadelphia, Pa., has for many years occupied a leading position in the insulated electric wire business which is famlliar to "old timers" in the electrical field. But the rapid growth of electrical industries of all kinds, bringing into the field men from all sections of the country, makes it necessary to continually remind the various interests that efficient results cannot only be obtained by the use of the highest grade of materials. How well the trade generally has appreciated the efforts of this firm to raise the standard of all insulated wires and cables, and also the success that has attended their efforts is well shown by the large sales and high reputation of their wires. On another page attention is called to several classes of their goods which should be as well known to the electric railway companies as they are to the electric light companies.

The Interior Conduit & Insulation Co., of New York, in order to meet a demand for a tube that will not disintegrate when placed in cement under tile floors and in like places, be less liable to mechanical injury during the construction of a building, and also be proof against fire arising from external sources, are now manufacturing their well known insulated tubing covered or armored with metal. Where electric wiring is to be introduced in a finished building, this brass covered tube (polished), they think,will be found especially desirable for and applicable to surface or exposed wiring, and they accordingly furnish their appliances brass covered to match. To avoid the possibility of careless or ignorant handling of their interior system by contractors or others, they have issued a set of specifications which they supply to customers and architects, to assist in the work of installation.

The Reliable Manufacturing Co. of Boston, Mass., have shipped their ratchet brake handles and sand boxes to the following companies during the past month: Newburyport Car Manufacturing Co., Newburyport, Mass.; The Norwich Street Railway Co., Norwich, Conn.; Citizens' Street Railway Co., Wheeling, W. Va.; Eastern Electrical Supply Co., Boston; Thomson-Houston Electric Co., San Francisco, Cal.; New York & Harlem Horse Railway Co., New York; Suburban Rapid Transit Street Railway Co., Pittsburgh, Pa.; Central Electric Railway Co., Sacramento, Cal.; Lamokin Car Works, Chester, Pa.; New Haven & West Haven Street Railway Co., West Haven, Conn.; Merrimac Valley Horse Railway Co., Lawrence, Mass.; Lynn Belt Line Street Railway Co., Lynn, Mass.; Worcester Consolidated Street Railway Co., Worcester, Mass.; Lynn & Boston Street Railway Co., Lynn, Mass.

The Morton Safety Heater Co., of Baltimore, on February 6 made a test of their system on a train of passenger coaches of the Baltimore & Lehigh Railroad Co., running from Baltimore to York, Pa. The train started from Baltimore on the coldest day of the season. It was seven degrees above zero outside, and nine degrees higher than that inside the cars. Steam was turned on for half an hour, when the temperature was seventy-two degrees. During the trip to York, which occupied four hours and twenty minutes, steam was turned on for only twelve minutes in addition. During the return trip steam was turned on for twelve minutes. Stops between the termini were made at forty-two stations where doors were opened for passengers to enter and leave the cars. During both trips the average temperature was maintained at seventy degrees. After the initial heating of the cars steam was applied only when the train was on the down grade so that the boiler was not robbed of steam. That portion which would have been exhausted was utilized. This system of stored heat in earthenware tubes has been since employed regularly on the road and it is giving entire satisfaction.

The Billings & Spencer Co. are furnishing their patent drop forged commutator bars to electrical companies and to companies using electrical apparatus. Among those who have ordered supplies of this kind from the company are the following: Edison General Electric Co.; Elektron Manufacturing Co., of Springfield, Mass.; Schuyler Electric Co., Middletown, Conn.; Mather Electric Co., Manchester, Conn.; Thomson-Houston Electric Co., Lynn, Mass.; National Electric Manufacturing Co., Eau Claire, Wis.; Standard Electric Co., St. Johnsbury, Vt.; Broadway & Newburg Street Railway Co., Cleveland, O.; Brush Electric Co., Cleveland, O.; Brosius Motor Sewing Machine Co., Atlanta, Ga.; Baltimore Car Co., Baltimore, Md.; Brooklyn Street Railway Co., Cleveland, O.; Manuel Balbis, Cienfuegos, Cuba; Eureka Electric Co., New York; Federal Street & Pleasant Valley Passenger Railway Co., Pittsburgh; Wightman Electric Manufacturing Co., Scranton, Pa.; Key City Electric Street Railway Co., Dubuque, Ia.; Minneapolis Street Railway Co., Minneapolis; Queen City Electric Co., Cincinnati, O. The company are selling to electric companies linemen's vises, carbon tongs, eye bolts, and forgings of all kinds.

The Berlin Iron Bridge Co., of East Berlin, Conn., recently closed a contract with the Chester Pipe & Tube Co., of South Chester, Penn., for their new building. This building will be fifty-two feet in width by 170 ft. long, and will be built entirely of iron, no wood work being used about the construction. The same company have taken a contract for a new boiler shop for the dry dock engine works at Detroit, Mich. The building will be sixty-eight feet in width, by 201 ft. in length, and will be designed and constructed entirely by the Berlin company, who not only furnish the iron work but the foundations, brick work, in fact, the whole building complete for the machinery. They have also closed a contract to supply an iron building for the True Blue Marble Co., of Rutland, Vt., to replace the mill of the company which was lately destroyed by fire. The building will be composed entirely of iron and marble, and will be eighty feet in width by 254 ft. in length, the side walls being of iron and marble and the roof of corrugated iron. Not only will the entire building be of iron, but the framework inside for carrying the gang saws, shafting, etc. will be of iron, so that there will be no woodwork about the building in any way to take fire.

Warren Webster & Co., of 491 North Third Street, Philadelphia, the sole licensees of the Williames vacuum system of steam heating, whereby they guarantee to heat buildings without back pressure upon engines and increase the efficiency of the heating surface, put the system in on trial. During the past few weeks they have booked a large number of orders. They furnish a descriptive catalogue of the Williames vacuum system, and send representatives to any part of the United States, at their expense, to examine plants and to explain to intending purchasers the advantages which they claim over the pressure system steam heating. During the past month, the same firm have received large orders for the Webster vacuum feed water heater and purifier. They have sent eighteen vacuum exhaust steam economizers to Sherman & Co., 71 Rempart du Lombard, Antwerp, Belgium, and through the good results shown they have sold all their foreign patents, which cover its manufacture in Great Britain, Germany, France, Belgium and Austria. All the economizers are sold on trial, with the guarantee to heat the feed water to the highest temperature with a less quantity of exhaust steam and with the greatest relief of back pressure. Other advantages are enumerated in the catalogue, which will be sent on application.

The Robinson Electric Truck & Supply Co., of Boston, added to their order book in a single week in February, orders for twenty-six more Robinson radial trucks. This company have about fifty

radial trucks in the works, to be completed for early spring delivery. The Robinson radial is so thoroughly and substantially built that in the hundreds now in use there has never been a break in any part of any truck through fault in design and construction, and only a break in two individual minor castings through violence. On one occasion, in a collision between a Robinson radial and an eight wheeled car, the radial knocked the eight wheeled car off its trucks into the street. The radial was uninjured, except that the controlling stand was broken. A new controlling stand was put on and the radial was again in regular service in less than an hour. The eight wheeler was in the repair shops for over two weeks. Not only is the radial most substantially built, but the framing of the car body for the radial truck is said to be stronger and more substantial even than the framing of coaches on steam roads. The popularity of the Robinson radial truck is shown by the fact that where it has been used orders for additional trucks are being sent forward to the Robinson company, and in not a single instance has a radial truck ever been discontinued where it has been put in operation.

The Page Belting Co. of Concord, N. H., report a very promising opening for the year 1892. Among the orders filled recently are complete new mill outfits for George O. Sanders, Nashua, N. H.; G. H. McDowell & Co., Cohoes, N. Y.; J. G. Bryson, Brazil, Ind., and Chattanooga Powder Co., Tenn. They have also equipped the electric light and power plant of the Peninsula Electric Light & Power Co., at Newport News, Va. This outfit included four "Acme" link belts and two "Eureka Dynamo" belts. They also furnished the complete outfit for the Penacook Electric Light Co., Penacook, N. H. Among the main belts shipped in the past month or so, they mention the following: A twenty-one inch, three-ply, for Madison, Me.; a thirty-six inch, for Muskegon, Mich.; a twenty-six inch, for North Leominster, Mass.; a twenty-four inch, for Detroit, Mich. They have done a very large business in their special electric belts, the "Acme" link, "Eureka Dynamo" and dynamo double. Some of the recent orders are: Of the "Acme," one to Bristol, Conn., three to Chicago, one to New York, and two to Presque Isle, Mich. Of the "Eureka Dynamo," two to Shamokin, Pa., two to Plymouth, N. H., one to Oswego, N.Y., one to Galveston, Tex., one to Cincinnati, O., one to Laredo, Tex., one to Raleigh, N. C., one to Wyoming, Mass., one to Bristol, Conn., one to Norfolk, Va., two to New York City, and one to Boston. Of the dynamo double, three to North Abington, Mass., four to Washington, D. C., one to New Orleans, one to Meyersdale, Pa., two to Chicago, one to New York, one to Boston, and one to White River Junction, Vt.

The Syracuse Tube Co. recently received an order from their representatives, the Engineering Equipment Co., of 143 Liberty Street, New York City, for a sample standard Syracuse pole for railway purposes, with the request that the same be "rushed." The company have every facility and the ability for the rapid execution of large or small orders for poles, as was illustrated by the following performance: The order mentioned above was received Wednesday and work was delayed until Thursday in order to employ some exceptionally fine skelp which was expected on that day. Upon its arrival on Thursday morning the skelp was taken into the mill and made into pipe, which in turn was used on the spot in the manufacture of the sample pole. The pole was then painted and shipped; all of which was accomplished by 12 o'clock noon. The pole was delivered in New York the next morning at 9 o'clock, as desired. The means and the amount of labor required to accomplish these results may not be apparent at first sight but some idea of the facilities and system required may be obtained when it is remembered that the pole contained three sections of pipe, each section of different size and length, and that the skelp had to pass through the ordinary process involving time and delays incidental to the manufacture of iron pipe and be completed before the making up of the poles could begin. The distinctive feature of the Syracuse pole is the exceptionally mechanical and strong manner in which the joints are made. The joints are the strongest parts of the Syracuse pole. They are made by inserting the smaller of two pipes into the larger and then swaging down the larger pipe while hot so that when shrunk upon the smaller pipe the joints are as strong as the original pipes themselves. This part of the process is facilitated by the use of dies under a steam hammer. The Syracuse Tube Co. have recently added to their space and equipment with the view to filling with despatch the large orders already booked and to be expected for the coming spring deliveries. The average capacity of their works is 600 poles per week, or 100 poles per day, which can be pushed to 800 poles per week when necessary to fill "rushed" orders. At these times a large stock of pipe of the sizes needed for pole manufacture is kept on hand and delays such ai might enter into the making of the special pole just described are avoided. Viewed in this light the above performance may be regarded as somewhat remarkable.

WESTERN NOTES.

The Brownell Car Co., of St. Louis, will erect additional buildings in the spring to provide additional facilities for their business.

F. W. Cushing, of 225 Dearborn Street, Chicago, will be the general Western agent for the Day Kerite insulated wires and cables.

The Hill Clutch Works have received contracts for furnishing machinery for the Benton & Bellefontaine Street Railway Co. of St. Louis, and the St. Louis & Suburban Railroad Co.

Chas. J. P. Heim, of St. Louis, Mo., whose portable fire hose bridge for cable railways has been described in this paper, writes us that he is willing to dispose of the patents covering its construction.

The Electrical Supply Co., of Chicago, report large sales of Wood's span wire ratchets, construction tools and railway material in general. They also carry in stock a complete line of parts and repairs for the Boston trolley and other goods.

Frank B. Rae has opened an office at 302 Hammond Building, Detroit, and will transact business as an electrical engineer. He will contract for the complete installation of street railway, electric light and power plants, and will supervise the construction work. He also is prepared to make reports on plants already installed, and to design new machinery.

The Short Electric Railway Co. of Cleveland, O., have recently closed an order for twenty forty H. P. gearless motors, to be used on the lines of the Consolidated Street Railway Co. of Grand Rapids, Mich. The contract was awarded to the Short company after a very careful inspection of a number of lines in different cities, on the part of the managers of the railway company.

The Walker Mfg. Co., of Cleveland, have secured the entire contract for the cable driving machinery for both stations of the Baltimore City Pass. Ry. Co., including five sets of machinery, in all of which the Walker differential winding drums will be employed. The same company have also secured a sub-contract from the Otis Bros. Elevator Co. for the Catskill Mountafn cable road. Length of incline, 7,000 ft.; elevation, 1,580 ft.

The Northern Car Co., of Minneapolis, are building the finest electric car ever turned out of their shops. It is being built for the Thomson-Houston company and will probably go to Sioux City. It measures about thirty-five feet over all, has ten windows on each side, and is mounted on double trucks, with thirty inch wheels. The body is paneled like a railroad coach and the finishings are neat and handsome. The interior is finished in polished light woods, and at night time will be brightened with eight large electric globes.

The Pullman Palace Car Co., of Chicago, report much interest and many inquiries concerning their new double decked, centre vestibuled car which has been described in these pages. These cars have been in use in a number of cities, and in every place have given excellent satisfaction, and several have already been ordered by street railway companies in different cities. The Pullman Palace Car Co. also report an order for twenty cars from the City & Suburban Railway Co., of Portland, Ore., and another from the Jacksonville, Ia., Electric Railway Co.

The Laclede Car Co., of St. Louis, are, at present, building some handsome cars for the Walnut Hills Electric Railway. The large order which this company received from the Third Avenue (New York) cable road for 375 cars is to be executed between now and midsummer. The first delivery of cars to the railway company is to be made in April and the last in July. The sample car sent to New York has been satisfactory to the Third Avenue management in every respect; 200 of the cars are to be closed, twenty-two feet in length, and mounted on four wheels, and the remaining 175 open but mounted on two four wheel bogie tracks.

The International Register Co. have opened an office at 435, The Rookery, Chicago, where A. H. Englund, formerly secretary and treasurer of the Electric Merchandise Co., is in charge as secretary and manager. The company have purchased the Pratt patents on conductors' fare registers, and have equipped a very complete factory for manufacturing these devices in both portable and stationary forms. Mr. Englund has a large acquaintance in the street railway field, and the prospect for a good trade is bright. The officers of the company are: President, A. S. Littlefield; vice president, W. J. Cooke; secretary and treasurer, A. H. Englund; superintendent, Charles E. Pratt.

The Falls Rivet & Machine Co., of Cuyahoga Falls, write us that they are very heavily loaded with work for electric plants at the present time, and are now erecting machinery at the following places: Wheeling Street Railway Co., Wheeling, W. Va.; The Powelton Electric Light Co., Philadelphia, Pa.; Louisiana Electric Light Co., New Orleans, La.; Edison Electric Illuminating Co., Easton, Pa., and are now erecting in their factory machinery for the following plants, and which they expect to ship at an early date: Utica Electric Light Co., Utica, N. Y.; Clinton Gas Light & Coke Co., Clinton, Iowa; Portsmouth Electric Light Co., Portsmouth, Ohio; Eckstein Building, Cincinnati, Ohio; Columbus Consolidated Street Railway Co., Columbus, Ohio.

The Stirling Co., Pullman Building, Chicago, manufacturers of their well known type of water tube safety boilers, have recently closed contracts with the following well known companies: Carnegie, Phipps & Co., Pittsburgh, Pa., 1,200 H. P.; San Francisco & San Mateo Railway Co., San Francisco, Cal., 1,250 H. P.; Los Angeles Consolidated Electric Co., 1,500 H. P.; Pacific Rolling Mills Co., San Francisco, Cal., 1,500 H. P.; Braddock Wire Co., Braddock, Pa., 600 H. P.; Cincinnati Wire Works, Cincinnati, O., 1,200 H. P.; Cold Storage Co., Chicago, 1,800 H. P.; Minneapolis Street Railway Co., Minneapolis, Minn., (second order), 2,000 H. P.; Toledo Water Works, Toledo, O., 1,500 H. P. This company have sold over 100,000 H. P. in the last three years, all giving satisfaction.

The American Car Co., of St. Louis, are very busy at present. In order to fill their many orders a night force and a day force have to be worked. As their paint shop is not yet finished they have rented the western portion of the large Cotton Compress Building not far from the works, and also situated on the railroad tracks. The company's present capacity is five cars per day. Among the large orders on their books may be mentioned 180 cars for the Washington & Georgetown railway, of which sixty are to be grip cars, sixty open and sixty closed trail cars; also 150 closed cars, twenty-two feet in length, with nine windows on each side, for the West Chicago Street Railroad, and fifty cars for the North Chicago Street Railroad. All work turned out by this company is first class in every respect, and needs no better recommendation than that it is supervised by Mr. Wm. Sutton and Mr. Emil Alexander.

The Brownell Car Co., of St. Louis, Mo., have received a large number of orders lately and report business as very brisk. Among their recent customers they mention the Baltimore Traction Co., for whom they are making a number of grip and trail cars for use on the Gilmor Street cable line, and the Consolidated Street Railway Co., of Grand Rapids. For this latter company they are building twenty summer car bodies which will be fitted with the Brownell improved trussed trolley bridge. This device has recently been patented by the Brownell Co., and its object is to strengthen the car roof while it supports the trolley. The Accelerator car manufactured by them is now in New York City and attracting much attention on account of its novel features. Mr. H. H. Littell, of Buffalo, who was recently in New York, rode on the car and expressed himself as much pleased with its principle and operation. The managers of the car company have much favorable testimony on the car and are justly pleased with the results attained by it.

Annual Report of the Louisville Street Railway Company.

The annual report of President T. B. Speed of the Louisville (Ky.) Street Railway Co. for the year ending December 31, 1891, and given to the stockholders last month, shows gross earnings $1,188,822.00, operating expenses $782,791.53, and net earnings $406,030.47. The increase of gross earnings as compared with 1890 has been $50,328.27, and as compared with 1889 has been $196,433.52. The increase of net earnings as compared with 1890 has been $24,314.58, and as compared with 1889 has been $63,198.65. The interest on the funded debt for the year was $314,180, leaving a surplus of net earnings of $91,850.47. The total mileage for the year 1891 is 8,153,618 miles, or an average of 22,338 miles per day. The average earnings per car mile on all lines for 1891 has been 14.57 cents; for 1890, 15.60 cents.

Expenses per car mile for 1891, 9.60 cents; for 1890, 10.40 cents. Net earnings per car mile for 1891, 4.97 cents, and for 1890, 5.24 cents.

The slight reduction in net earnings per car mile was caused by the additional number of cars run in 1891, as compared with 1890, principally trailers on the electric lines. The additional mileage has been 880,709 miles.

The funds arising from the sale of the bonds of the company have been exhausted in the improvements and extensions of the past year, and further money is necessary. The company are to continue to substitute electrical equipment on the remaining lines for animal power. No floating debt has been created by the company with the exception of a temporary loan of $20,000. The company have already equipped and in operation forty-one miles of electric roads, and there remains operated by animals ninety-two miles of road. The plan was therefore proposed of changing $1,000,000 common stock of the Louisville Railway Co. into preferred stock, allowing any stockholder to make the change upon payment of the market value, about $50 per share, in into the treasury of the company. The capital stock at present is $6,000,000, of which $1,000,000 is five per cent. preferred. It is thought that the plan will be adopted.

Annual Report of the Federal Street & Pleasant Valley Railway Co.

At the annual meeting of the Federal Street & Pleasant Valley Passenger Railway Co. of Pittsburgh, Pa, the report of the treasurer showed gross receipts for the year $388,505.39; expenditures, including salaries, labor, repairs, interest on bonds and general expenses, $300,601.02; net earnings, $87,904.37; dividend No. 33, paid in July, 1891, $39,000; surplus carried over to new account, $48,904.37. Dividend No. 34, of three per cent., payable January 25, was then declared on the earnings of the last six months. The president, D. F. Henry, in his report to the stockholders, after referring to the successful results obtained with electric traction and the satisfaction of the manngement in the same, stated that during the last year they had completed four and a half miles of new track laid with the improved Johnson girder rail, also three miles of new track laid with T rail and had replaced six and a half miles of old iron tram rail with heavier and better steel rail. The power plant had also been increased by the addition of one Westinghouse compound condensing engine of 250 H. P., and three Edison dynamos of 150 kilowatts each. The rolling stock had been increased by the addition of ten motor cars and three electric snow sweepers. Two car houses also had been built during the year. As a summary of the work of the preceding year Mr. Henry gave the following facts: "Passengers carried, 7,770,108; car miles run, 1,345,149, as against 6,612,913 passengers and 1,223,600 miles for the previous year, showing an increase of seventeen and a half per cent. in passengers carried, and about ten per cent. in the mileage run. Gross receipts, $388,505.39, or 28.88 cents per car mile, an increase of $56,604,59, or over seventeen per. cent. Gross expenses, including interest on funded debt, amounted to $300,601.02, being 22.35 cents per car mile. Excluding interest, and charging only operating expenses, we find 19.79 cents per car mile as the cost and show $122,279.37 net earnings, or 9.09 cents per car mile. In the past twelve months we have been quite free from delays, the greatest being about thirty or forty minutes, caused by an electric light tower being thrown down by a severe wind storm, thereby grounding our wires. And in conclusion, would add that notwithstanding the different roads we operate along narrow streets, with hundreds of curves, numerous steam, cable and electric railway crossings, and heavy grades, it is certainly very gratifying to be able to state that having handled over 14,000,000 passengers and run over 2,500,000 miles on our various roads in the past two years, not a single passenger has been injured while on board our cars."

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, JANUARY 26, 1891, TO FEBRUARY 16, 1892, INCLUSIVE.

JANUARY 26.

Car Brake, Edgar Peckham, Kingston, N. Y. 467,896
Carbon Brush Holder, Cyprien O. Mailloux, New York, N. Y. 467,542
Cushioned Car Wheel, Benjamin F. Haugh, Indianapolis, Ind. 467,721
Electric Railway, Warren B. Hutchinson, Passaic, N. J. 467,699
Motor Car, Charles Lancaster and John Sturgeon, Chester, England 467,741
Motor Mechanism for Street Cars, Rich'd W. Thickins, Minneapolis, Minn. 467,693
Sand and Water Distributing Cylinder for Cars, Thomas A. Heherington, St. Louis, Mo. 467,809
Street Car Replacer, James Findlay, Toronto, Canada 467,763
System of Electric Distribution, Nelson W. Perry, Cincinnati, O. 467,897
Trolley Wheel for Electric Cars, Levi A. Simons and George R. Root, Omaha, Neb. 467,583

FEBRUARY 2.

Cable Grip Adjusting Device, Henry H. Linch, San Francifco, Cal 468,064
Car for Use upon Inclined Railways, Jacob Messner, Calumet, Mich. 467,945
Combined Chair and Fish Plate Joint for Railways, William Wharton, Jr., Philadelphia, Pa. 468,162
Conduit Electric Trolley, Malone Wheless, Nashville, Tenn. 468,166
Conduit for Electric or Cable Roads, Clarence H. Bates, Minneapolis, Minn. 468,314
Electric Fare Register, Willard H. Gilman, Boston, Mass. 468,172
Electric Railway, Malone Wheless, Nashville, Tenn. 4 8,165
Electric Railway, Malone Wheless, Nashville, Tenn. 468,164
Electric Railway, Malone Wheless, Nashville, Tenn. 468,163
Electric Motor Regulation, Francis O. Blackwell, New York, N. Y. 468,128
Electric Railway Motor, Henry M. Byllesby, St. Paul, Minn. 467,969
Insulator, Charles T. Lee, Boston, Mass. 467,941
Rail Joint, Charles H. Jenne, Indianapolis, Ind. 467,935
Railway Switch, Samuel T. Mock, Milwaukee, Wis. 467,948
Side Bearing for Car Trucks, Melville V. Mullen, Chicago, Ill. 468,057
Street Railway Tunnel and Method of Constructing the same, Theodore G. Gribble, Yonkers, N. Y. 468,282
Trolley Wire Hanger, Charles T. Lee, Boston, Mass. 467,940
Truck for Vehicles, David L. Barnes, Chicago, Ill 468,146

FEBRUARY 9.

Adjustable Guard Rail for Street Cars, Daniel Catarleus, Brunswick and Augustus S. Crable, Lansingburg, N. Y. 468,454
Adjusting Device for Cable Grips, Clarence L. Anderson and George H. Fairchild, San Francisco, Cal. 468,555
Car Wheel, Henry F. Mann, Allegheny, Pa. 468,675
Car Wheel, Henry F. Mann, Allegheny, Pa. 468,676
Electric Motor, James T. Wilson, Tyrone, Pa. 468,716
Electric Railway, Charles W. Thomas, Jersey City, N. J. 468,708
Electric Railway System, William J. Ogden, Baltimore, Md. 468,575
Elevated Electric Conduit, Charles O. Newton, Homer, N. Y. 468,388
Elevated Railroad Car, William T. Shaffer, Evanston, Wyo. 468,699
Motor Gearing for Electric Cars, Elbert B. Phillips, Cleveland, O. 468,526
allway, Alexander G. E. Westmacott and James P. Hutchinson, Newtown, Pa. 468,608
Railway Joint, William A. Guthrie, Durham, N. C. 468,518
Trolley Wire Support, Jonathan P. B. Fiske, Lynn, Mass. 468,336

FEBRUARY 16.

Automatic Passenger Register, Daniel L. Tower, Brooklyn, N. Y 468,845
Cable Railway, Wm. C. Metzner and Gustavus E. Buschick, Chicago, Ill. 468,813
Car Step, Michael B. Ryan, St. Louis, Mo. 468,899
Car Truck, William A. Dutton, Cleveland, O. 469,011
Converter System for Electric Railways, Thomas Edison, Llewellyn Park, N. J. 468,949
Double Traction Motor for Elevated Railroads, George A. Stephenson, Los Angeles, Cal. 468,842
Electric Railway, Frank J. Sprague and Patrick F. O'Shaughnessy, New York, N. Y. 468,959
Electrically Propelled Car, Harry E. Dey, Brooklyn, N. Y. 468,948
Elevated Railway Structure, George A. Stephenson, Los Angeles, Cal. 468,841
Motor for Street Cars, Alonzo J. Painter, Pasadena, Cal. 468,824
Signal for Electric Railway Systems, Frederick A. Cheney, Elmira, N. Y. 468,787
Track Cleaner, James M. Taylor, Omaha, Neb. 469,103
Traction Device for Tram Cars, Walter B. Wright, Chicago, Ill. 468,860
Trolley for Electric Cars, John W. Beebe, Waterloo, N. Y. 468,779
Turn Table Connection for Electric Railways, Rudolph M. Hunter, Philadelphia, Pa. 468,912

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. Street Railway Publishing Company, World Building, New York.

The Accelerator.

The Accelerator car, exhibited at Pittsburgh by the Brownell Car Co., has since been running on the lines of the North Chicago Railroad Co. (cable) Chicago, the Twenty-third Street line (horse), and Broadway line (with horses), of New York City.

President Yerkes, of the Chicago lines, says of the car: "Every promise made regarding it has been fulfilled," and he has purchased the right for its use on all his lines. The car has been carrying large numbers of passengers in New York, and both railroad managers and traveling public seem satisfied with results.

QUOTATIONS OF STREET RAILWAY STOCKS.

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 7 Exchange Place, Members of Boston Stock Exchange. Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	84¾	85
West End Com'n	50	$7,150,000	J. & J.	5	1890-1891	73	73½

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Feb. 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co	100	$270,000	New.	...	Oct., 1887	90	95
Union R. R. Co., Prov	100	2,000,000	Q.—J.	2	1862-1863	190	192
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co	100	$360,000	J. & J.	4		200	225
Holyoke Street R. R.	100	150,000	J. & J.	4		190	200
Northampton Street R. R.	100	50,000				25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	3			65
Enterprise Ry. Co	25	250,000					8

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co		100,000	J. & J.	6	1915		
Enterprise Ry. Co		50,000	J. & J.	5	1906		

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE-SASSIER, 174 Common Street, New Orleans, La., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co	100	800,000	Quart.	1½	1867	120¾	123
Crescent City R. Co	100	1,150,000	"	1¾	1866	90	90½
Canal & Claiborne R. R. Co.	40	240,000			1888	22	26
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	130½	
Orleans R. R. Co	50	185,000	"	2	1868	72	
St. Charles Street R. R. Co	50	600,000	"	1½	1866	89½	92

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	101¼	
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93-'99		
do do new	1886	40,000	M & N	6	1896		
N. O. City R. R. Co	1879	495,200	J & D	6	1903	118	
N. O. & Carrollton R. R. Co.	1882	300,000	F & A	6	'92-'06	113½	
St. Charles Street R. R. Co.	1881	165,000	J & D	6	'89-'01		

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4		140	
State Street Horse R. R. Co	25	23,000	J. & J.	3		100	
New Haven & W. Haven R. R. Co	25					20	
New Haven & Cent'lle H. R. Co.							
Whitney Ave. Ry. Co	50	25,000				7	
Bridgeport Horse R. R. Co	100	140,000					
Hartford & Westfield Horse R. R. Co	100	200,000	J. & J.	3		125	

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co.	1874	20,000	J. & J.	7	Jan., 1894	105	
New Haven & W. Haven R. R. Co	1889	50,000	J. & J.	5	July, 1899	100	
Bridgeport Horse R. R. Co		50,000		6			
Hartford & Wethersfield Horse R. R. Co., Deb. Series A	1888	100,000	M. & S.	5	Sept., 1908		
Hartford & Wethersfield Horse R. R. Co., Deb. Series B	1890	100,000	M. & N.	5	May, 1910		
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued)		100,000	M. & N.	5	May, 1910		

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co	50	1,250,000	Q.—J.	1½		107	106
Broadway R. R. Co	100	525,000	Q.—F.	2		185	
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2		176	
Coney Island & Brooklyn R. R. Co	100	500,000				125	

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort		140,500	M & N.	7	May, 1894	104	
Atlantic Ave. R. R. Co. Cons.		900,000	A. & O.	5	Oct., 1909		106
Broadway R. R. Co		350,000	J. & J.	5	6 m. notice	100	
Coney Island & Brooklyn R. R. Co., 1st bonds		300 000	J. & J.	5	Jan., 1909		103
Coney Island & Brooklyn R. R. Co., certificates		300,000	J. & J.	6	July, 1894	101	
South Brooklyn Central R. R. Co., 1st		125,000	F. & A.	7	Aug., 1897	107	
South Brooklyn Central R. R. Co., 2d		150,000	F. & A.	6	July, 1941	103	
Brooklyn City R. R. Co., 1st		3,000,000	J. & J.	5	July, 1916	108	

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Aug.	1½	1890	112	117
Watervleit Turnpike & R. R. Co	100	240,000			1863	10	12

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	103	
" " " 2d Mort	1873	20,000	M. & N.	7	1893	102	
" " " 3d Mort	1875	28,500	J. & J.	7	1895	105	
" " " 4th Mort	1880	11,500	M. & S.	6	1905	105	
" " " 5th Mort	1888	50,000	M. & S.	5	1913	105	
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103	104
" " " Debenture	1891	200,000	M. & N.	6	1901	112	114
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	105	
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	75	

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾		25	27
Broadway & Seventh Avenue	100	2,100,000	Q.—J.	2		205	205
Brooklyn City	10	2,000,000	Q.—F.	2		165	170
Brooklyn Crosstown	100	500,000	A. & O.	4			
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2		104	108
Christopher & Tenth	100	650,000	F. & A.	1¾		115	116
Central Crosstown	100	600,000	Q.—F.	1¾		125	130
Dry Dock, E. B'way & Battery	100	1,200,000	Q.—F.	2		125	135
42d & Grand St. Ferry	100	748,000	Q.—F.	3		230	240
42d St., Manhat. & St. Nich. Av.	100	2,500,000				37	40
Eighth Avenue	100	1,600,000	Q.—J.	2		105	110
Houston, W. St. & Pav. Ferry. Leased to B'way & 7 ave	100	1,000,000	Q—F.	2		160	
Second Avenue	100	1,862,000	J. & J.	5		95	100
Sixth Avenue	100	1,500,000	M. & S.	3		130	140
Third Avenue	100	2,000,000	M. & N.	4		290	305
23d St	100	600,000	Q.—F.	2½		220	230
Ninth Avenue	100	800,000		3		90	95

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry		700,000	J. & J.	7	July, 1900	110	
B'way & 7th Ave., 1st mort		1,500,000	J. & D.	5	June, 1904	105	107
2d mort		500,000	J. & J.	5	July, 1914	105	106
Broadway Surface Guaranteed		1,500,000	J. & J.	6	July, 1924	106	107
Additional		1,000,000	J. & J.	5	July, 1905	93	95
Brooklyn City		200,000	J. & J.	5	Jan., 1902	105½	107½
Brooklyn Crosstown		200,000		5	1902	107	109
Cen'l Park, North & East River		1,200,000	J. & D.	7	Dec., 1902	114	116
Christopher & Tenth		250,000	A. & O.	7	Oct., 1898	112	114
Central Crosstown		250,000	M. & N.	6	Nov., 1922	118	120
Dry Dock, E. B'way & Battery. 1st mort		840,000	J. & D.	7	June, 1893	104	106
Scrip		1,200,000	F. & A.	6	Aug. 1914	98	100
42d & Grand St. Ferry		236,000	A. & O.	7	April, 1893	110	112
42d St. Manhat. & St. Nich. Av 1st mort		1,200,000	M & S.	6	Sept., 1910	112	114
2d mort		1,200,000	J. & J.	6	1915	38	39
Eighth Ave., Scrip		1,000,000	F. & A.	6	Aug., 1914	105	110
Houston, W. St. & Pav. Ferry.		250,000	J. & J.	7	July, 1894	109	111
Second Avenue		1,600,000	M. & N.	5	Nov., 1909	102	103
Third Avenue		5,000,000	J. & J.	5	Jan., 1937	110	115
23d St		250,000	M. & N.	7	May, 1893	108	110

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$600,000	M. & N.	4	May, '91.	184	190
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Period.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Montreal St. Ry.	1885	£60,000	.....	5	1965	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref.	100	$1,000,000	A. & O.	5	Jan. 1891	78	80
Louisville St. Ry. Co., com.	100	5,000,000	.....	...	Jan. 1891	21	22
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	94	95
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	112½	.....
Central Passenger Ry. Co.	1888	400,000	M. & N.	6	1908	112½	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	320	325
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	....	96
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	181¼	182
West Division City	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	134⅝	135⅝
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Chicago City	.....	4,619,500	J. & J.	4½	.....	99	99¼
Chicago Passenger	1883	400,000	F. & A.	6	1903	105	109
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,640,000	M. & N.	4½	1927	95	97
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100	101½
West Division Railway	.....	3,790,000	J. & J.	5	.....	102	102½
" " " Ext.	.....	250,000	J. & D.	6	.....	101	101½
West Chicago Street	.....	4,160,000	M. & N.	5	.....	102	102½
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	.....	98

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co	50	1,500,000	.....	..	.....	28⅞	29
Citizens' Traction R. R. Co	50	3,000,000	J. & J.	3	.....	60¾	61
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	18⅜	18½
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	53	54
Federal St. & Pleasant Valley	50	1,300,000	J. & J.	3	.....	23⅞	24⅛
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	36	37
West End R. R. Co.	50	200,000	J. & J.	...	.....	70	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	49	50½
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co	50	60,000	.....	...	.....	5	20
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	40	.....
Pittsburgh Incline Co.	100	150,000	.....	...	.....	115	.....
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Citizens' Traction R. R. Co	1887	1,250,000	A. & O.	5	1927	107	108
Pitts. & Birmingham Traction Co.	1889	1,500,000	M. & N.	5	1929	95	95½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	.. .	104
Pleasant Valley Ry.	1891	300,000	J. & J.	5	1919	.....	.....
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	102	109½
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	.....	98
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Pleasant Valley R. R. Co.	1873	75,000	J. & J.	6	1903	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1907	...	.....
Fort Pitt Incline Plane Co.	1881	30,000	.. ....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.	1883	125,000	.....	6	1903	.....	.....
Monongahela Incline Plane Co.	1887	50,000	A. & O.	5	1892	...	.....
Monongahela Incline Plane Co.	1887	50,000	A. & O.	5	1897	.. .	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.. ..	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH Broker, 440 California Street, San Francisco, Cal., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.	100	1,000,000	Monthly	5	....	118½	118
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	90	100
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	47½	53
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	.....	40
Omnibus Cable Co.	100	2,000,000	Monthly	4	.....	65	67
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	22½	30
Bonds.	**Date of Issue**	**Am't Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	.....	107
Market Street R. R.	.....	3,000,000	J. & J.	6	913	121	125
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	115½	.....
Powell Street R. R.	.....	700,000	M. & S.	6	1912	.....	115
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	110	115
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	92½	95
Cal. St. Cable R. R.	.....	.....	.....	...	.....	102¾	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Feb. 18.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine	100	$324,000	Q.—J.	3	1864	101	102½
Cass Ave. & Fair Grounds	50	300,000	.....	...	1876	44	50
Citizens'	100	1,500,000	A. & O.	1¼	1887	100	105
Jefferson Avenue	100	112,000	.....	..	1885	200	300
Lindell	100	2,500,000	Q.—J.	...	1890	56	60
Missouri	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central	100	200,000	.....	...	1884	100	105
People's	50	1,000,000	M. & S.	6	1889	40	45
St. Louis	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal	50	150,000	Jan.	1.50	1872	15	25
Union	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban	100	1,000,000	... .	...	1891	11	16
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Benton-Bellefontaine	1880	$500,000	F. & A.	6	1900	102	102½
Cass Avenue	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	107	108
Lindell	1890	1,500,000	J. & J.	5	1895–1910	99	100
Mound City	1890	525,000	A. & O.	6	1900–1910	105	106
Missouri Cable	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort	1882	125,000	J. & D.	6	1902	102	105
" 2d mort	1886	75,000	M. & N.	7	1902	104	105
People's Cable	1889	800,000	J. & J.	6	1889–1914	97½	100
Northern Central	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable	1890	1,500,000	M. & N.	5	1900–1910	97½	98
Union	1885	150,000	M. & N.	6	1895–1915	102	103
Union Depot	1890	1,600,000	J. & O.	6	1900–1910	105	106

PHILADELPHIA STOCKS AND BONDS.—Corrected by ROBERT GLENDINNING & Co., 143 So. Fourth st. (Bullitt Building), Philadelphia, Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'	50	$500,000	Q.—J.	4	1858	255	.....
Continental	50	1,000,000	J.—J.	6	1873	120	122
Frankford & Southwark	50	1,250,000	Q.—J.	6	1854	196	200
Germantown	50	1,500,000	Q.—J.	...	1858	97½	98
Green & Coates	50	500,000	Q.—J.	3	1858	118	120
Hestonville	50	2,050,000	.....	...	1859	30	32
Lombard & South	25	500,000	A.—O.	8	1861	59	61
People's Common	25	1,500,000	M.—S.	2½	1873	50	54
" Preferred	25	750,000	M.—S.	2½	.....	50	.....
Philadelphia City	50	1,000,000	J.—J.	7⅛	1859	148	150
Philadelphia & Gray's Ferry	50	617,500	J.—J.	3½	1858	66	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	75	.....
" (40 pd.)						65	.....
Ridge Avenue	50	750,000	Q.—J.	5	1872	200	205
Second & Third	50	1,060,000	Q.—J.	4½	1853	150	160
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	191	192
Union	50	1,250,000	J.—J.	9½	1864	170	175
West Philadelphia	50	750,000	J.—J.	10	1857	175	180
Metropol tan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	97	100
Baltimore Traction	25	5,000,000	.....	...	1889	20	20½
Buffalo (N. Y.) Railway	100	6,000,000	.....	...	.....	25	30
Newark (N. J.) Passenger	100	6,000,000	.....	...	.....	15	20
BONDS.	**Date of Issue**	**Amount Outstanding**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	109	110
" " Imp.	1892	1,250,000	M.—S.	6	1901	102½	.....
Germantown, 1st mort.	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort.	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co	100	5,000,000	M. & N.	....	Jan. 1, '89	60	....
BONDS.	Date of Issue	Am't Outstanding.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & CO. Bankers and Brokers, 26 West Third Street, Cincinnati, Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	109½	109⅞
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	109½	109¾
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	120	123½
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	62	65
" " " Pref.	100	100,000	.....	6	.....	98	101
BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	102	.....
" "	.....	50,000	J. & J.	7	July, 1894	104	.....
" "	.....	50,000	J. & J.	7	July, 1895	.....	110
" "	.....	50,000	J. & J.	7	July, 1896	108	112
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	103½	.....
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	.....
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D	6	Je. '94-1924	105½	.....
" " Cable.	.....	250,000	M. & S.	5	Mar. 1906	104	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	110	.....
" " "	.....	300,000	J. & J.	6	Jan. 1914	107	107½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	100	103
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & CO., Bankers, 9 South Street, Baltimore, Md., Feb. 19.

Company.	Par.	Capital.	Period	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass Ry. Co	25	1,000,000	Quart.	3	.....	60	70
Union Pass. Ry. Co	50	750,000	.....	...	.....	....	.....
Highlandtown & Point Breeze Ry. Co	50	189 000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	20¼	21½
North Balto, Pass. Ry	25	.....	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " cons. mort.	.....	1,500,000	.....	5	.....	93	100
Balto. Traction Co. (Cable)	1899	1,500,000	M. & N.	5	1929	110	111
City Pass. R. R. Co	1891	2,000,000	"	5	1911	110½	111

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & CO., Bankers, 1344 F Street, N.W., Washington, D. C., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	235	250
Metropolitan R. R.	50	750,000	Q. J.	...	1864	100	110
Columbia R. R.	50	400,000	Q. M.	...	1870	64	67
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	42	43
Eckington & Soldiers' Home.	50	352,600	.....	...	.....	32	.....
Georgetown & Tenallytown	50	200,000	.....	...	.....	42	.....
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	....	.....
BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	101	.....
do. do. convert.	'83-'91	2,000,000	J. & J.	6	1899-1929	150	.....
Eckington & Soldiers' Home.	.....	100,000	J. & D.	6	1896-1911	97	100
Capitol & North O St. R. R.	1891	250,000	J. & J.	5	1921	103½	110
Metropolitan R. R. convert.	1891	200,000	J. & J	6	1901	120	130

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	170	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	75	78
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

The Street Railway Stock Market.

The financial situation in relation to street railway securities may be summed up in the word, favorable. The season is most propitious for the placing of street railway stocks and bonds under as favorable circumstances as have prevailed for several years. Then it must be said that the present time shows a greater need for favorable conditions than any we have ever had before, when the great movement in street railway construction is remembered. We are obliged, as usual, to describe the general situation in order to reach the tendencies of street railway securities, because, as before described in this column, the two are so related that one cannot be separated from the other.

The coal combination with its attendant excitement on the Stock Exchange, is significant in many ways to the street railway interests, besides the mere rise in the securities most concerned; while the consolidation of coal railway interests have more or less taken the attitude of a trust, or a pool, which is outlawed in this state, and under the laws of the United States, the principle involved of combination for mutual protection, is so widespread that laws antagonizing it are necessarily limited to technicalities which are secondary to the issue itself. So far all the law has been able to do in order to prevent the formation of trusts is to compel the trust to organize under the corporation laws; but such an act in no important sense alters the principles underlying the trust idea. A corporation must publish not less frequently than once a year an annual report of the company's standing, but beyond that particular the advantages of a corporation over a trust so far as the public is concerned, are not apparent. This being a reasonable conclusion, and a corporation of any size being perfectly lawful, it is not readily apparent why the existing prejudice against trusts should prevail to the extent it does. While we are not defending trusts, we are disposed to expose inaccuracies of opinions in a field that, in all probability, will grow into large proportions at an early date. The present instance of the coal combination will probably renew all the agitation against trusts which were in force several years ago; and in view of this possibility it is worth noting that the gentlemen who have enlisted themselves in the movement are among the most prominent in New York. Consequently it is to be presumed that they have taken their attitude after proper reflection regarding the consequences.

The significance of this movement to the street railway interests, is the road it points out for a union of forces in cases where any undue competition exists. While the field of such operations among street railways is necessarily more limited, the fact that a method of that kind is always open for adoption, relieves one of the severe strains of threatening competition, should such competition threaten to destroy all profits. Consequently the coal movement will be watched with keen interest to learn how the matter will turn out.

The money market is abnormally easy; interest rates are lower than they have been for a long time. This state of affairs is favorable to a rise in the value of street railway securities in several ways. First, in the readiness with which brokers can get loans to carry stocks, thereby increasing the demand for securities of all kinds; and next, in the fact that whenever interest is low, dividend paying securities rise in value, because such dividend paying securities earn more money than loaning money at interest; which means, idle capital will invest in such securities in preference. Then there are few or no signs

of any important change in the money market for some time to come; in all probability the present figures will hold well into the summer, which probability gives all new street railway enterprises a good opportunity to obtain capital under favorable conditions.

Steam railway earnings for January were about three per cent. in excess of the same month a year ago, and February promises to considerably exceed that figure. The first half of February shows an increase in such earnings of about eight per cent. in excess of the same period in 1891, and the probabilities are for the whole month that the increase will be even better, all of which tends toward a higher market for all kinds of securities. The railways west of Chicago have not yet entirely recovered from the glut in cereal freights, the grain of the Northwest has not all been marketed by any means, and there are districts in Dakota where the wheat has not yet even been all threshed. The railways east of Chicago now prevent any gluts in freight by notifying Western roads that whenever they have more grain than they can handle to advantage, they will take no more. This action prevents those blockades which occured frequently in the earlier part of the season, to the great detriment of railway profits. This particular was one of the causes why the railway earnings for January fell below the average increase for the past six months.

The volume of the Stock Exchange transactions during the last month has been abnormally large, one or two days showing the largest sales on record, and some of the brokers, in consequence, had the greatest difficulty in making their deliveries. In view of this trouble, and at the incitement of the banks, and probably because of the repeated urgings of the comptroller of the currency, a movement is now afoot for the Stock Exchange to adopt a system of clearings for the delivery of securities, which, when adopted, will remove most of the risk which the banks now labor under in their over certification of checks, which over certification now ranges from $20,000,000 to $50,000,000 daily.

Electrical stocks received a great deal of attention on the floor of both the New York and Boston boards, on account of the proposed consolidation of the Edison General Electric and Thomson-Houston Electric companies, and the quotations on both stocks advanced considerably. The basis for the proposed consolidation is given in another column. J. M. B.

Financial.

The West Side Rapid Transit Co., of Chicago, have filed a certificate of increase of capital stock from $2,000,000 to $6,000,000.

$ $ $

A movement is on foot to consolidate the Cincinnati Street Railway with the Mt. Adams & Eden Park Street Railway of Cincinnati.

$ $ $

H. S. Chamberlain has been appointed receiver of the Chattanooga (Tenn.) Union Railway by Judge Ray, upon application of W. S. Davis.

$ $ $

The Plymouth (Mass.) & Kingston Street Railroad Co. have petitioned the State Railroad Commissioners for right to extend their tracks and increase their capital stock from $35,000 to $40,000.

$ $ $

The directors of the Springfield (Mass.) Street Railway Co. have voted to increase their capital stock $50,000, making $700,000 in all. This was the limit allowed by the railroad commissioners last fall.

$ $ $

The Schuylkill Electric Railway Co. of Pottsville (Pa.) have declared a cash dividend of three per cent. on full paid shares of stock. This is out of the net earnings of the company during the six months preceding.

$ $ $

The capital stock of the Traction Co. of Philadelphia will soon be full paid. A call was issued last month for $10 per share upon the old stock, upon which only $40 had been paid. The call will give the company $1,000,000 fresh capital.

$ $ $

A controlling interest in the stock of the North Baltimore Passenger Railway Co. was purchased last month by the Baltimore Traction Co. for $45 per share. The par value is $25, and the stock has been selling at about 31 to 33.

$ $ $

The absorption of the Watervliet Railway & Turnpike Co. by the Albany Railway Co. took place at the end of January, 1892, the latter company guaranteeing interest upon the first and second mortgage bonds of the Watervliet Railway company.

$ $ $

The earnings of the St. Paul (Minn.) City Railway Co. in January were $57,695, against $52,892 last year. The January earnings of the Minneapolis Street Railway Co. were $82,281, against $70,873 last year, a total for the Twin City company of $139,976 against $123,765 last year.

$ $ $

The annual report of the Newport (R. I.) Street Railway Co. presented last month shows that the number of passengers carried during the year was 808,150, an increase of 27,092, over the preceding year, and that dividends of seven per cent. on the preferred and five per cent. on the common stock have been paid.

$ $ $

The following gives the receipts for the last eleven months of 1891 of the Concord (N. H.) Street Railway Co.: February, $1,331.28; March, $1,492.28; April, $1,632.87; May, 2,024.89; June, $2,369.29; July, $2,967.78; August, $3,264.26; September, $2,915.27; October, 2,849.25; November, $2,722.80; December, $2,609.17.

$ $ $

The report of the Glens Falls (N. Y.) Sandy Hill & Fort Edward Street Railway Co. for the quarter ending December 31, shows gross earnings, $8,080.92; operating expenses, $5,506.03; net earnings, $2,574.89; other income, $426.53; gross income, $3,001.42; taxes, $1,698; net income, $1,303.42, as against a net loss of $693.02 for the corresponding quarter of 1890.

$ $ $

At a special meeting of the stockholders of the Lynn & Boston Street Railroad Co. held last month the directors were authorized to issue coupon notes to an amount not exceeding $300,000 at five per cent. interest, having twenty years to run; the proceeds to be used in paying the floating debt and for additions to construction, real estate, equipment and other personal property.

$ $ $

A mortgage in the sum of $800,000 given by the Toledo Electric Street Railway Co. to the New York Security & Trust Co., of New York City, was filed at the recorder's office last month. By the terms of the instrument, the street railway company takes up $600,000 worth of corporate bonds issued last March to secure a mortgage given to the same party, and issues $800,000 more to secure the present loan.

$ $ $

The following amounts were paid last month to the municipality of Chicago, for quarterly licenses to January 1892: North Chicago Street Railway Co., $2,451.25; West Chicago Street Railway Co., $4,507.18; Chicago City Railway Co., $4,330. For the corresponding quarter last year the amounts were: North Chicago Street Railway Co., $2,163.75; West Chicago Street Railway Co., $4,602.83; Chicago City Railway Co., $4,398.

$ $ $

The Metropolitan Street Railway Co. of Kansas City, in their annual report show for 1891: gross earnings $675,501; net earnings, $190,693; net, with miscellaneous income, $196,480; interest, $100,720; dividends, $69,835; surplus, $25,925. The expenses per horse car mile run in 1891, 11.200 cents; in 1890, 10.900 cents, and in 1889, 9.700 cents. The expenses per electric car mile were in 1891, 10,900 cents; in 1890, 11.500 cents; 1889, 11.800 cents.

$ $ $

Charles E. Benton has been appointed receiver of the Utica (N. Y.) Belt Line Street Railway Co. The company's property is nominally worth $248,800 and actually $155,400. The property is covered by a first mortgage to secure $5,000,000 in bonds and a second mortgage to secure $2,000,000 in bonds, of which $69,500 have been issued. There is a floating indebtedness of about $75,000. The receiver is authorized to issue certificates for $7,500 due for rent and to operate the road.

$ $ $

The Massachusetts State Railroad Commissioners have received petitions from the Cottage City Street Railroad Co. for leave to increase their capital stock $10,000 and to issue $25,000 of bonds, and from the Essex Electric Railway Co. of Salem for leave to issue $200,000 of bonds. They granted the petition of the Globe Street Railway Co. of Fall River to increase their capital stock from $400,000 to $700,000, and to issue mortgage bonds to the amount of $700,000 instead of $800,000, as prayed for.

$ $ $

At the annual meeting of the Central Traction Co., of Pittsburgh, Pa, held February 9, the report showed as follows: Receipts from passengers and rents were $186,320.51; expenses, including interest, $129,647.70; leaving $56,672.81 as the net earnings. The election for directors resulted: George I. Whitney, president; Calvin Wells, Thomas B. Atterbury, T. A. Gillespie, E. M. Byers, C. H. McKee and J. R. McGinley, with John J. Miller, secretary. The passengers carried numbered 3,000,000.

$ $ $

A bill was filed last month in the United States Circuit Court by the Fidelity Trust & Safety Co. of Louisville, Ky., trustee for the first mortgage bondholders of the Mobile (Ala.) Street Railway Co., asking for a foreclosure of the mortgage of $500,000, on account of a default in interest due July, 1891, and January, 1892, amounting to $30,000. The bonds of the company are mostly held in Mobile, New Orleans, New York and Chicago. Mr. T. G. Outlaw was appointed receiver, and has filed his bond of $150,000.

The directors of the Worcester, Mass., Consolidated Street Railway Co. voted last month to act on the decree of the railroad commissioners and issue $350,000 of new stock, share for share to the holders of old stock. The first payment for those desiring to take the new stock will be due on March 15, and others on the 15th of each succeeding month until June. It is expected that the value of the company's stock after the new issue will be about 167½, and several sales of rights have been made at $67.50 per share.

$ $ $

The operations on the Third Avenue (New York) Railroad Co. for the last quarter of last year resulted in gross earnings of $414,982, and net income of $61,052. The gross earnings of the corresponding quarter in 1890 were $409,355, and net earnings $79,302. The great difference in the two reports lies in the fixed charges, which were $63,459 in 1890, and $86,432 in 1891. The company evidently values the cable improvement at $1,987,300, for that sum is given under the assets opposite "Third Avenue Cable Road." The funded debt is $5.000,000; mortgages against the company, $46,000, and profit and loss, surplus, $34,159.

$ $ $

By virtue of a decree of the Circuit Court in the case of Thomas Sparks, trustee, *vs.* the Ohio Falls Street Railway Co., the street railway with all the rights and franchises will be offered for sale at the Court House, at Jeffersonville, Ind., on Saturday, March 19, 1892, to satisfy a judgment of $12,000.00. The indebtedness was incurred in making extensions and failure to renew paper or to float bonds cause of the suit. The franchise is unconditional and is granted for a period of fifty years from January 14, 1889. The city has a population, including suburbs, of 15,000. The length of the line is five miles. The cost of plant was $35,000.00.

$ $ $

Harry C. Reiner, receiver for the Keokuk (Ia.) Electric Street Railway Co., has filed a statement in the Superior Court showing the receipts between December 8, when he was appointed, and January 24, to have been $1,981.85, while the operating expenses were $2,205.50. He affirmed that, owing to the condition of the track, equipment and rolling stock with the present inclement weather, it is impossible to make operating expenses. Accordingly, to meet the $1,116.61 indebtedness incurred, he asked the authority to issue $1,000 in receiver's certificates of $200 each, bearing seven per cent. interest. It is proposed to make these certificates a lien on the property, prior to all other claims.

$ $ $

At the annual meeting of the Standard Underground Cable Co. at Pittsburgh, January 28, 1892, Mr. Joseph W. Marsh was re-elected vice-president and general manager, Mr. Frank A. Rinehart, secretary and treasurer and Mr. O. R. Ebel, auditor. The business of the company for the year 1891 was very gratifying, having amounted to $518,677.27. The net earnings over all expenses for the year were $65,858.37, and the total surplus earnings or undivided profits of the company up to December 31, 1891, now amount to $369,213.50. During the year 1891 the company reduced their accommodation paper from $52,200 to $10,500, and in addition to this paid up all bills in full to December 1, besides having discounted a portion of the December bills.

A Purchase Announced.

The Dayton Manufacturing Co., announce that on February 18, they purchased the entire railroad supply business, including railroad supplies, patterns, tools, patents and goodwill of Post & Co., of Cincinnati, O. The Dayton Manufacturing Co. will complete all unfilled orders on the books of Post & Co., and state that with the increased facilities afforded them by this addition to their own large stock of manufactured and raw material as well as patterns, tools, etc., they are better able than ever to supply customers with everything in their line.

The National Capital.

The City of Washington is an object of perennial interest to all patriotic Americans. Not alone because it is the great throbbing heart of the mightest and grandest Republic the earth has ever known, but also on account of its material magnificence. All Americans take pride in its beautiful avenues, majestic architecture, stately homes, and well stored galleries and museums as things of grandeur and beauty in themselves, apart from the historic interest with which they are invested. It is a hope and aspiration of all "Young America," at least, to some time or other visit the Capital of his country.

The Baltimore & Ohio R. R. offers unequalled facilities in aid of this desire. All its through trains between New York, Philadelphia and Baltimore on the east, and Pittsburgh, Cincinnati, St. Louis and Chicago on the west, pass through Washington. Its fast express trains are vestibuled from end to end and heated with steam. Pullman's latest and best productions in the way of sumptuous Drawing Room Sleeping Cars are attached to all its through trains. The present management of the B. & O. have made vast improvements in the last two years, and the road is to-day one of the foremost passenger carrying lines in the country. Through tickets via B. & O. R. R. can be procured at all the principal ticket offices throughout the United States.

New York and Boston by the Big Four Route.

"The Southwestern Limited" via the Big Four Route, from St. Louis, Indianapolis and Cincinnati to New York and Boston, equipped with Wagner palace sleeping cars, combination library, smoking and cafe cars, luxurious coaches, and elegant dining cars, vestibuled from end to end, and running through solid via the great four-track New York Central & Hudson River Railroad, is conceded by competent judges to be "America's finest train," and with its terminal facilities in Grand Central Station, New York City, avoiding all ferries and transfers, offers advantages possessed by no other line. Tickets via the popular Big Four Route are on sale at all coupon ticket offices throughout the country. Take the Big Four Route on your next trip East. D. B. Martin, General Passenger and Ticket Agent, Cincinnati, Ohio.

A Luxurious Car.

Speaking of the private compartment cars, we quote from the *San Francisco Daily Report* of January 20, 1892, the car described being identical with those in daily service on the New York & Chicago, limited, over the Lake Shore route.

"Isn't this too lovely for anything!" exclaimed a very pretty Oakland girl yesterday afternoon as she entered the Wagner compartment car attached to the Wagner vestibule train of sleepers, which brought out the Eastern press delegates last week.

A D. R. reporter, standing near, at once became interested, for whatever receives so favorable a comment from an æsthetic damsel residing in the Athens of the Pacific must needs be lovely. The girl was right. Standing in one of those luxurious compartments, with everything so bright, attractive and comfortable, an irresistible desire to travel in a Wagner compartment car seized the reporter. "All the comforts of home" and everything that the heart of the traveler could desire were there. Hot and cold water within two feet of him as he reclined indolently on which in the day time was the most comfortable of lounges and at night is miraculously changed into the softest and most sleep inducing kind of bed. Cut off from the curious stare of his fellow travelers, the tourist can gaze his fill at the passing scenery and, when wearied of that, he can turn his gaze inward and amuse himself by wondering how the ingenuity of the Wagner people must have been taxed to devise so many comfortable things, and put them in so small a space.

Even the most æsthetic tastes could not find subject matter for offense in a Wagner compartment car. All the colors blend nicely, the dark, handsomely stained wood of the car harmonizing with the elegant frieze covering of the seats.

The compartment car is in the same style as those run on the famous limited train between New York and Chicago. It has ten connecting staterooms, furnished in different styles of wood, upholstered with silk damask to correspond with the wood. The seats are covered with the finest kind of frieze plush.

The car is steam heated, and each compartment is lighted by gas and contains a lavatory, hot and cold water, closet, etc.

Oh, yes, the reporter forgot about that pretty Oakland girl. He was just in time to catch her last sentence as she stepped off the train, and this was it, honor bright: "I vow I'll never travel in a Pullman sleeper again."

Bids Solicited for Street Railway Franchise At PLAINFIELD, N. J.

The subscriber, the City Clerk of Plainfield, N. J., solicits bids pursuant to resolution of the Common Council of said City, as follows:

"Whereas, it is, in the sense of the Common Council, that the best interests of the City of Plainfield require that a street railway in this city should be constructed and put into actual operation at the earliest date practicable,

"Resolved, that the City Clerk be and he hereby is instructed to advertise in the Engineering News and Street Railway Journal for sealed proposals, to be submitted to him on or before Monday, March 7, 1892, to be opened at the regular meeting of the Common Council, to be held on that date at the Council Chamber in said city at eight o'clock P. M., which proposals shall set forth that the proponents offer to organize under the Act of the Legislature of the State of New Jersey, entitled 'An Act to Provide for the Incorporation of Street Railway Companies and to Regulate the Same,' approved April 6, 1886, and the acts amendatory thereof, and supplemental thereto, and shall specify in detail the route or routes proposed, the character and description of motive power, rails, street cars and other equipment, and the terms and advantages offered." Frank W. Runyon,

Dated, Plainfield, N. J., February 3rd, 1892. *City Clerk.*

WE PURCHASE

Total Issues of Street Railway Bonds.

CORRESPONDENCE INVITED.

N. W. HARRIS & CO.,

BANKERS,

163 Dearborn Street Chicago,

15 Wall St., New York. 70 State St., Boston.

SPECIAL NOTICES.

FOR SALE.

FOR SALE.—38 lb. girder steel rails (side bearing) for relaying. S. P. S. Ellis, Penn Building, Pittsburgh, Pa.

FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD Co., Washington, D. C.

FOR SALE—STREET CARS.—On account of increase of business calling for larger cars, we have for sale 9 twelve-foot double-end, box cars, with fare box in each end. Gauge 4 feet 8½ inches. Apply to UNION STREET RAILWAY Co., New Bedford, Mass.

POSITIONS WANTED.

WANTED.—A good, practical foreman, capable of handling a great force of men in city railway work. Must come well recommended. Address "CONTRACTOR," care of STREET RAILWAY JOURNAL. 1t

WANTED.—S. P. S. Ellis, Penn Building, Pittsburgh, Pa., representing Johnson Company of Johnstown, Pa., invites correspondence with manufacturers desiring to be represented in Pittsburgh and vicinity.

WANTED.—A man with over 10 years' experience, desires a position to take charge of the inspection and detective department of a street railway company in any part of the country. Can furnish the best of references regarding ability, etc. Address "W. F. G.," care of STREET RAILWAY JOURNAL. 4t

WANTED.—A position as foreman or manager of railroad or stable, in the city, country, or States. Fully understands everything pertaining to railroads, and thoroughly understands the care of horses. Was with the Third Avenue Railroad Co. for twenty years. Can give good reference. Address "MANAGER," care of STREET RAILWAY JOURNAL. 1t

WANTED.—By a thoroughly practical mechanical and electrical engineer a position as superintendent or manager of an electric road. To any company about changing from horse to electric power, I will guarantee a great saving. Am competent to purchase and install both steam or electric plants of the best for the least money. Can furnish 15 years' references, which will include my record as an occasional manager and a reliable man whose whole time is given to the interests of any company by whom I am employed. Address "ECONOMICAL MANAGER," care of STREET RAILWAY JOURNAL. 3

FOR SALE.

125 tons second-hand 38 lb steel tram rails, in excellent condition.
100 tons second-hand 25 lb steel T rails, but little used.

D. E. GARRISON & CO., - - 219 N. 4th St. Louis, Mo.

FOR SALE.

Two 150 H. P. Engines, made by the N. Y. Safety Steam Power Co. Size, 15½ in. × 16 in. Two Band Wheels, 72 in. × 15 in. Foundation Stone for Engines.

Three Hill Friction Clutch Pulleys, 72 in. diameter × 21 in. face.

Three Hill Friction Clutch Pulleys, 72 in. diameter × 12½ in. face.

150 ft. of 3 15/16 Shafting, with Couplings and Adjustable Floor Stands.

Three Boilers, 44 in. diameter × 26 ft. long, with four flues each; all complete with steam and mud drums, fire front, breeching, steam pipe and fittings, two large heaters and purifiers.

This is a Complete Plant for Electric Purposes,

All in First Class Order, ready to put up. For Sale Cheap.

GRAINGER & CO.,

Foundry & Machine Works, Louisville, Ky.

FOR SALE.

A FIRST-CLASS Horse Railway Plant,

IN A LIVE, GROWING CITY,

CAN BE BOUGHT CHEAP,

In fact, for ONE-HALF actual present value.

Franchise EXCLUSIVE and for ELECTRIC Road.

With electricity it will prove not only a SAFE and SURE investment, but will pay, WITHOUT QUESTION, from start, at least 20 per cent. net.

Will take bonds of the road in payment for present road, if electricity is used.

Address,

"ELECTRIC," care STREET RAILWAY JOURNAL,
WORLD BUILDING, NEW YORK.

FOR SALE.

350 Tons 48 lb. Chicago Pattern Slot Rail,
2 Walker U Frames with 12 ft. Staggered Arm Sheaves,
4 Walker U Frames with 10 ft. Staggered Arm Sheaves,
1 Set Double Cable Driving Machinery with Four Ring Walker Differential Drums,
1 Hazelton Tripod Boiler, 150 H. P.,
1 " " 300 "

All the above but little used and in excellent condition.

CONSOLIDATED STREET RAILWAY CO.,
GRAND RAPIDS, MICH.

FOR SALE.

Electric Cars,

BOTH OPEN AND CLOSED.

QUICK DELIVERY AND AT LOWEST PRICES AND ON LONG TIME. THEY ARE REAL BARGAINS.

For Particulars write to

NEW YORK EQUIPMENT CO.,

15 Wall Street, NEW YORK.

STEEL RAILS.

Complete Outfit for

LOGGING, MINING, PLANTATION

—AND—

Street Rail and Tram Roads.

LIGHT SECTIONS RAILS and SPIKES IN STOCK.

Locomotives, Motors, Cars, etc.

New and Second Hand.

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ELECTRIC RAILWAYS.

C. E. LOSS & CO.,

RAILWAY CONTRACTORS,

Waukegan, Ill.

Contract for Road-bed Construction and all Materials, also for Entire Equipment.

Correspondence Solicited. —— References Furnished.

CORLISS ENGINES

OF THE HIGHEST TYPE AND IN ALL SIZES, ARE MADE BY

THE **Lane & Bodley CO.,**

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THE STREET RAILWAY JOURNAL

Vol. VIII. *NEW YORK & CHICAGO, APRIL.* *No. 4.*

Car House and Shops of People's Street Railway Co., Scranton, Pa.

By J. H. Bickford.

When electric power was first adopted upon street railways, it was generally supposed that the existing car houses and repair shops would answer all purposes. Consequently many roads packed their cars into low, narrow buildings, studded with posts, rendering it impossible to get between the cars to do the necessary repairs, and in many cases having but a single short pit for the examination of motors. Others housed their cars in open sheds, while still others stabled their electric steeds in places where it became necessary to examine the bottom of the cars from improvised boats or rafts, two cases of the latter kind having been encountered by the writer. The maxim "experience is a good teacher" may be ancient, but that it applies to the subject under consideration is self evident and needs no further comment. The short space of four years has taught us many useful lessons, and although there have been some heedless and thoughtless scholars, yet I hope the majority have graduated to a position where they realize the importance of providing proper facilities for the housing and repairing of the much, heretofore, neglected street car motor. That some have done this is a fact made plain by the many substantial and convenient buildings which have been erected during the last year, some of which have already been illustrated and described in this journal. It is true that, like the Phœnix some of these have arisen out of the ashes of former structures, but the latter are far more beautiful than the former, and decidedly more useful.

Among those which were unfortunate enough to be visited by fire, was the People's Street Railway Co. of Scranton, Pa. However, they are fortunate enough today in possessing a building for the housing and repairing of cars, that is so much superior to the former one that the company should consider their bitter experience in the form of a blessing.

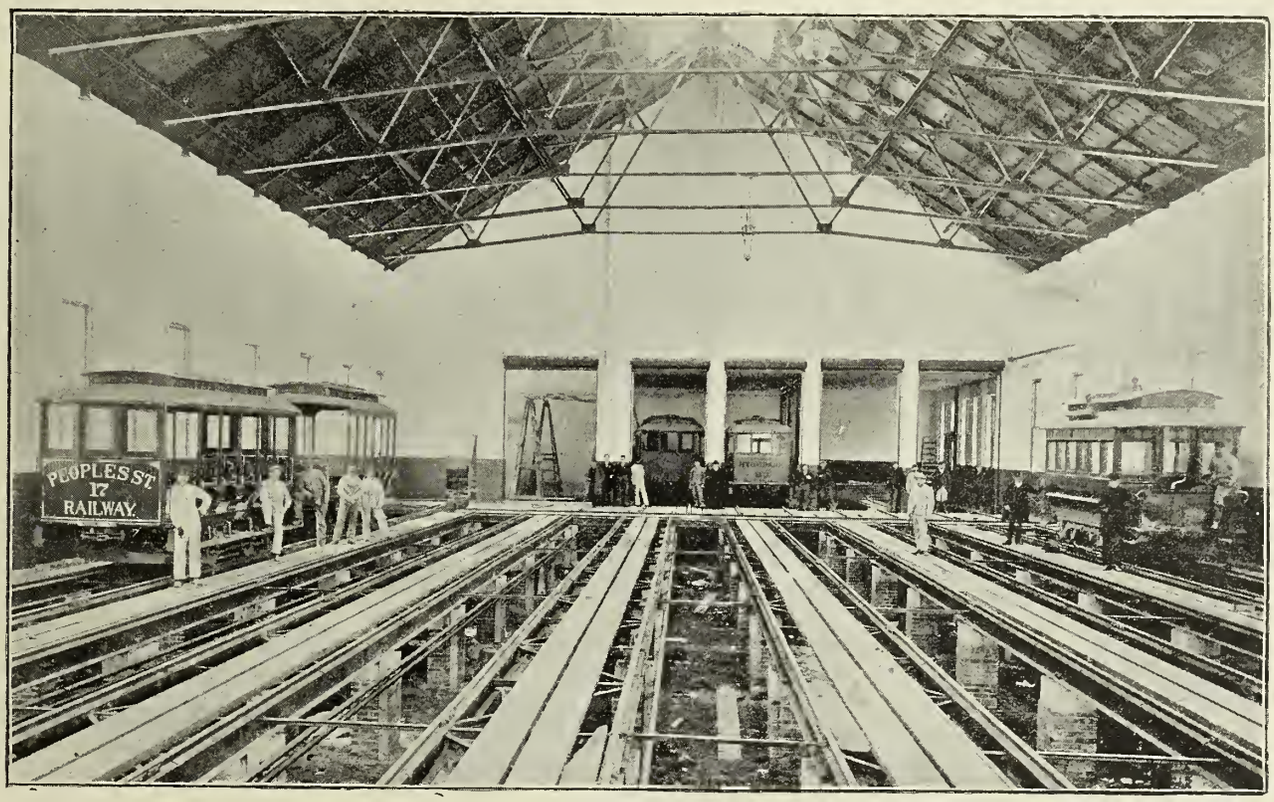


FIG. 1.—INTERIOR OF NEW CAR HOUSE—PEOPLE'S STREET RAILWAY, SCRANTON, PA.

A short description, with illustrations of this car house, may be of interest to those contemplating building a similar structure; and, I hope, will serve as a lesson to those who are still living in their old barns of four years ago. The general design and arrangement for the building was made by the writer, while the architectural work was done by Mr. L. C. Holden, of New York City.

The building stands close beside the new Government post office now being erected at Scranton, and consequently, its outward appearance, especially the front, was made to correspond with its surroundings. It is 68 ft. wide, 225 ft. long, and the height from rails to trusses is 25 ft. There are but three pillars or posts in the whole structure, the whole roof being supported by trusses. It will be noticed by an examination of Fig. 5, that the building combines a car house and complete set of repair

shops. This combination is decidedly advantageous, making it less expensive to do the repairs, and bringing all parts of the work directly under the eye of the superintendent. It is true there is some risk in housing all cars in one place, and concentrating all shops under the same roof, but in this case, the building being as nearly fireproof as is possible to make it, total destruction by fire would be almost an impossibility.

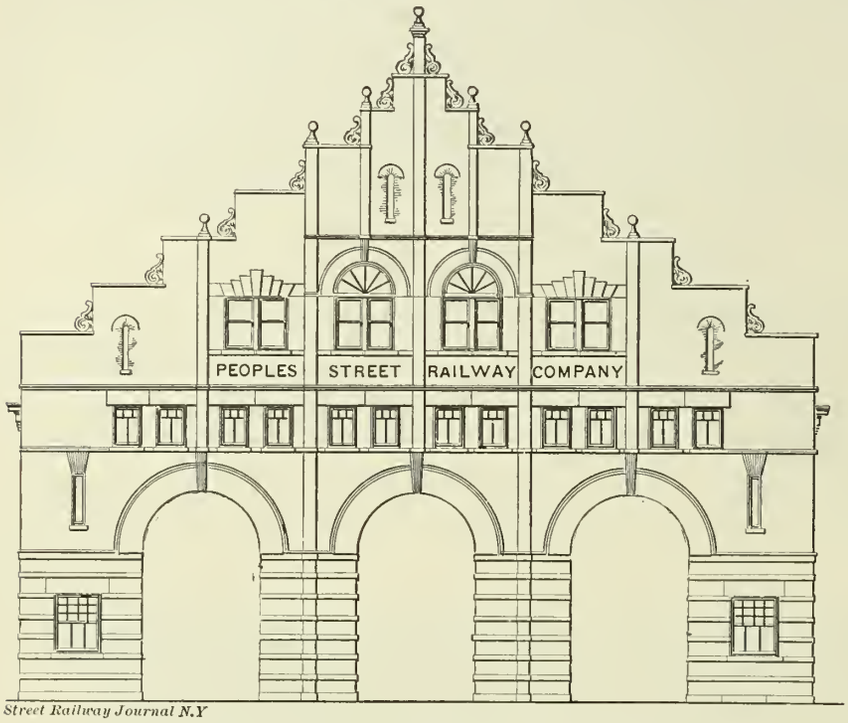


FIG. 2.—FRONT ELEVATION OF CAR HOUSE—PEOPLE'S STREET RAILWAY.

Brick and iron are the principal materials used, the only wood entering into the construction being the window frames and sashes, a few of the doors and the planks between the tracks.

Before the building was designed, the railway company decided that they would establish shops sufficiently large and convenient to accommodate the requisite amount of machinery for doing all repairs of every kind, being dependent upon no local machine or wood working establishment. This was undoubtedly a wise conclusion, and the example here set is surely worthy of the consideration of all roads not provided with means for doing their own repairs.

No description of the outside of the house is necessary, as it is well shown in Figs. 2 and 3. Looking at the inside (Figs. 1, 4 and 5), we have, first, the main storage room for cars, shown in Fig. 1, which is 150 ft. long and 68 ft. wide. Here is space for thirty-five cars on seven tracks. Three of these tracks lead directly to the street, while a transfer table is used for putting cars on the other four.

There are, strictly speaking, no pits in the house, but an iron trestle work covers the entire room, making a clear space, four feet six inches deep under every car, which permits passing from one side of the building to the other underneath. The ground under the trestle is concreted, and then cemented, and provided with drains, all centering in one main sewer. By this means all cars can be washed right where they stand. This can be done in winter as well as summer, as every track is provided with steam heat. By having ready access to the bottom of all cars, a thorough inspection can be had of all the motors and running gear at any time, without moving a car. The height from the rails to the trusses being twenty-five feet, enables work of all kinds to be done on top of the cars to the trolleys, and when cars are standing in the house the trolleys can stand erect, relieving the springs from all strain. The entrances to the front of the main building are closed by means of rolling steel shutters.

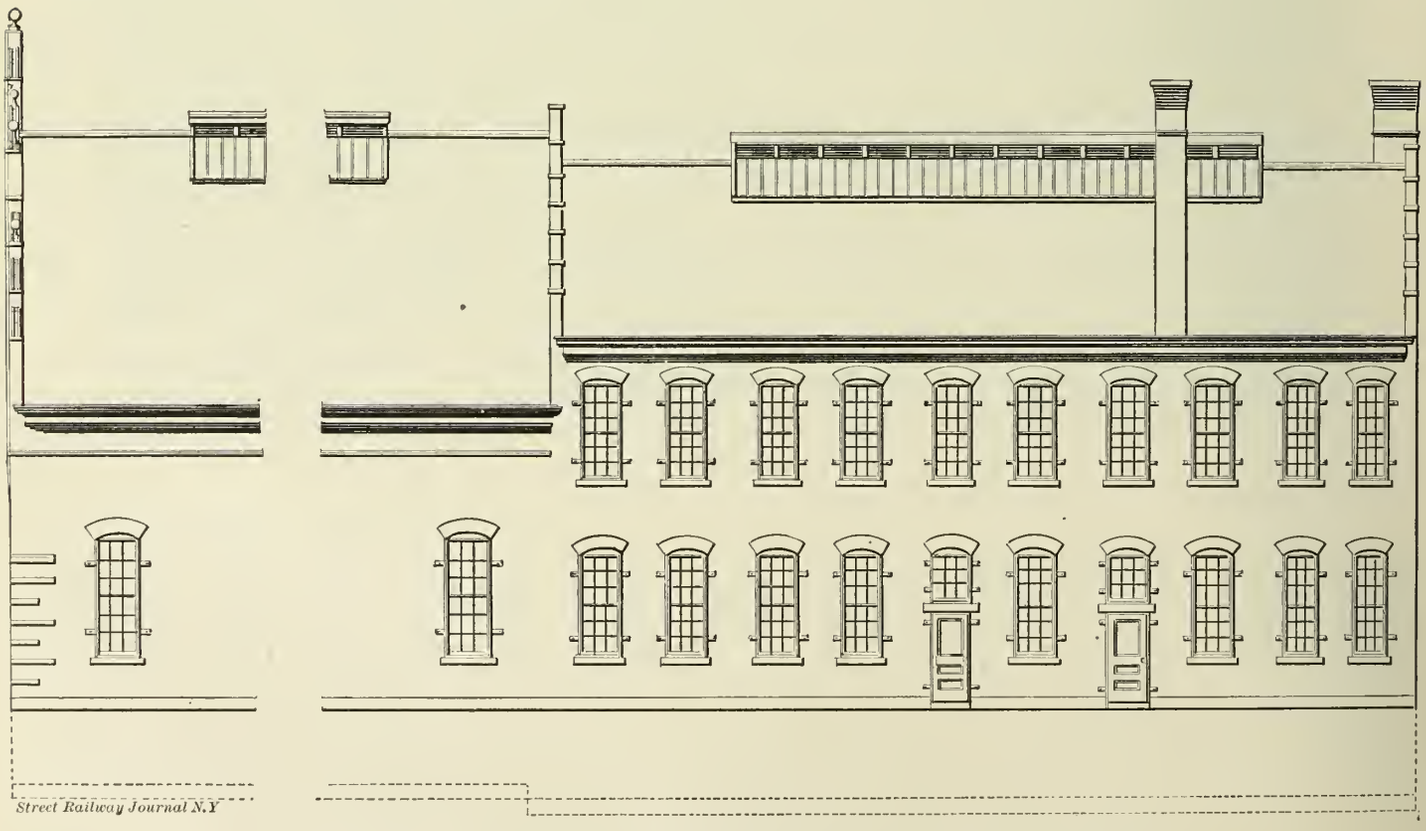


FIG. 3.—WEST SIDE ELEVATION OF CAR HOUSE—PEOPLE'S STREET RAILWAY.

Passing to the repair shops directly in the rear of the main car storage, we have the following rooms on the ground floor: Machine shop, blacksmith shop, winding and testing room, stock room, oil room, and general work-

ing space. This general working space will admit of four cars being put in at one time, and is separated from the main house by rolling steel shutters, as also is the elevator well. There is, besides, a small room for rough storage. There is also an elevator well extending from this floor to the second story, provided with an elevator capable of taking up a fully equipped car and run by an electric motor.

In the second story we have the paint shop which is a large and thoroughly lighted room, and capable of holding six cars at one time; the carpenter shop, and employes' reading room. In the basement is the boiler room, and a large storage room under the machine shop. All the shops are heated by steam, and all conveniences are provided for the employes. No pains or money have been spared to make this house a model in every respect, and the railway company deserve great credit in providing such a structure.

It is pleasing to note the improvements in this kind which have been made during the last twelve months, all bespeaking the confidence which many of our leading street railway officials have in this comparatively new form of motive power. That it has come to stay is an assured fact beyond question, notwithstanding the severe attacks and malignment of the daily press, and improvements such as described above are only a forecast of what is to come.

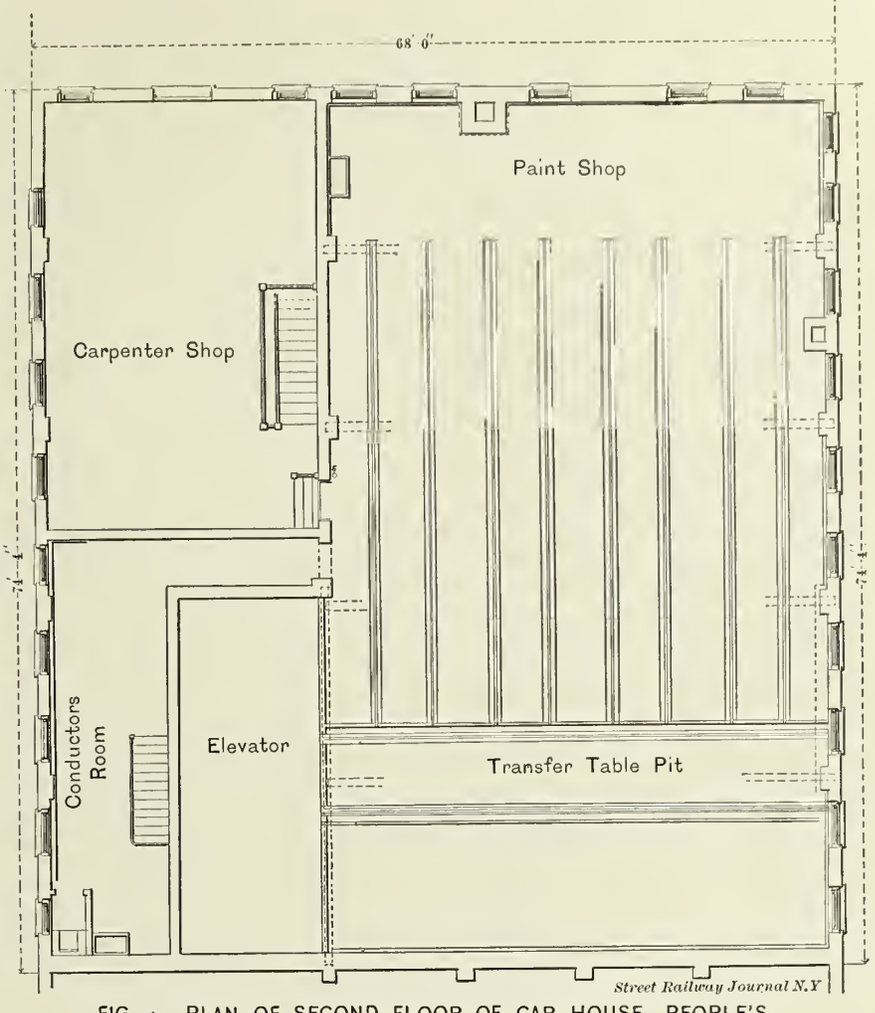


FIG. 4.—PLAN OF SECOND FLOOR OF CAR HOUSE—PEOPLE'S STREET RAILWAY.

A BILL has been introduced into the Massachusetts legislature and favorably reported by the railroad committee, authorizing all steam railroads of that state to operate their roads by electricity. The movement is said to have originated with the late James T. Furber, who was an advocate of electricity for interurban railroad traffic. The Old Colony Railroad Co. have been carrying on some experiments, with a view to investigating the relative advantages and disadvantages of electric power for railroad service, and it is said that this road, as well as the Boston & Albany, will probably make practical trial on a short section of their lines before long. In the meantime Henry Villard is reported as making a careful investigation of the same power for some of his Western roads, especially the Wisconsin Central, and as being greatly in favor of a trial on a large scale. The result of these investigations throughout the country will be watched with the greatest interest.

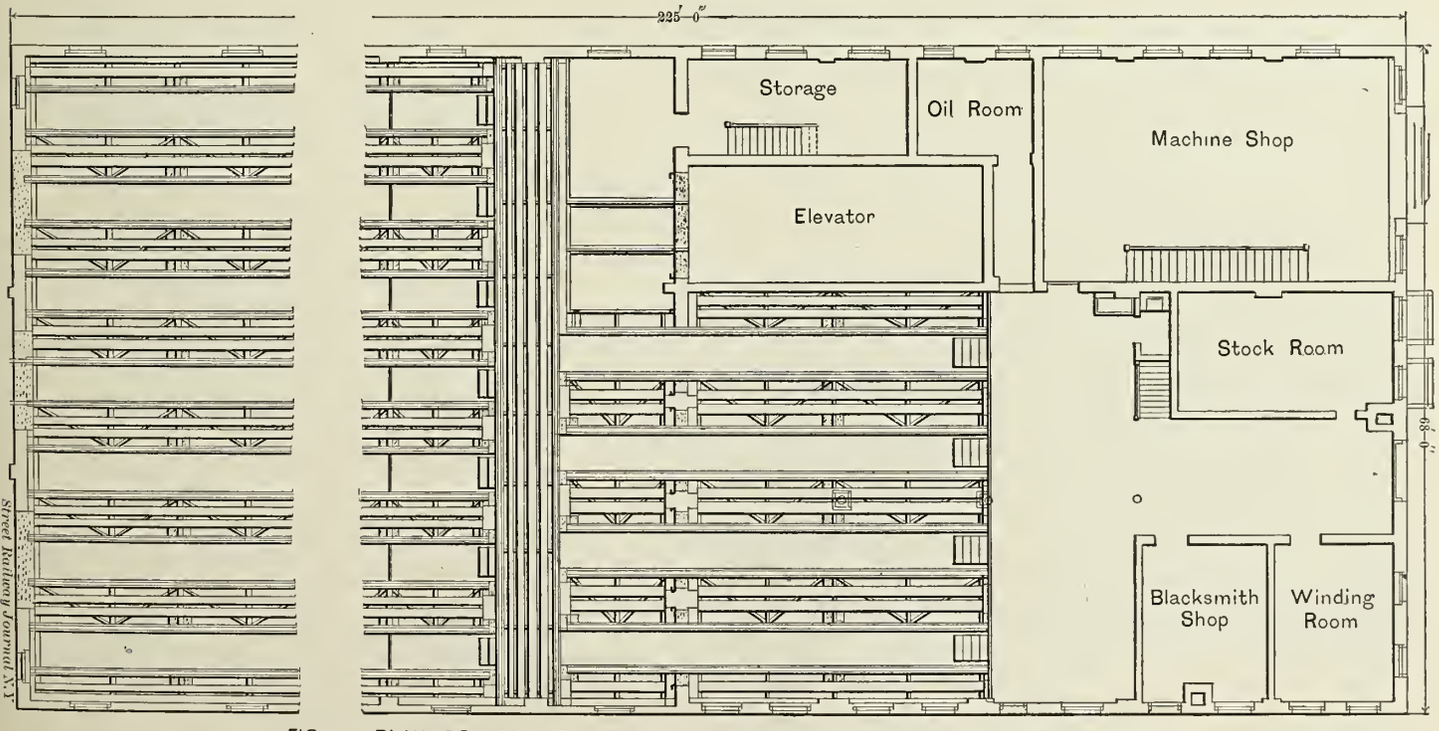


FIG. 5.—PLAN OF GROUND FLOOR OF CAR HOUSE—PEOPLE'S STREET RAILWAY.

THE net earnings of the West End Street Railway Co. of Boston, Mass., for January show an increase of about $40,000 over the net earnings of the corresponding month of a year ago.

A Paying Train.

Street railway managers who complain about the general dullness of business, should glance at the accompanying engraving which is from an actual photograph, and which shows that some roads sometimes carry paying loads. The view shows a cable railway train on the Washington & Georgetown Cable Railway going north on Seventh Street, loaded with passengers bound for a ball game, and was taken last summer. The building in the



LOADED FOR BASE BALL, SEVENTH STREET, WASHINGTON.

background is the United States Patent Office. The single car shown in the engraving as turning the corner is an Edco storage battery car, on the Eckington & Soldiers' Home Railway.

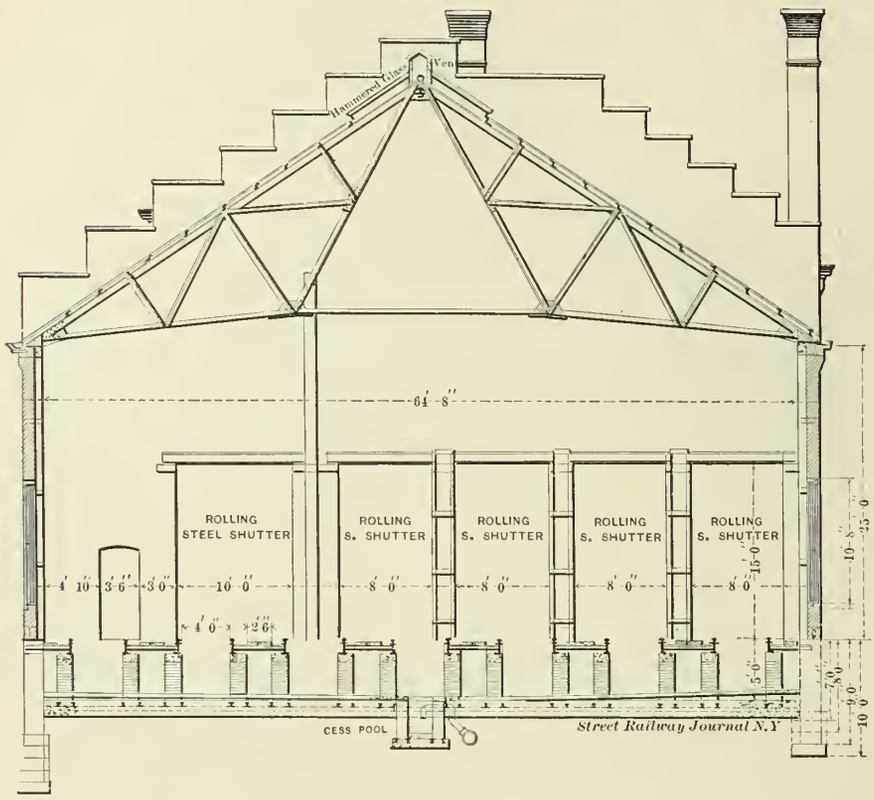


FIG. 6.—CROSS SECTION THROUGH CAR SHED, PEOPLE'S STREET RAILWAY.

The East Cleveland Street Railway.

Cleveland was one of the first cities in which electric power was adopted on a large scale as a means of street car propulsion, and the success attained on the several lines there went far in convincing street railway managers of the desirability of the electric means for propulsion. During a recent visit to the city by one of our representatives, the same officials, who showed their foresight in the adoption several years ago of the electric motor on their lines, exhibited equal enthusiasm over the results attained by electricity and confidence in it as providing the most desirable method of operating future extensions. Below will be found some facts secured during a visit to the power station of the East Cleveland Railway Co. and a trip over this company's line.

THE POWER STATION.

This is located near Cedar Avenue, is entirely of brick and presents an attractive appearance. The dimensions of the first building constructed by the railway company for the purposes of a power station were 80 × 100 ft. to which was added later an extension, 80 × 140 ft. with flat roof finished off with battlements rising to about thirty feet from the sidewalk, making the present building an L with a front of 160 ft. and sides of 100 and 140 ft. This building will probably be again extended soon, so as to occupy an area 240 × 140 ft. All future buildings will be of brick with roof of 2 × 4 ins. joists laid edgeways and supported on iron trusses. The present stack is 136 ft. high with six foot flue and the contract has been let for an additional stack which will be 175 ft. high and will have an eight foot six inch flue.

The boiler equipment (Fig. 2) consists of seven Cooper boilers, and an equal number built by the Variety Iron Works of Cleveland. Each of these is 72 ins. × 18 ft., of 130 H. P. capacity, and is designed to supply steam at 100 lbs. pressure. All are provided with the Murphy smokeless furnace and automatic stoker, manufactured in Detroit, which give satisfaction. The Ford boiler cleaner is being tried, and seems to give good results. The pumps are of the Deane duplex and Hughes' patterns, two of the former and four of the latter being employed. Five Berryman heaters, 12 ft. × 40 ins., and Reliance water columns, complete the boiler house equipment.

Water for the boilers is now taken from the city mains, but the railway company have just completed an artesian well, 377 ft. deep, and having a hole eight inches in diameter. This well will give a supply of 100,000 gals. in each twenty-four hours, with natural rise of water to within seventy-five feet of the surface. The contractors for this well were the Buffalo Well Drilling Co.

The railway company are using for recording the steam pressure at all times, a Bristol recording steam gauge, made in Waterbury, Conn. This makes a record upon a prepared disk, and these latter, which show the pressure record for each twenty-four hours, are kept on file.

The interior of the engine room is clearly shown in Fig. 1, and the power is furnished by both high and low speed engines. The former were the first installed, and they occupy the old part of the building. The original installation was one 125 H. P. Armington & Sims engine, with two generators of sixty H. P. each. This was soon increased 200 per cent., which took care of all the motors for about seven months, at which time the entire plant was again increased 200 per cent., giving a generator capacity then of 1,000 H. P. About one year later this plant was increased over 100 per cent., which gives at the pres-

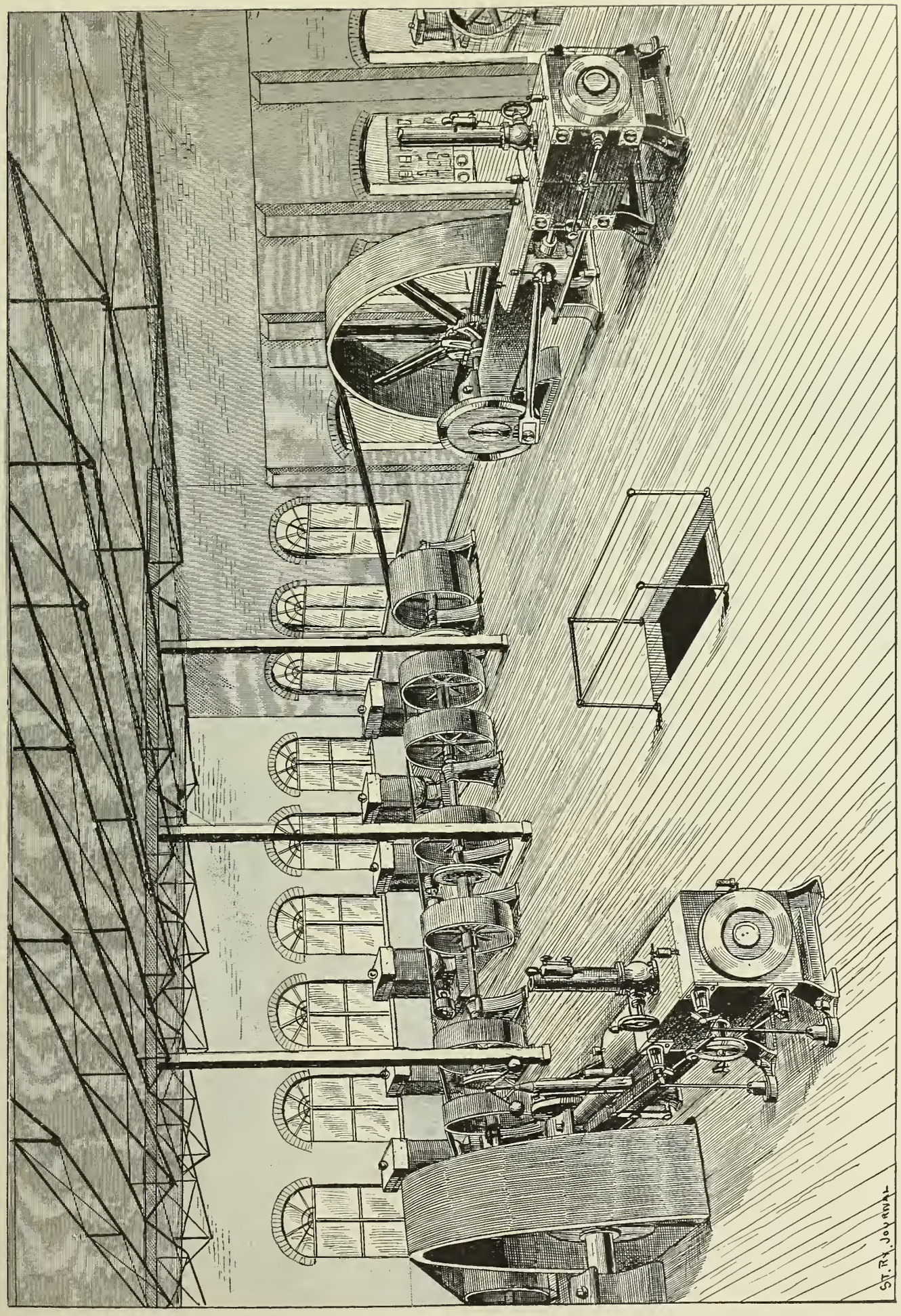


FIG. 1.—INTERIOR OF ENGINE ROOM—EAST CLEVELAND STREET RAILWAY.

ent time a generator capacity of more than 2,000 H. P. The last increase was made contrary to the general opinion at that time in regard to the practicability of running low speed engines in connection with high speed engines, the result of which, however, has been very favorable, and enables the management to judge of the efficiency of the two kinds of plants. Some interesting figures in this regard are given in another column.

The present steam engine equipment consists of three 200 H. P., 18½ × 18 ins. Armington & Sims engines, running at 200 revolutions, and three 125 H. P., 14½ × 15 ins. engines of the same type running at 260 revolutions. The slow speed engines are two in number, manufactured by C. and G. Cooper & Co. of Mt. Vernon, O., of 500 H. P. each, cylinders 28 × 48 ins., and with a speed of seventy-two revolutions per minute. The fly wheels of these engines are twenty feet in diameter, have a fifty-two inch face and weigh twenty-five tons each. These engines are fitted with a bell crank on the governor with a movable weight by which the speed can be increased or decreased at will while the engine is running. The effect of the weight is to balance in part the influence of gravity on the governor balls, and the connections are so arranged that should the governor belt break, the steam supply will be cut off, avoiding any tendency on the part of the engine to race.

All oiling of the engines is done automatically through a series of pipes connecting with a reservoir and having branches with outlets over each oil cup. The waste oil is first put through two filters, then runs by gravity into a tank, whence it is pumped to the reservoir over the boilers and which has a capacity of about eight barrels. From this reservoir the oil runs through a settling T which has a valve at the bottom, through which all impurities may be drawn out, and from there to every engine in the station. Small branch pipes lead to all bearings. Each pipe is fitted with a small valve by which the flow can be regulated.

The belting is two ply, was supplied by the Bodifield Belting Co., and gives good satisfaction.

The high speed engines are, of course, belted directly to the generators. The low speed engines are belted to a line shaft furnished by the Hill Clutch Works of Cleveland, O., and consisting of four lengths, aggregating about seventy-nine feet, seven inches in diameter. On this there are six 88 × 26 ins. split friction clutch pulleys so arranged that either of the two engines, which are at the ends of the shaft, can run the entire line, and there being a friction clutch cut-off coupling in the centre either engine can run one-half separately.

The receiving pulley of the engine next to the old part of the building is on a quill or hollow sleeve. This is done so that if the plant be extended in the future and another slow speed engine added, this engine can be shut down without interfering with the running of the line shaft.

The engine nearest the observer in the view of the station interior is belted direct with a cut-off coupling between the receiving pulley and the shaft, by which means the engine can be stopped while the shaft can be run from the other engine. The receiving pulleys are 74 × 50 ins. The shaft is supported by eleven Hill self oiling bearings and stands.

As each generator is driven from a clutch pulley it can be stopped or started without interfering with the other machines, and as the engines are entirely independent of one another, the plant is strictly interchangeable, lessening the possibilities of a shut down to a minimum.

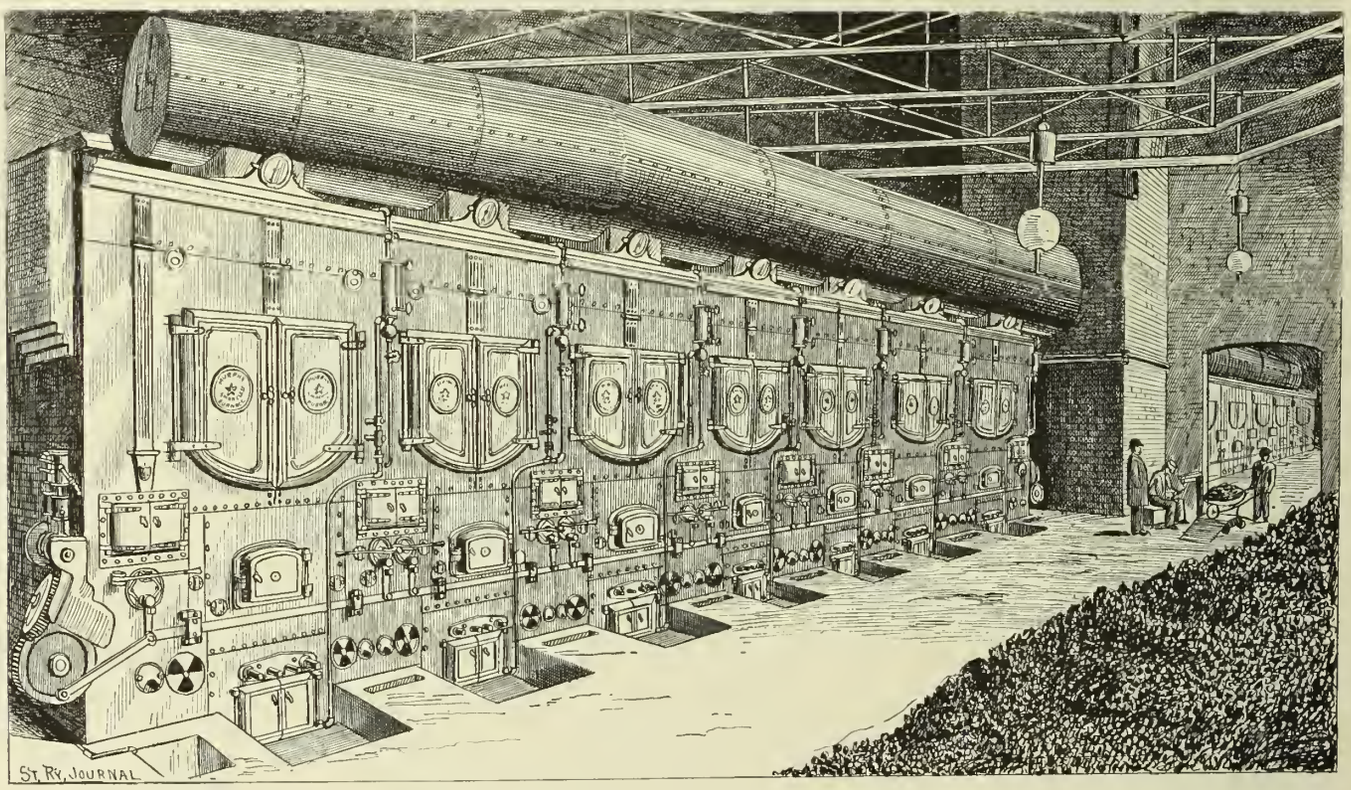


FIG. 2.—BOILER ROOM, EAST CLEVELAND STREET RAILWAY.

The generators, which are sixteen in number, are all of the Edison compound wound type, and vary in size from forty to 175 kilo-watts capacity each. The first six generators installed were of the shunt type, but it was found that the voltage varied so greatly when these were relied upon to supply the current that a change had to be made to compound winding. The present machines hold the voltage within a range in variation of ten volts and give excellent satisfaction. Two more generators of the 175 kilo-watt size will soon be added to the station equipment.

A special device has been adopted to keep the armatures cool while running. The power station is provided with a basement six feet in the clear under the engine and dynamo rooms and having grated windows. Laid into the generator foundations are tile pipes four inches in diameter, the upper opening being directly under the armature while the lower end opens into the basement. The air in the latter being always cooler than in the engine room, a stream of cold dry air is insured through the tile pipes. It has been found by tests that the air in the basement is about twenty degrees below that of the engine room.

The power house, motor shops and grounds are lighted by arc lights, operated from the street railway circuit. These lamps have proved very satisfactory to the company, especially on the ground of economy of power. The company consider themselves the pioneers in lighting in this manner from a 500 volt railway circuit, having had lamps in operation about three years.

The switchboard is in the old part of the building and is so arranged that it can be extended indefinitely as the plant grows.

Each line section, which, it might be mentioned, includes not more than three miles of double track, is provided with fusible copper plug switch on the switchboard, which admits of each section being operated separately or with the others, the feed wires of all the sections being connected together at their outer ends by fuses. The fusible switches employed are of a special construction, designed by Mr. R. M. Fuller, assistant electrician of the company,and manufactured by the East Cleveland Co. The peculiarity of this switch is the manner in which the fuse is adopted, it being held between a stationary post and an eccentric, at the outer end of which is a lever with a ball or weight. This arrangement compensates for any slack in fuse wire, at all times insures a sure contact, and makes it easy to replace any melted fuses. The company have always used a fusible plug and think it much superior to circuit breakers. They have never had a machine damaged from overload due to short circuit on the line.

The power house is provided with the Wason lightning arresters, two of which are connected to each feed wire on entering the building. These arresters are arranged to be switched on separately, permitting the placing of new fuses at any time. The company have never had a case of damage in the power house by lightning.

The voltmeter is connected to a switch, from which the voltage of any machine can be taken, and each section of line is provided with an ammeter. All the feed wires being connected together at their outer ends, the station attendants are enabled to switch out all but two wires after 1 o'clock at night, when only the night cars are on. These two feed wires are provided with a drop, which rings a large bell in case a fuse blows on any section.

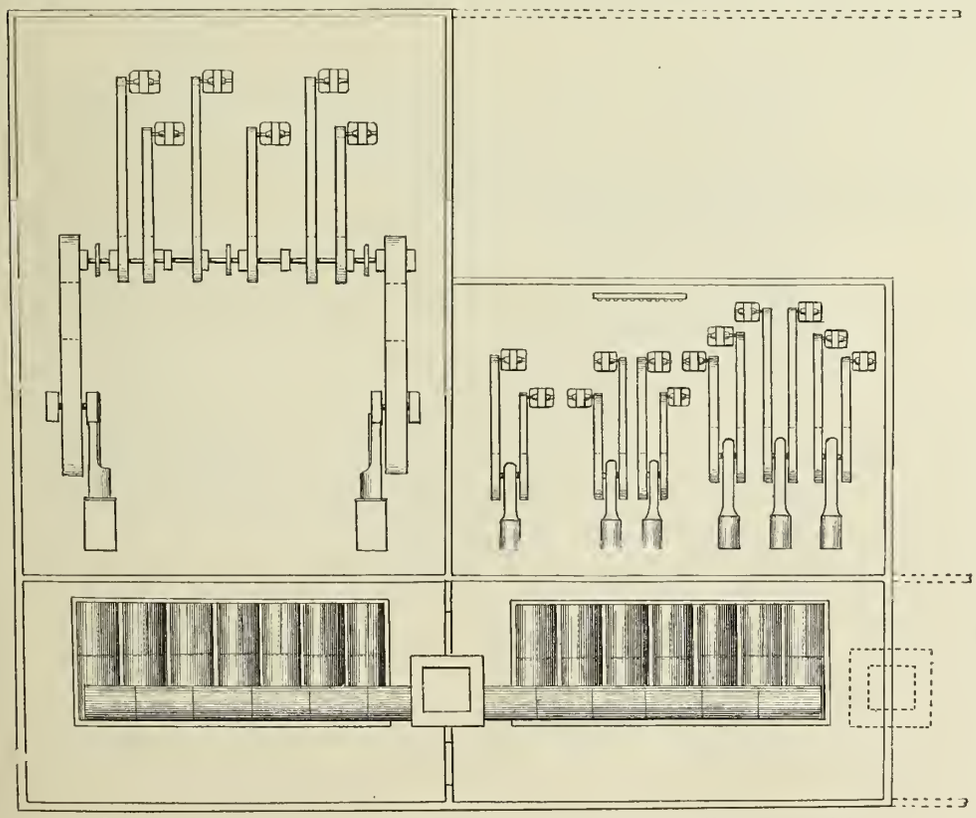


FIG. 4.—PLAN OF POWER STATION—EAST CLEVELAND STREET RAILWAY.
(Direction of proposed extension is shown by dotted lines.)

All the wiring in the power house is below the floor, which makes a much neater appearance than having it overhead, and also facilitates moving machinery. The greatest loss on the longest line, which is about six miles from the power house, is never over 10 per cent., and it is the policy of the company that, as the number of cars increases, to put up additional feed wires, always keeping their loss within 10 per cent.

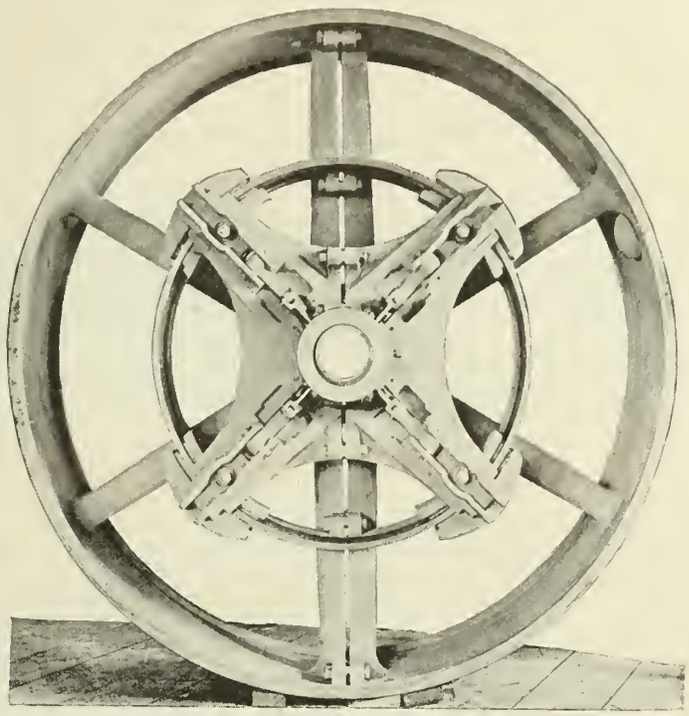


FIG 3.—HILL CLUTCH PULLEY—EAST CLEVELAND STREET RAILWAY.

OVERHEAD CONSTRUCTION.

The first overhead construction put up consisted of iron poles twenty six feet long, set five feet in the ground, and tamped in with broken rock and cement. The span wires were No. 6 iron cable, and No. 6 silicon bronze trolley. But with the increase of the number of cars, the company found these wires too light, and have substituted No. 4 soft copper for span wire, and No. 0 hard drawn copper for the trolley wire. The advantage claimed for copper as a span wire is long life, owing to its ability to withstand heavy blows without breaking, and its resistance to corrosion from acid and gases in factory smoke. The construction just described covers six miles of the total of forty-four miles of road, while the rest consists of copper span wire and No. 4 silicon bronze trolley, except on the Suburban, which has wooden poles carrying a bracket arm eight feet long, and a No. 0 hard drawn copper trolley-wire. The section of line which runs east from Lake View through the village of Collamer, is lighted by the company with thirty-two C. P. lamps, suspended in the middle of the street from every second span wire.

The overhead wiring in the centre of the city is so arranged that it can be cut out in sections in case of fires, thereby facilitating the work of the firemen. Providing for the safety of firemen in this way, the company find that the fire department does much in return to facilitate

the clearing up of a street after a blockade has been opened. The downtown wires of the East Cleveland Co. cross and recross those of other roads with which circuit breakers have been arranged, permitting the interchange of current in the downtown sections. By the different roads keeping the same polarity on the overhead wires there is never a difference of potential to exceed forty volts between the ends of the circuit breakers.

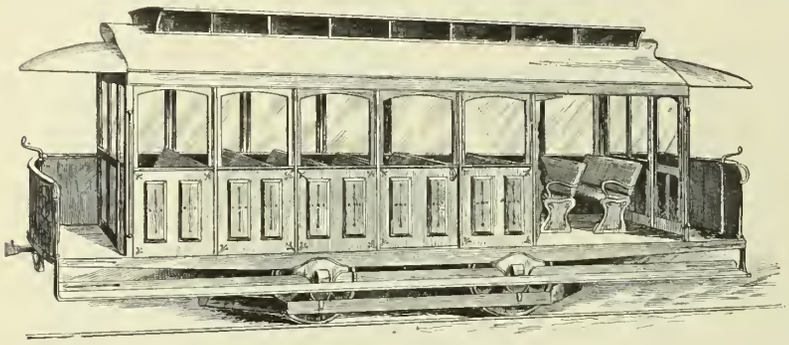


FIG. 6.—COMBINATION CAR—EAST CLEVELAND STREET RAILWAY.

All the overhead lines are provided with Wason lightning arresters well grounded and placed one at every mile of the road.

RETURN CIRCUIT.

The return curcuit is partly provided for by laying between the rails of each track two No. 4 copper wires, while the heavier lines have three No. 4 wires to each track. The company are of the opinion that an efficient return circuit cannot be provided by means of rods or plates buried in the earth, especially in a soil which, like that of Cleveland, consists of dry sand. In addition to the wires between the rails, the latter are connected together by No. 4 copper wire. The rail bonds are connected together across to each track at every second joint, and at every fourth joint the four rails are connected together, insuring a perfect return even in case one or more wires be broken. By placing the ground wire about six inches away from the rail the company find there is no galvanic action which would deteriorate the copper were it placed in contact with the iron.

TRACK.

The track is laid with Johnson sixty-two pound girder rails spiked directly to the ties, and without ballast. This construction, it is stated by the management, does not seem to stand up well under the traffic, and the joints pound considerably.

CARS.

Of the ninety-three motor cars operated by the East Cleveland Railway Co., ninety are equipped with Edison motors. Of these, eighty have the Edison No. 6 motors, and ten the Edison No. 14 motor, both of which give good satisfaction. In addition, the company have in operation one car equipped with Thomson-Houston S. R. G. motors, one equipped with Wightman motors, and one with a Detroit motor. The company have three long cars, two mounted on Robinson radial trucks, and one on Brill maximum traction trucks. All other cars are of the sixteen foot, open platform type. A number are equipped with Burton electric heaters, and all carry Wason lightning arresters. About eighty motor cars, two-thirds of which draw trail cars, are kept in constant operation, and the total daily car mileage is 13,000.

During the last year the company built about twenty-five car bodies, and they expect in the future to do all their own construction in this line. They are about to build under patents a combination car of an entirely new design.

This car, as will be seen from Fig. 6, has eight cross seats with room for four passengers in each and is intended to be used as a closed car in winter and an open car in summer. The aisle instead of being in the centre as in ordinary cars, is at one side. When used as a closed car, this aisle is reached by three doors, one at each end of the car and one at the side. A step is provided which extends the entire length after the manner of ordinary open cars. The side of the car nearest the aisle consists of two removable panels which are taken out in summer. The windows at the opposite sides and ends are so constructed that they can be let down, making it practically an open car.

The officers of the East Cleveland Railroad Co. are A. Everett, president; C. W. Wason, vice-president; H. A. Everett, secretary and treasurer; E. Duty, superintendent.

The Ford-Washburn Storage Car.

During the month of March a number of public trial trips were made in Cleveland by the "Ideal," a new storage battery car operated by the Ford-Washburn Storelectro Co. of Cleveland. This car, a view of which is shown on this page, is twenty feet nine inches long inside, twenty-eight feet over all, was built by the J. G. Brill Co., and is mounted on a Tripp truck, furnished with extension springs.

The battery is of an entirely new design and possesses a number of novel and important features. Each cell contains five sets of elements comprising four positive and five negative, made of perforated lead, formed in rectangular shape and placed alternately, one outside of the other. Recognizing the trouble which has occurred in previous storage batteries from short circuiting, the inventors of this battery have made it impossible for a positive element to touch a negative. This has been accomplished by separating the two by a porous partition, through which the acid can percolate, but which offers an effective barrier to the active material. The arrangement is exceedingly simple, and attains effectively the desired result.



THE STORELECTRO CAR.

The negative elements are all connected together by a solid lead strip welded to the bottom of each receptacle. The positive elements are similarly connected at the top. By this method of connection, it is claimed that a more evenly distributed charge is obtained, and an extra strength given to the battery, while at the same time perfect contact is assured.

The sets of elements are placed in hard rubber boxes, the dimensions of 150 ampere hour cell, such as is used on the present car, being twelve inches high and $4\frac{1}{2} \times 8$ ins., and its weight complete with acid and rubber box, forty pounds.

To prove the impossibility of injury from short circuiting these cells, this has frequently been done by the

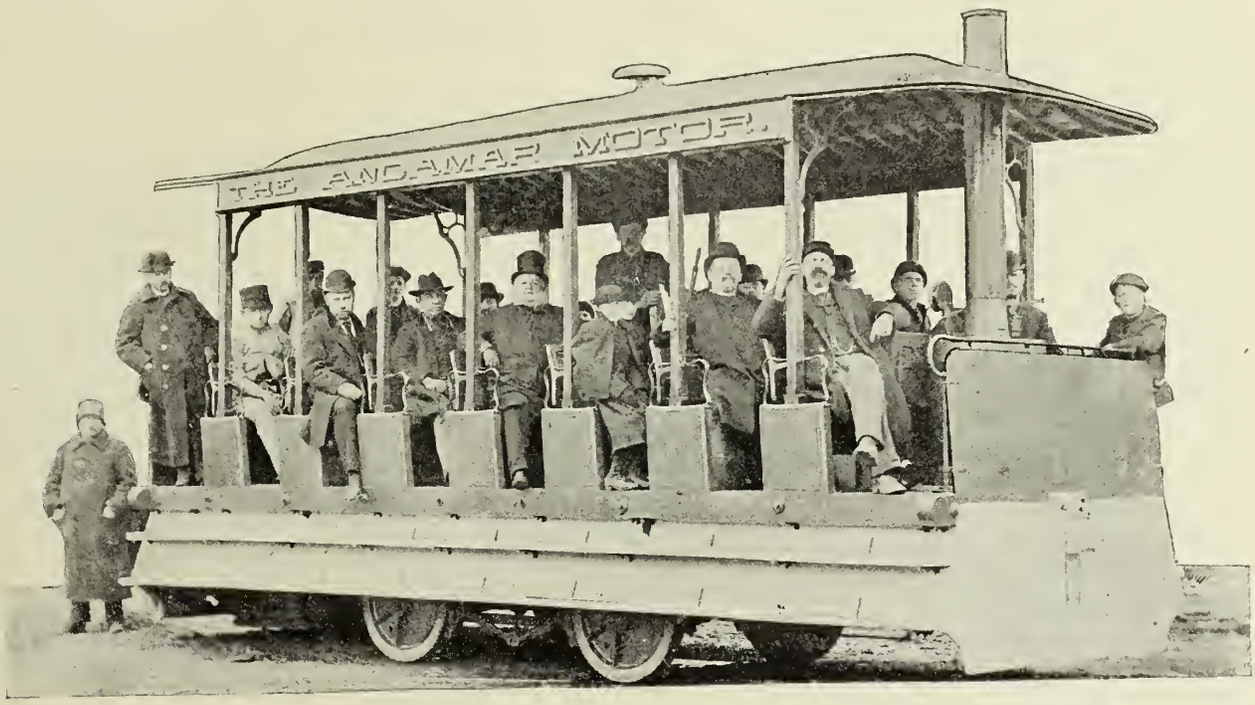
inventors who have connected the positive and negative elements through an ampere meter and obtained a momentary current of from 300 to 500 amperes, but the cells have withstood the strain without deterioration.

The battery equipment for each car consists of 180 cells of the size already mentioned. The cells are completely sealed up, with the exception of two vent holes in each cover.

The motor is a Ford & Washburn thirty-five H. P., with patent ventilated armature, and is capable of working up to forty H. P. for a short time. This motor is geared to both axles, and can be run from either end in either direction, and at seven variations of speed, by an ingenious method of battery commutation. The weight of the motor equipment complete is about 2,000 lbs.

The batteries are, as usual, carried under the seats, but, instead of having the side panel removable, are carried in trays which are slid into position through openings at the ends of the car. This is provided for by having suitable openings in the dash board.

The car in its trial trip has made an excellent showing and has maintained, for a considerable time, a speed of from fifteen to eighteen miles an hour. Upon a recent trip over the lines of the Woodlawn & West Side and East Cleveland Street Railway companies, the car, with thirty-five passengers, covered sixteen miles with an average ampere reading of 20, and voltmeter reading of 350, and 3.3 miles were run in twelve minutes, during the rest of the trip trolley cars were in the way. On the route named there are twenty-three sharp curves and ten grades, ranging from 2 to 5 per cent. The car has drawn a loaded trailer up a 1½ per cent. grade at the rate of fifteen miles per hour. With one charging the car can run, it is said, on ordinary track, for a distance of forty miles. At a test made in Cleveland, the cost of coal for charging the battery was one-half cent per car mile, with coal at $1.40 per ton.



THE KINETIC STEAM MOTOR CAR FOR WEST CHICAGO STREET RAILWAY.

The Kinetic Motor.

This new street railway motor, after a series of exhaustive tests, is claimed by its inventors to have thoroughly solved the problem of how to secure the best possible service at the least possible cost. It represents no new principle of power, but is a direct application of the most simple, efficient and reliable form of energy yet discovered or utilized—that of steam.

The working machinery of the motor resembles that of the locomotive, but in place of the boiler there is a receiver of proper capacity, which is charged with water heated to a high temperature. This receiver is heavily jacketed to prevent radiation, while a simple form of auxiliary heat, occupying but a small space and completely hidden from view, assists in maintaining a steam producing standard of heat in the water from five to eight hours from one charging. Steam is generated as needed from this heated water, and, passing into the cylinders, performs its work as in the locomotive. The motor is charged from a stationary boiler, which alone consitutes the "plant," the process of charging occupying only two minutes or less. A run of twenty miles or more can be made without recharging. The weight of the car and apparatus shown in the engraving is nine tons.

The claims made in behalf of the motor may be thus summed up :

Each motor contains its own source of power, and is not dependent in its working upon any system of wires, trolleys, cables or conduits.

Under the most exacting conditions it has shown itself equal in strength to the ordinary electric motor car, being capable of hauling from three to five loaded passenger cars over an ordinary track with ease.

There is absolute freedom in its use from the grinding and buzzing sounds inevitable in the operation of many mechanical systems. The machinery works easily and noiselessly, and the motor can be stopped or started without the jerky motion common to other forms of power.

There is no smoke or cinders, no noise of escaping steam no possible danger from overheated boilers. Any one competent to run a horse car can operate it.

It has been demonstrated by repeated trials that the cost of maintaining power by this system will not exceed one-third of that of any other system known. President H. M. Whitney, of the West End Street Railway of Boston, says in a recent speech that for that road in the year 1891 the cost of running a horse car was nearly twenty-eight cents per car mile, and of this about twelve cents per car mile was for motive power alone.

The cost of the Kinetic motor has been found to be less than two cents per car mile for motive power.

The illustration shown is of the car which has just been completed and will very soon be in operation on the line of the West Chicago Street Railway.

The Kinetic Power Co., of which Gen. Joshua L. Chamberlain of New York is president and Gen. Francis A. Osborne of Boston may be addressed for further particulars. The offices of the company are in the Rookery, Chicago, and the Mills Building, New York.

Handsome Open and Closed Cars.

In the accompanying engravings are shown two handsome cars, built for the Jamestown (N. Y.) Street Railway Co., by the J. G. Brill Co. of Philadelphia,



OPEN CAR EMPLOYED ON ELECTRIC RAILWAY AT JAMESTOWN, N. Y.

which are illustrative of the growing tendency to longer cars for high speed and heavy traffic.

The closed car is twenty-four feet long, has vestibuled ends, which are fitted with drop sashes, sheathed up with sheet steel on the outside, and fitted with Brill's folding vestibule doors on the sides. The interior is finely fitted and decorated. As will be noticed, the car differs from most other styles of cars in having a beveled edge, polished crystal, plate glass window nearly six feet in length, in the centre. The body of the car is mounted on two Brill Eureka Maximum Traction trucks. The car is painted black, with gold decorations, letters and numbers, and the trail cars are of the same colors.

The open car is a new design of a twelve seat, open motor car, eight of the seats having reversible backs, and four seats having stationary backs. The ends of the car are enclosed with drop sashes, and the cars themselves are fitted with spring roller curtains, bird's eye maple veneer ceiling, handsomely decorated, and solid, polished bronze trimmings throughout. This car, like the closed car, is mounted on Eureka Maximum Traction pivotal trucks. This car is painted white, with gold letters and decorations, while the trail cars to be drawn by it are also white, making a white train of open cars, and a black train of closed cars.

Both cars will be equipped with two Short single reduction, thirty H. P. motors to each car, and both will have thirty-three inch driving wheels

These cars are the result of the liberal policy of A. N. Broadhead, president of the Jamestown Street Railway Co., who has made special efforts to bring his street railway to the front as one of the best equipped electric railways in the country, and the manufacturers state it as their belief that these styles of cars will be adopted in many places where interurban and suburban street railways are being installed.

The Street Railway of Palatka, Fla.

We present herewith a view of one-half of the



CLOSED CAR EMPLOYED ON ELECTRIC RAILWAY AT JAMESTOWN, N. Y.

motive power, together with the entire rolling stock, car, barn and stable of the Palatka, Fla., Street Railway. As will be seen, the rolling stock consists of two short cars, one open and the other closed, both made by the John Stephenson Co., Ltd., of New York. The motive power consists of two mules, one of which is shown in the view. The line is laid narrow gauge. The view shown was taken on the occasion of an excursion recently tendered by the president and owner of the road, who may be recognized in the group.



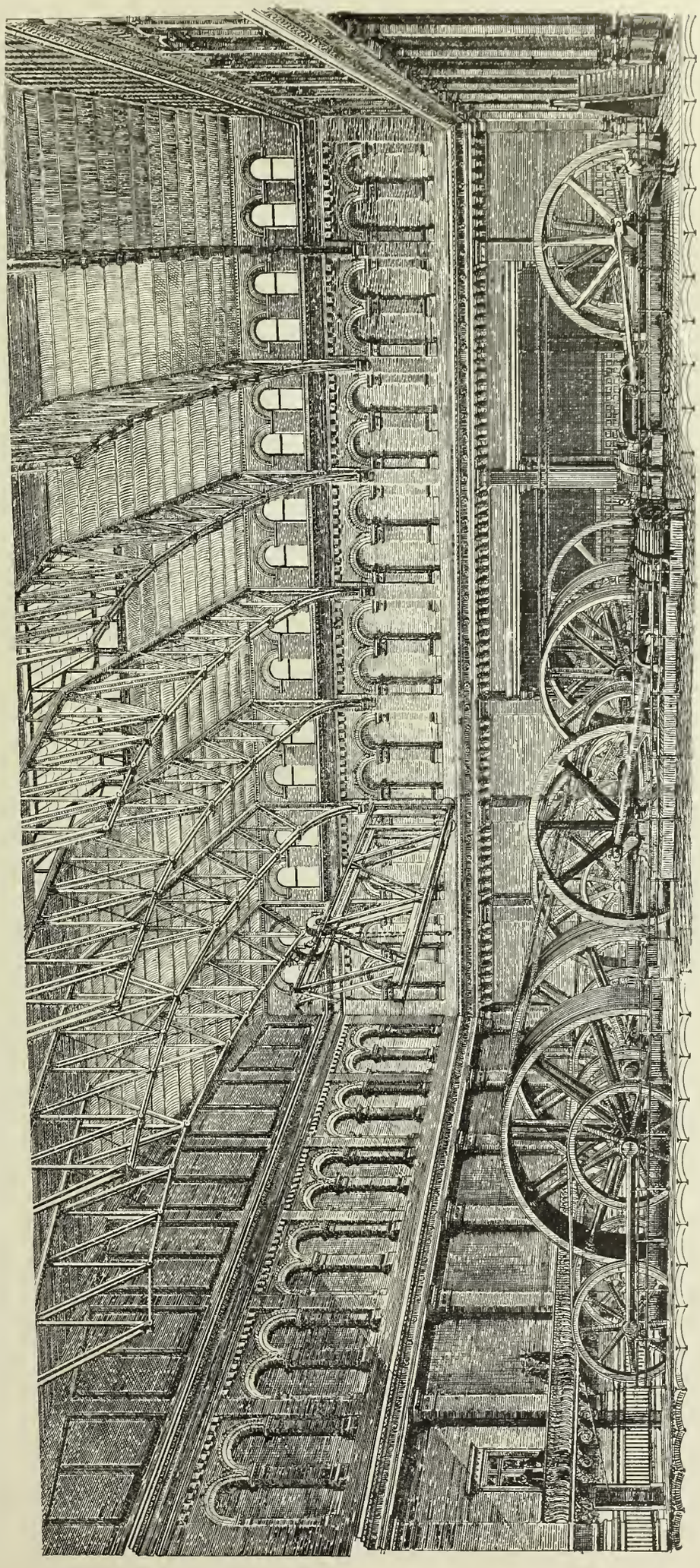
STREET RAILWAY OF PALATKA, FLA.

The frequency of fires in street car houses and power plants, emphasizes the value of fireproof structures for these purposes, and among the materials employed nothing in the market is superior to the porous terra cotta manufactured by the Pittsburgh Terra Cotta Lumber Co. The above is a name given to earthenware tile which is made of a composition of clay and sawdust, fashioned into hollow forms and rendered porous by the sawdust being consumed in the process of burning. This material is adapted for flooring and partitions in all classes of buildings. It will hold nails and screws perfectly and can be readily cut with a hand saw. Besides being adapted for building purposes this material is highly recommended for switchboard construction in electric power plants. An illustration showing its use for this purpose was given in our Souvenir edition last October, since which time it has been extensively employed. The material being in place is plastered on the face with cement, and finished to represent marble or marbleized slate.

Interior of Third Avenue (Uptown) Cable Railway Station.

In our September issue for 1891, ground plans were shown of the two cable power stations of the Third Avenue cable railway of New York, and in the February issue for this year there was shown an exterior view of the lower power station. On this page the reader has before him a view of the engine room of the Sixty-fifth Street station. The power will be provided by four Corliss engines, built by the Corliss Steam Engine Co., of Providence, so arranged that one or all of them may be operated simultaneously. The means of transmission will be by Lambeth cotton ropes. The cotton rope drums contain twenty-two grooves.

The machinery will be securely fastened to substantial cast iron bed framing, which is firmly bolted to the foundations which are built of brick, laid in the best Portland cement. The architect for this station is Albert Wagner, of 67 University Place, New York.



PERSPECTIVE VIEW OF ENGINE ROOM OF MAIN POWER CABLE STATION, THIRD AVENUE RAILROAD CO., SITUATED ON 65TH AND 66TH STS., BETWEEN 2D AND 3D AVE., NEW YORK.

Love Electric Conduit System.

The Love conduit electric railway system which was fully illustrated and described in the last issue of the Street Railway Journal is now in practical operation in Chicago. The car which is run over the Fullerton Avenue loop, is an ordinary open car equipped with a McGuire truck. Thus far little or no difficulty has been experienced in the electrical part of the system. There has been no trouble from grounds. The Love company, however, state that the mechanical details have not yet been entirely worked out. The matter of a trolley was not decided upon in advance, but several different forms were experimented with. A number of changes have been made, but the best form of trolley has not yet been determined upon. Superintendent Roach of the North Side cable road, who has been examining the system carefully, states it as his opinion that the company has every reason to be encouraged by reason of the successful operation of the car. The minor details in the system will, in his opinion, be worked out without any great trouble. The Love company are very conservative in their statements. While they say they believe they have been successful they assert that they propose within a short time to demonstrate the complete success of the system in all respects and in every kind of weather. Until they have done this, they say, they will not make any strong statements, although they are confident the problem of a conduit road is solved.

Eickemeyer Motors in Toledo.

Reference was made in the last number of the Street Railway Journal to the fact that several Eickemeyer motors were in operation on the system of the Toledo Consolidated Street Railway Co. The machines, which were made under the Eickemeyer patent by the Western Electric Co. of Chicago, were regarded as experimental when first sent to Toledo, but they have proved so successful in operation that additional orders have been sent to Chicago, and within a short time twenty-one motor cars of this type will be operated.

The general appearance of the car is shown in Fig. 1, which illustrates generally the method of connection between armature and axles.

The motor and truck are shown in Fig. 2. The former is of the Eickemeyer design in which the armature and field magnet coils are completely encased in a steel framework which forms the magnetic field. The armature coils of the motor are first formed upon arbors, and afterwards are placed upon the armature where they are secured by the usual lugs and bands. The field magnet coils also are wound upon arbors, from which they are removed before being placed in position in the motor. The coils are divided into sections, and are so connected to the controller mechanism as to give the changes necessary to produce the several speeds. Little, if any, use is made of resistance coils in operating the motor, so there is practically no lost energy due to that cause.

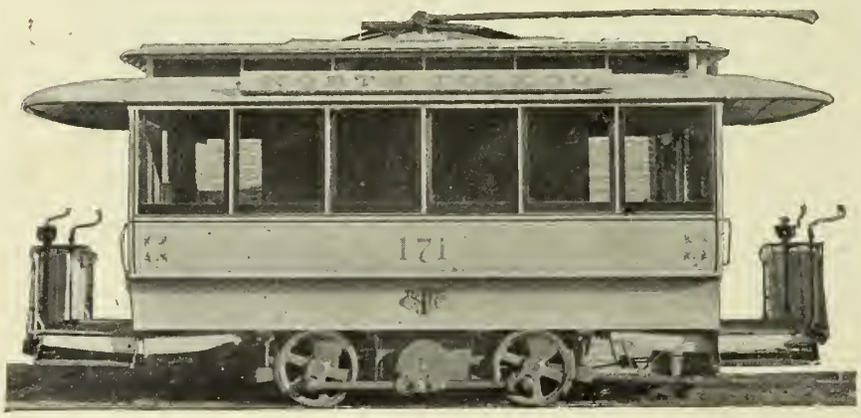


FIG. 1.—CAR—EICKEMEYER SYSTEM.

The truck consists of four cast iron pedestals bolted to the steel frame of the motor, and in the pedestals float the axle boxes which are within the drive wheel. At the outer extremities of the pedestals are bolted heavy timber cross girths, which serve as supports for the car body. The system of connection of the motor and axles is effected, as the illustration shows, by means of parallel rods which are fitted with swiveled brasses, so that the independent movement of the axles, to the necessary degree, is made possible, thus facilitating the rounding of curves, and the passing of slight irregularities in the track. The motor armature is provided with a crank disk at each end, with the pins located at angles of ninety degrees. This arrangement prevents the possibility of a dead centre in the motor, and a consequent refusal to start. The success of this method of connection, which has been adopted in locomotives for many years, has been extremely gratifying.

In equipping cars the Western Electric Co. supply a thirty H. P. motor, when the grades to be encountered do not exceed 6 per cent. When more severe conditions are to be met more powerful motors are furnished. The weight of the thirty H. P. motor and truck complete is four and a half tons. The sixteen foot car body used with the motor weighs three tons, making seven and a half tons for the complete equipment.

Novel Method of Motor Attachment.

A novel method of connecting an electric motor to the axles of a street car has recently been devised by Mr. John Christiansen, of Quincy, Mass., and has been tried on the line of the Quincy & Boston Railway. The motor is designed to run continuously and is so arranged that it can be thrown in and out of connection, at the volition of the driver, by an endless belt connected with the car axles. Connection between the motor and belt is made by mounting a rubber covered pulley on the armature shaft and pressing, or not, the belt against this by means of a corresponding rubber covered pulley which acts as a buffer. A novel type of car wheel having serrated rims is also used, one of its objects being to facilitate the operation of the car when the rails are covered with ice and snow.

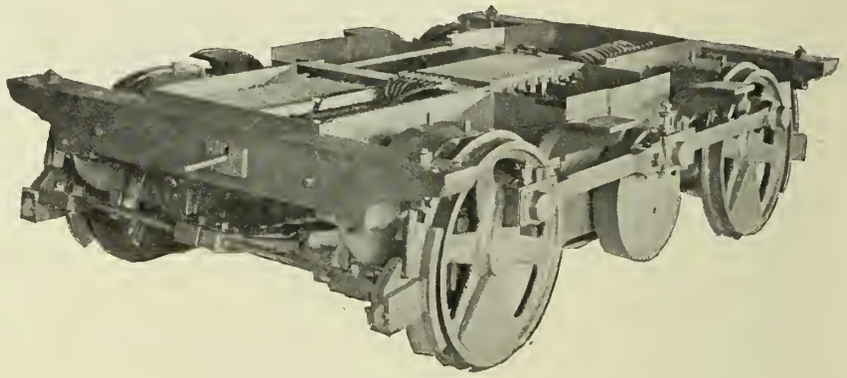
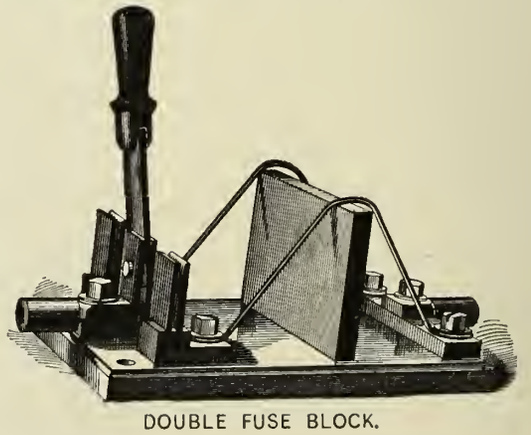


FIG. 2.—TRUCK—EICKEMEYER SYSTEM.

Double Fuse Block.

The accompanying illustration shows a double fuse block recently brought out by Wm. H. Weston & Co., of Philadelphia, manufacturers of electrical apparatus. The arrangement of the apparatus is compact, and, as will be seen from the engraving, its method of operation is simple. It is claimed that the change from one side to the other can be made very quickly by means of the switch attachment in case that one of the fuses blows, and that it can be manipulated with much greater ease, and with much better effect than the ordinary plug fuse block.



DOUBLE FUSE BLOCK.

The West End Street Railway Co. will institute the electric system in Brookline, Mass.

The Mather Generator for Electric Railways.

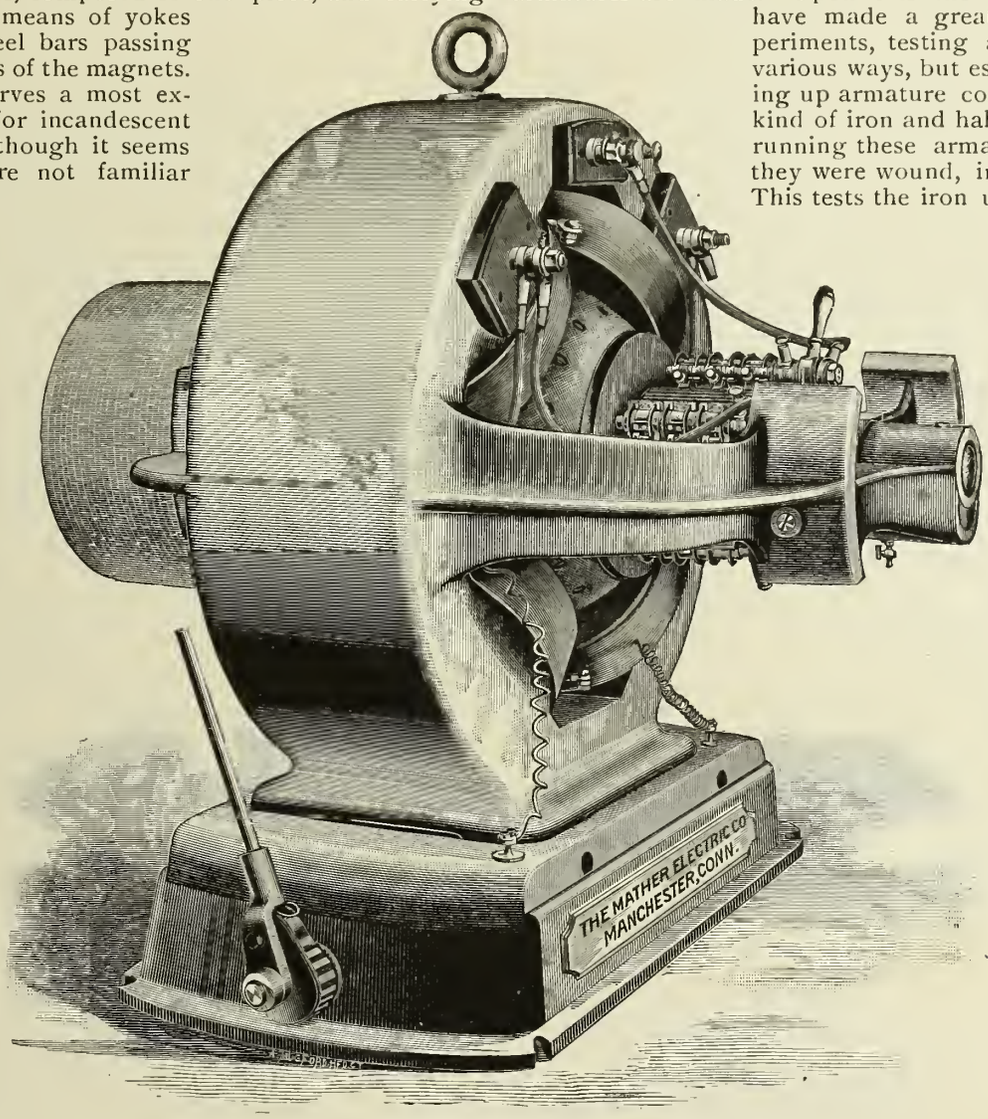
By Prof. Wm. A. Anthony.

The special feature of the dynamos manufactured by the Mather Electric Co. of Manchester, Conn., has been the construction of field magnets without joints, and having a general form as nearly as possible like the natural one of the lines of magnetic force. Following out this principle of construction, the Mather incandescent dynamos, which have been on the market for several years, have been made with cast iron field magnets of the well known ring forms, composed of one piece, and carrying the armature by means of yokes supported by steel bars passing through the poles of the magnets.

This form serves a most excellent purpose for incandescent dynamos, and although it seems to those who are not familiar with the mode of winding a difficult form to wind, it is really not so when wound for low potentials, but for high potential machines it becomes necessary, in order to avoid the strain on the field coils due to sudden changes of potential or breaking of the field circuit, to wind the wires in such a way that no two wires having any considerable difference of potential should be near each other. This necessitated the adoption of a form of field coil that could be wound in a lathe, with a single wire, in layers, and it was this necessity that led to the adoption of the form here illustrated of generators and motors. It was deemed very desirable to retain as far as possible the special features of the incandescent machines, and to this end designs were made to cast the field magnets in one piece, or, if joints are used at all, they are made by a cylindrical piece fitting into a hole bored in the casting and presenting a very large surface of contact so as to reduce as far as possible the magnetic resistance of the joints, and the machine has been so constructed that there were exactly the same joints in each of the magnetic circuits. By this construction there is a perfect symmetry of form in the several magnetic circuits of any one field magnet, and the different coils of the armature all pass through precisely equal magnetic fields. As a result of this arrangement there is absolute freedom from sparking at the commutator. In the four pole machines the armatures are so wound that there are only two paths for the current, but, at the same time, the winding is such and the commutator is so constructed, that opposite bars are joined by a cross connection, and either two or four brushes can be used at pleasure.

The speeds of the various machines have been adjusted to the sizes of the armatures. The faster a generator or a motor runs, the greater is the output to be obtained, and the limit of speed is entirely a mechanical one. In designing these machines, it has been the aim of the Mather company to use as high a speed as is consistent with good mechanical principles, and they believe that the speeds adopted will be found in every way more satisfactory than anything slower. Besides the advantage of greater output, the smaller number of windings upon the armature running at a higher speed presents very many advantages in smooth running at the commutator.

A very important factor in the construction of large machines is the quality of the sheet iron of which the armatures are made. Upon this the Mather company have made a great number of experiments, testing all their iron in various ways, but especially by building up armature cores of half of one kind of iron and half of another, and running these armature cores before they were wound, in an excited field. This tests the iron under exactly the conditions to which it is exposed in practice, and if one end of the core was found to heat more than the other, the iron which heated less was, of course, the better iron. By such experiments as this the Mather company have at last found an iron which can be used for armature cores of twenty-four and thirty inches in diameter, running in intense fields and at speeds of 400 or 500 revolutions, with very little heating. This reduces the unknown losses in the running of the dynamo to a minimum, and the C^2R losses in the winding of the armature and field, which can be known to a fraction, become the greater part of the total loss when the machine is doing work. The Mather company claim a machine in which all the magnetic and electrical parts are absolutely balanced, a machine which will run at a perfectly safe and manageable speed, and gives a large output for its weight, a machine which runs with absolute freedom from sparking at the commutator under great variations of load, and has an efficiency at least as high as, if not higher than, any other similar machine in the market. The sizes of machines constructed for railway generators are 50, 75, 120, and 180 kilowatts capacity. The last has six poles; the others are four pole machines. The same principles of construction apply to all.



THE MATHER GENERATOR FOR ELECTRIC RAILWAYS.

It is an interesting fact that the street railway lines of New York City have come under the control of Hon. William C. Whitney almost as completely as the same service in Boston has come under the management of his brother, Henry M. Whitney, and their remarkable business ability is being pretty generally recognized in both cities.

Track Brakes.

By Frank Van Vleck, M. E.

Street cars, in design, are a hybrid from two different classes of construction, the omnibus and the railway car, and partake of many of the good and bad features of each. The wheel brakes were the mechanical inheritance from the steam railway car, and structural lightness from the omnibus. This lightness of weight on wheels is one of the reasons of the inefficient action of wheel brakes on street cars. In the steam service, the cars are heavy and the brakes are powerful, quick and mechanically automatic, and a car is rarely required to stop within its own length. Grades are necessarily light and other conditions favorable. Hence, wheel brakes constitute all that is necessary or desirable. But the instant we apply the wheel brakes to the street cars we are met with a host of difficulties. The cars are light for a heavy adhesion contact between wheel and rail. Often the rail is slippery with ice, dampness, or the slimy ooze of a city pavement. No matter how powerfully the brakes are applied the wheels will slip; then from an electric car drops the sand; usually, by this time the wheels are locked by the brakes, skidding occurs, the limit of braking power is reached, and the car gracefully slides, to the ruination, incidentally, of wheels.

For celerity of action in applying these brakes look at the childishly elementary brake handle. It would be a libel to say that this descended either from the omnibus or the steam car. The only conceivable parentage indicates that it is direct from the hand organ, and is similarly successful in blasting many lives. Some of the late ratchet brake handles are a great step ahead, but what is wanted is something better than a bent brass handle set to wind up a loose chain on the end of a rod. The new arrangement demands a lever, direct, powerful, positive and quick. The lever, of course, may be operated by either hand or foot as circumstances dictate. If a hand lever, it can be equipped similar to a locomotive reverse lever, with its engaging and disengaging pawl. The hand lever offers a long leverage, and a long arc of action with a quick movement. The foot lever offers the disadvantage of a small arc of action, due to the fact that a man can-

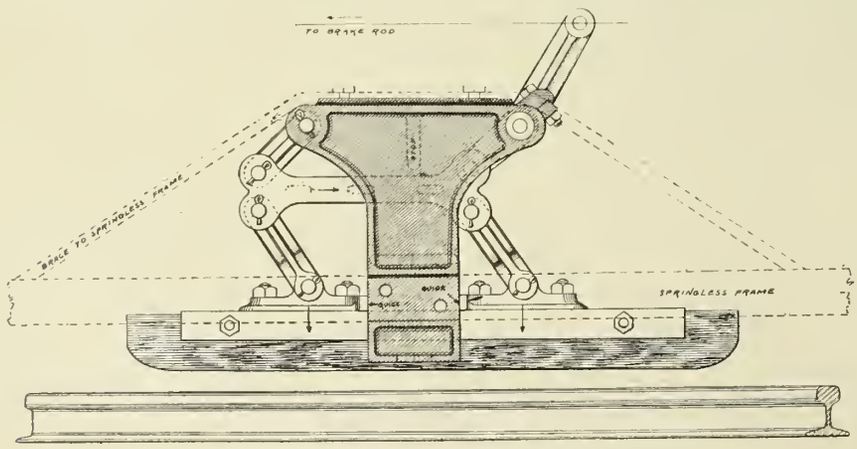


FIG. 2.—TRACK BRAKE—LOS ANGELES.

not be relied upon to raise his foot more than twelve inches to tread his brake, and that pawl or ratchet cannot be adapted to hold the foot lever down, without requiring an awkward additional movement or mechanism for disengaging.

From what has been said it must not be inferred that wheel brakes are to be abandoned. They should be retained and their efficiency and efficacy greatly enhanced by better design and construction. Every wheel of the car should have its proper brake shoe, regardless of whether the car is of four, six or eight wheels. In addition, track brakes should always be provided.

To be sure, no track brake or other form of brake, save a rigid bumper on the rails, will stop a car instantaneously. If such a brake existed it would kill a car load of passengers to save, possibly, a victim from the wheels. A track brake is simply an aid, but an extremely valuable one.

Calfornia, which has "set the styles" for cable road inventions, has every one of its hundreds of cable cars equipped with track brakes. When questioned as to

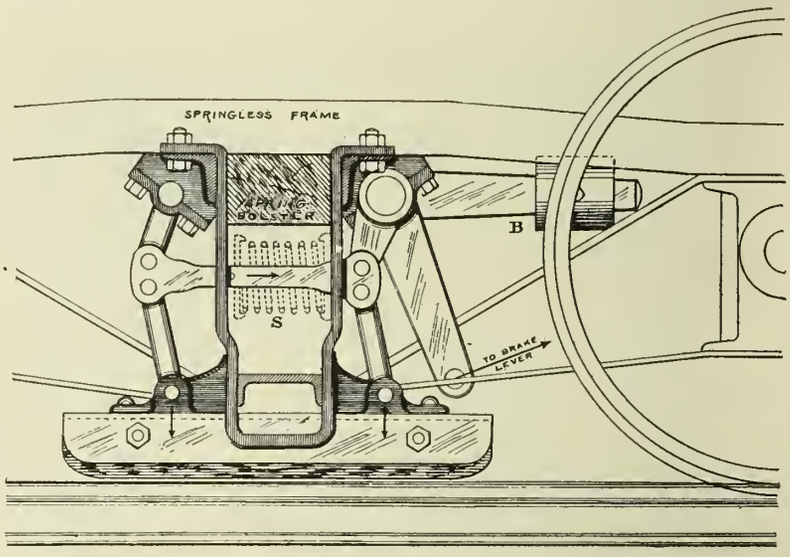


FIG. 1.—TRACK BRAKE—SAN FRANCISCO.

whether they are regarded as desirable or useful, there is not an officer but will reply "They are absolutely necessary." In San Francisco, cars are stopped and even held on grades by these brakes, which to the Eastern wheel brakeman seems scarcely less than miraculous. On the level, in preventing collisions, cars are often brought to a stop from full speed within ten feet.

Track brakes, as ordinarily constructed, have the brake shoe or "slipper" formed of wood. Many roads use soft wood, while others regard the wearing of a hard close grained wood most satisfactory, the matter being solely determined by the original cost and the cost of renewal. Under ordinary usage, the slipper ought to wear from two to four weeks, and often longer. Iron brake slippers have in many instances been tried, but in each case they were found wanting in adhesion, and when the rails were wet or icy the sliding might become disastrous. The usual length of the wooden slipper is from eighteen inches to three feet; when made longer than this they will overdrag at the ends when passing curves of short radius. The length is governed by the size of the car.

Most failures in the arrangement of track brakes have been due to faulty connections with the truck or car body. The brake to be always successful must be supported directly from the axles; that is, there must be no interposition of springs; consequently they cannot be located on truck bolsters or on the car body. In short, they must be carried on the "springless frame" (for want of a better name) of the truck. The reason for this is evident. If located on parts subject to springing, or on the car body, irregularities in the loading of the car, swaying and all other movements are communicated to the track brakes, the consequence being that the track brake is in full bearing at one instant and free at the next. If this one matter is carefully looked into it will generally bring successful working of an otherwise badly designed brake. Original amplitude of leverage at the brake handle reducing to a minimum the final move-

ment at the slipper will bring into play heavy power, and in well arranged cases even sufficient to take the weight of the car from the wheels. It is a mistake to attempt to lift the slipper too far from the rail. One-half inch is ample, while to go as far as two inches, means a waste of power.

The track brakes described in this article are all chosen from examples which are now in use and have

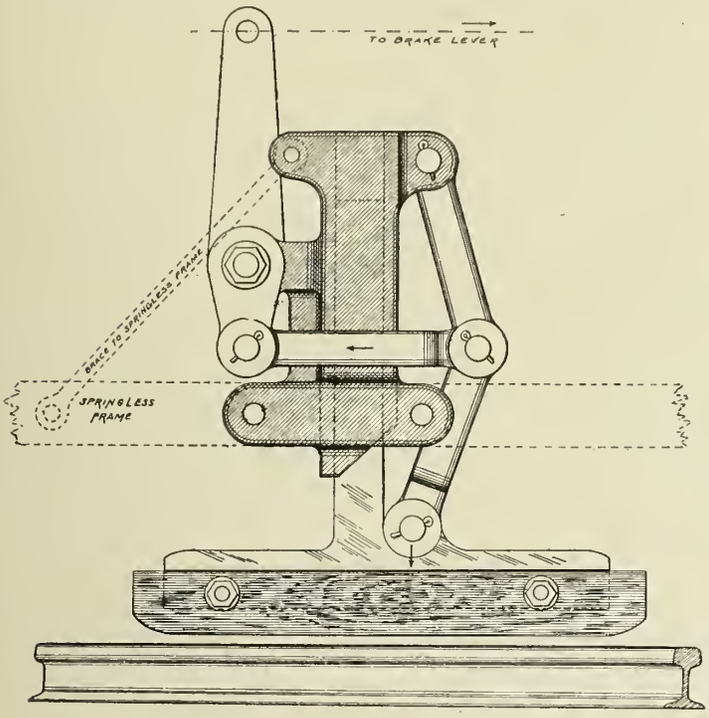


FIG. 3.—TRACK BRAKE—CINCINNATI AND PITTSBURGH.

afforded eminent satisfaction. The prevailing mechanical principle underlying them all will be seen to be an adaptation of the toggle joint.

In Fig. 1 is shown a type of track brake fitted to the rear truck of combination open and closed cars. It is placed on the truck under the closed portion of the car, as that is the heaviest portion of the car body, and therefore, more of the weight of the car can be brought upon the track brake. It will be seen that the brake is brought into action by the straightening of the double toggle joints. As these joints move, the wooden brake block or slipper is brought forcibly down upon the rail. This movement of toggles approaching the straight or dead position, as is well known, affords one of the most powerful mechanical devices for exerting pressure. The upper end of each toggle joint, it will be observed, is attached to the springless frame of the truck; hence no vibration or unequal loading of the body of the car due to the feminine passengers seeking the shady side of the car or other cause, will affect the degree of the pressure of the wooden brake shoes on the rail.

Of course the entire truck is not springless; the bolster or other arrangements are as usual carried on ample springs. The springless portion, of which most trucks possess one or more members, is sought as an absolute necessity for the track brake. It will be seen that the weight of the brake shoes and levers all tends to drop the brake upon the rail. This in practice is provided for in three general methods. The first and most usual is to attach a weighted lever to the brake shaft, as shown at B. The second plan is to place on the toggle connecting rod a spring, as shown by the dotted lines at S. Another method is independent of weights and springs, and relies solely on the holding power of double pawls, or square cut ratchets on the gripman's or motorman's brake lever. In short, it is nothing less than the locomotive driver's lever—it stays where put.

This form of track brake is in use to almost the exclusion of any other in San Francisco, has been adopted by the San Diego Cable Tramway, the cable roads of Portland and Seattle and others.

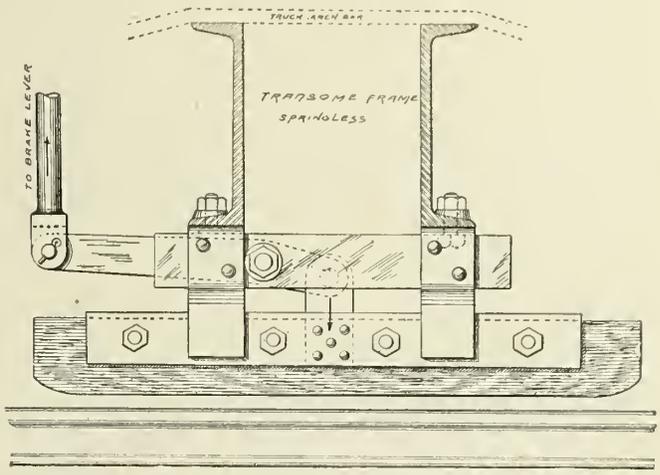
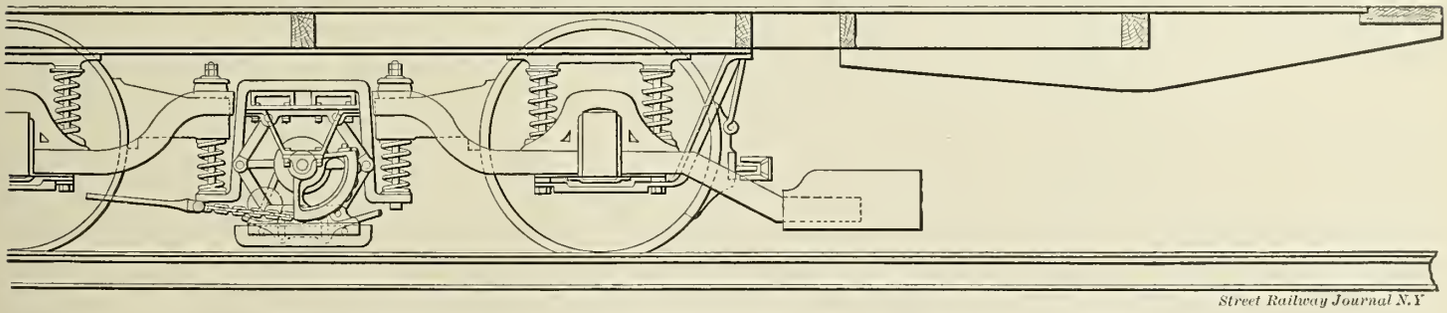


FIG. 4.—TRACK BRAKE—HOBOKEN.

Another modification of this double toggle brake is shown in Fig. 2. This has the advantage in being a self-contained attachment to the truck, and is easily removed and replaced by another, and then repaired for its own ills, without the necessity of sending the whole truck to the shops.

The cable lines of the Pacific Railway at Los Angeles, the Butte City Cable Railway as well as several others, use this form entirely. It was brought to its present success by the Brownell Car Co. of St. Louis.

In Fig 3 we have another form in which the employment of the double toggle is abandoned. The brake has many advantages, is very compact and most substantially proportioned. The Cincinnati Cable Railroad and the Pittsburgh Cable Co. have used this design extensively, and have found the brakes reliable. The J. G. Brill Co. of Philadelphia were its introducers.



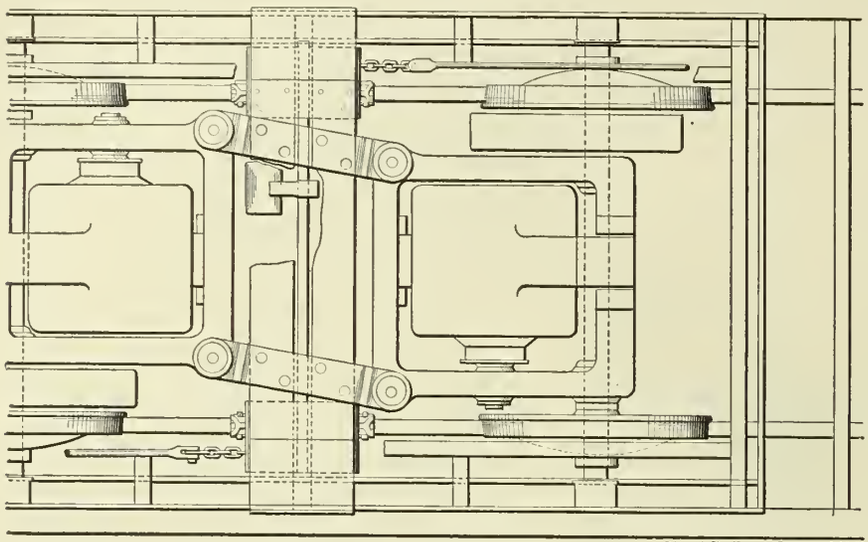
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FIG. 5.—WOOD & FOWLER TRACK BRAKE FOR ELECTRIC CARS—SIDE ELEVATION.

Fig. 4 represents the form of track brake used on the Hoboken elevated railroad. It does its work with a certain degree of success, but is by no means a model. It lacks the power of the toggle arrangement, and is not properly guided to prevent up and down rocking of the end of the brake shoe. A sufficient "see-saw" action in the brake shoe, may bring the end of the shoe in contact with some projecting end of a rail or with a high guard rail; then disaster is at once courted. In the previous example it will be seen that the shoe must come down in perfect parallelism with the rail.

One of the latest forms of track brake has been brought out by Messrs. Wood & Fowler of Los Angeles, and it possesses many valuable features. In Figs. 5, 6, 7,

8, 9 and 10 it will be seen that the brake action, as before, is by means of the reliable toggles, but these latter, instead of being connected together by a single connecting rod, have each a connection with the revolving eccentric head. Figs. 5, 6, and 7 show the application to an electric car, and 8, 9 and 10 to a cable car.



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FIG. 6.—WOOD & FOWLER TRACK BRAKE FOR ELECTRIC CARS—PLAN.

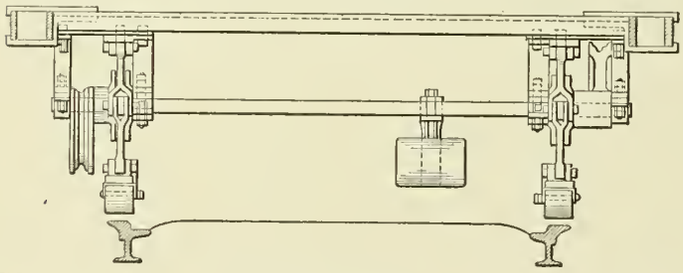


FIG. 7.—WOOD & FOWLER TRACK BRAKE FOR ELECTRIC CARS —END ELEVATION.

From the position of the toggles it will also be seen that guides to prevent the see-saw action are wanting, and are totally unnecessary. This permits of the whole device being arranged in a lighter manner. This type of brake is readily adaptable to any truck, and when attached to the springless frame can be made specially effective. A very ingenious substitute for the brake equalizer is seen in the use of the two sectors and chain on the main brake shaft. By this means it is equally easy to apply the brakes from either end of the truck or car.

The special significance attaching to this brake is that it has been doing admirable service on a road by nature afflicted with grades running from 18 to 20 per cent., the Temple Street Cable Railway of Los Angeles. The brakes are the outcome of a grim necessity for something to hold a car on these grades, and the management devised these as being the best suited for exacting conditions.

A number of other valuable possible forms of track brakes suggest themselves to the writer, but as the object of this description has been to describe brakes at actual and successful work, possible designs cannot, therefore, be considered.

Many who anticipate the introduction of track brakes specially for use on electric trucks, first of all inquire what about the "patent plague" and track brakes; to which it must be acknowledged that the field is well covered with patents. There being numerous modifications of the

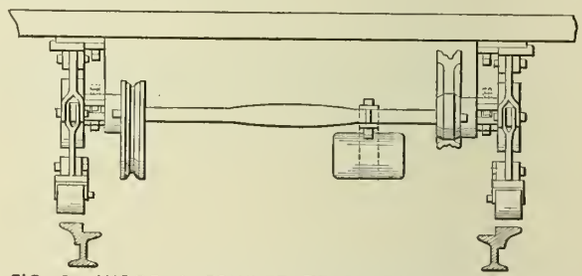
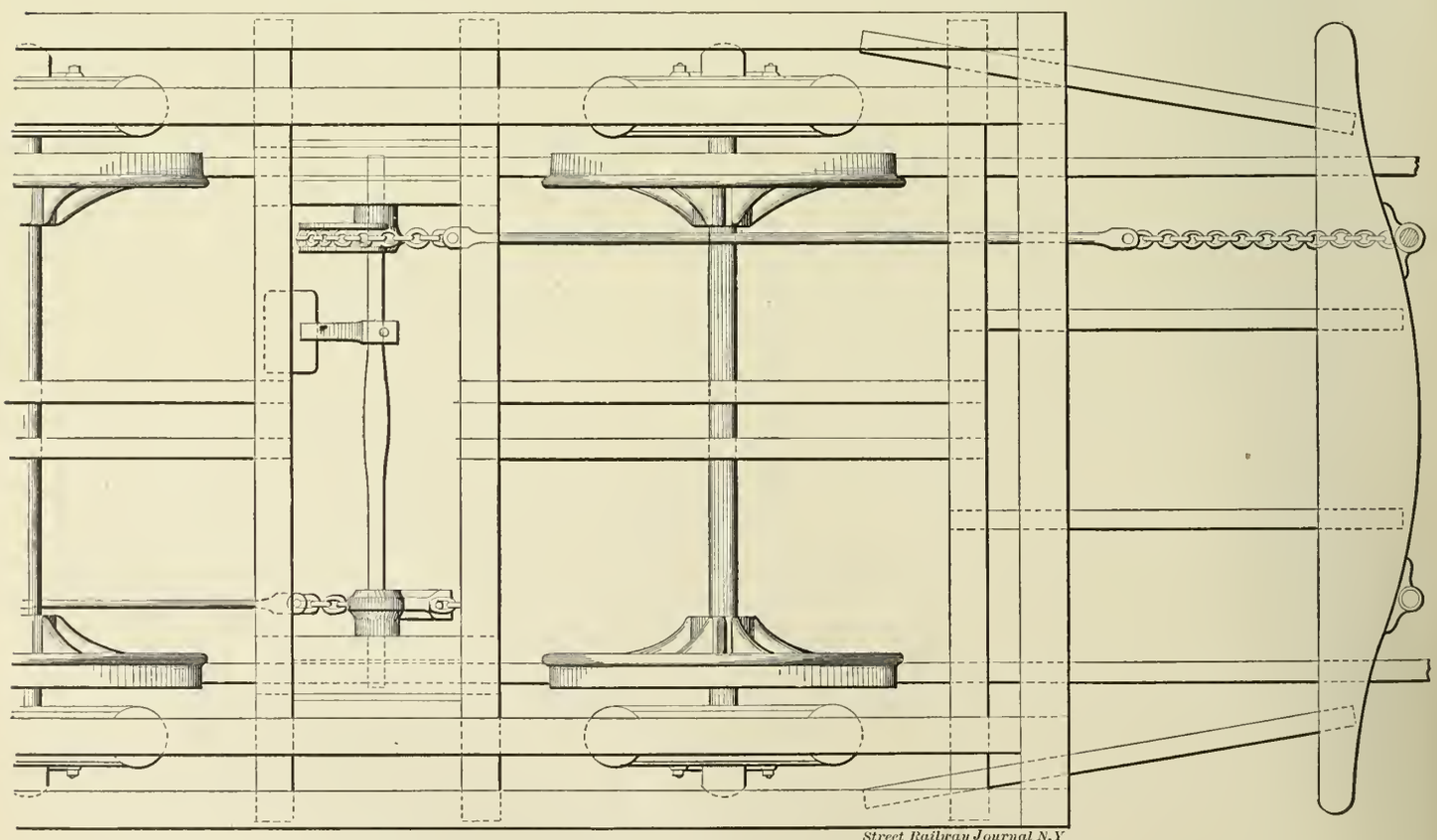


FIG. 8.—WOOD & FOWLER TRACK RRAKE FOR CABLE CARS—END ELEVATION.

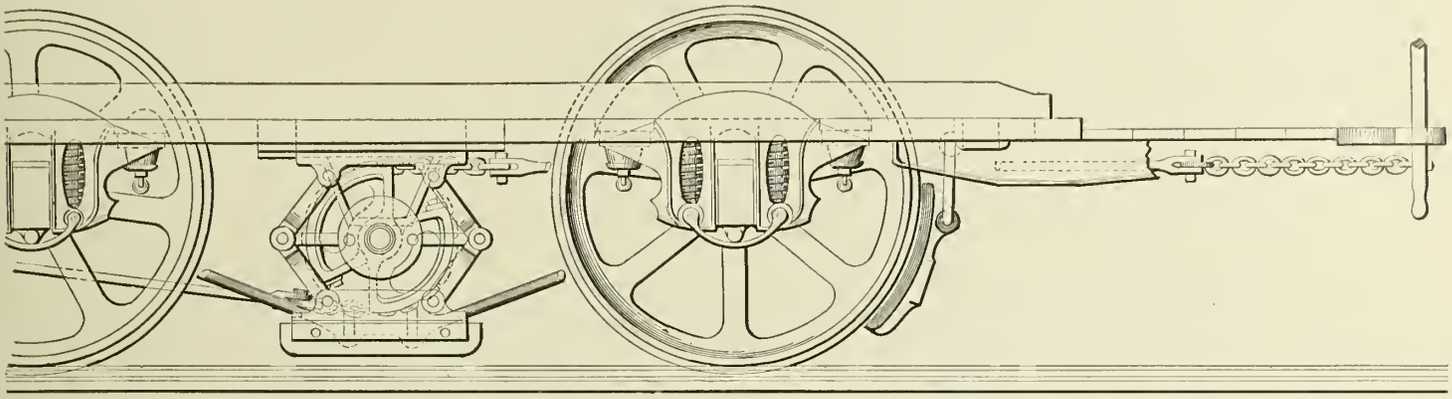


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FIG. 9.—WOOD & FOWLER TRACK BRAKE FOR CABLE CARS—PLAN.

same design, royalties or construction premiums need not be large, certainly never large enough to counterbalance the many advantages derived from their use. If the patentees of these brakes who, years since, had the temerity to apply for patents solely by reason of the fact that look into the future they should see the pressing need for them, why should they not now receive the small reward for their foresight?

It should be added, in conclusion, that the writer has neither invented, patented, nor is interested in brake patents, but as a witness simply desires to praise this new and valuable aid to street railway car safety. As track brakes become more widely known, they will inevitably be generally adopted. Even now practically all cable roads are equipped with them, some few electric roads, and a larger number either arranging for or debating the near introduction.



Street Railway Journal N.Y.

FIG. 10.—WOOD & FOWLER TRACK BRAKE FOR CABLE CARS—SIDE ELEVATION.

A Table of Statistics.

In the subjoined table are given statistics of the street railways in the United States at the end of the years 1890 and 1891, compiled from the directory of street railway companies published each month in the STREET RAILWAY JOURNAL.

A COMPANY has been organized in Pensacola, Fla., to introduce a spring motor for street cars. Each car carries a combination of six steel coil springs confined in barrels, somewhat similar to those used in clock mechanism, placed under the car, and so arranged that they may be wound singly or all together, and the force expended in like manner. The springs are wound at the station and when wound are intended to be capable of driving a car about eight miles.

Comparison of Mileage and Cars of Street Railways in the United States for the Years 1890-91.

States and Territories.	1890.										1891.									
	Horse.		Electric.		Cable.		Steam Dummy.		Total.		Horse.		Electric.		Cable.		Steam Dummy.		Total.	
	Miles	Cars.	Miles	Cars.	Miles	Cars.	Miles	Cars.	Miles.	Cars.	Miles	Cars.	Miles	Cars	Miles	Cars.	Miles	Cars.	Miles.	Cars.
Alabama	88	179	.....	.....	.....	.....	149	135	237	314	67	153	8	8	.....	.....	165	141	240	302
Arizona	3	2	.....	.....	.....	.....	.....	.....	3	2	4	6	.....	.....	.....	.....	.....	.....	4	6
Arkansas	50	127	5	8	.....	.....	.....	.....	55	135	60	188	8	39	.....	.....	7	3	75	230
California	153	517	31	45	130	655	60	132	374	1,349	272	614	97	201	146	731	57	135	572	1,681
Colorado	101	207	93	167	24	137	4	10	222	521	76	242	130	264	39	198	.....	.....	245	704
Connecticut	86	291	12	24	.....	.....	.....	.....	98	315	117	388	7	16	.....	.....	.....	.....	124	404
Delaware	7	32	5	10	.....	.....	.....	.....	12	42	5	33	7	23	.....	.....	.....	.....	12	56
Dist. Columbia	60	229	16	36	6	24	.....	.....	82	289	62	368	29	62	6	24	.....	.....	97	454
Florida	57	104	.....	.....	.....	.....	.....	.....	57	104	59	107	.....	.....	.....	.....	.....	.....	59	107
Georgia	96	259	44	49	.....	.....	35	32	175	340	86	151	99	151	.....	.....	34	41	219	343
Illinois	394	1,699	150	273	67	1,050	8	16	619	3,038	382	2,011	229	436	69	1,342	8	16	688	3,805
Indiana	117	394	66	81	.....	.....	6	8	189	483	108	393	107	164	.....	.....	7	11	222	568
Iowa	101	222	111	213	.....	.....	19	34	231	469	58	133	158	318	4	25	20	31	240	507
Kansas	90	160	55	95	.....	.....	20	19	165	280	72	129	66	116	.....	.....	20	19	158	264
Kentucky	173	478	38	80	.....	.....	.....	.....	211	558	133	344	72	238	.....	.....	.....	.....	205	582
Louisiana	146	329	5	8	.....	.....	.....	.....	151	337	117	464	5	4	.....	.....	36	36	158	504
Maine	33	90	11	13	.....	.....	.....	.....	44	103	45	89	11	37	.....	.....	.....	.....	56	126
Maryland	178	522	9	5	.....	.....	.....	.....	187	527	169	480	9	9	10	30	.....	.....	188	519
Massachusetts	403	2,865	157	493	.....	.....	6	8	566	3,366	482	3,265	257	912	.....	.....	7	8	746	4,185
Michigan	166	639	88	154	.....	.....	9	6	263	799	123	524	157	238	.....	.....	11	6	291	768
Minnesota	60	131	115	437	16	73	.....	.....	276	664	16	26	230	740	16	73	.....	.....	262	839
Mississippi	6	11	5	15	.....	.....	2	6	13	32	18	24	.....	.....	.....	.....	6	13	24	87
Missouri	83	554	192	713	125	1,166	37	78	437	2,511	92	684	252	907	118	996	44	79	506	2,666
Montana	.....	.....	13	23	3	4	12	19	28	46	5	14	43	44	6	4	11	9	65	71
Nebraska	110	299	83	121	10	22	.....	.....	203	442	67	191	133	223	10	22	.....	.....	210	436
New Hampshire	28	63	14	33	.....	.....	.....	.....	42	96	26	66	16	32	.....	.....	.....	.....	42	98
New Jersey	203	683	48	167	3	14	.....	.....	254	864	210	690	71	211	3	17	8	20	292	938
New York	861	5,510	234	465	13	80	19	17	1,114	5,992	921	5,877	326	531	13	88	8	17	1,268	6,513
North Carolina	15	32	10	20	.....	.....	.....	.....	25	52	11	25	27	42	.....	.....	.....	.....	38	67
Ohio	335	1,046	224	698	43	261	.....	.....	602	2,005	284	636	378	1,060	44	305	2	4	708	2,005
Oregon	26	76	26	55	.....	.....	34	24	86	155	34	11	34	76	6	22	31	35	105	144
Pennsylvania	517	2,505	187	390	41	234	4	8	749	3,237	576	1,945	338	776	64	339	4	8	982	3,068
Rhode Island	68	439	10	25	3	8	.....	.....	81	472	69	355	13	31	3	57	.....	.....	85	443
South Carolina	37	83	.....	.....	.....	.....	.....	.....	37	83	35	89	.....	.....	.....	.....	.....	.....	35	89
South Dakota	13	11	.....	.....	.....	.....	6	2	19	13	17	16	9	7	.....	.....	6	2	32	25
Tennessee	128	220	94	94	.....	.....	79	114	301	428	34	121	161	193	.....	.....	74	99	269	413
Texas	185	441	139	175	5	12	24	33	353	661	189	464	197	297	6	24	32	41	424	826
Utah	19	31	15	52	.....	.....	30	19	64	102	.....	.....	79	107	.....	.....	3	11	82	118
Vermont	15	21	.....	.....	.....	.....	.....	.....	15	21	15	22	.....	.....	.....	.....	.....	.....	15	22
Virginia	48	116	50	120	.....	.....	.....	.....	98	236	42	101	73	97	.....	.....	4	.....	119	198
Washington	4	6	110	134	21	55	28	12	163	207	6	12	160	154	31	75	29	18	226	259
West Virginia	18	31	19	36	.....	.....	8	12	45	79	16	26	16	39	.....	.....	8	12	40	77
Wisconsin	114	305	39	65	.....	.....	5	7	158	377	117	310	49	89	.....	.....	.....	.....	166	399
Wyoming	5	5	.....	.....	.....	.....	....	.....	5	5	5	11	.....	.....	.....	.....	.....	.....	5	11
Total	5400	21970	2523	5592	510	3795	604	751	9,109	32,051	5,302	21,798	4,061	8,892	594	4,372	642	815	10,599	35,877

Car Building.

From Advanced Sheets of "Street Railways" (Trams).—Continued.

By C. B. Fairchild.

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CAR TRUCKS.

Truck building is a business by itself, and is not necessarily carried on where the coaches are made, although most car shops have a truck department, and make some special type of truck. Trucks are made in a great variety, adapted to the various forms of motors and power employed, and purchasers of street cars usually specify the style and make of truck upon which they wish their cars to be mounted.

Trucks are not only modeled to suit the different types of motors employed, but also for use under long and short cars employing the same motors, while in the material used and the method of construction, we find a wide range of practice. This is not surprising, for in horse car practice we still find many forms of running gear, with no approach to a universal standard, except it be in the matter of a journal box, which, fortunately, is admirably adapted for use with mechanically propelled cars. But the running gear of a four wheel horse or trail car cannot be regarded as a truck in the sense in which the term is applied to the combined appliances upon which the bodies of mechanically propelled cars are mounted. Hence, the self contained motor truck is of comparatively recent origin, and may be said to have had its birth with the advent of electric traction. It is true that rigid frames have been employed in the construction of trucks for steam and gas motors and for grip cars, but nothing growing out of the experience had with these trucks, nor, indeed, from steam railway practice, serves as a guide in the construction of electric trucks so that they will meet the peculiar conditions under which electric railways are constructed and operated. Hence, it is not surprising that radical defects have heretofore entered into truck construction, attended with damaging and fatal results to motor, car body and track, as the scrap heap of many a street railway can testify. The cause of failure in some cases and of success in others, is owing, no doubt, to the methods followed by the inventors. One class invented a theory, and then denied or ignored facts which demonstrated its fallacy, while the other class ascertained and studied the facts and worked along the line of scientific truths evolved from the plain teachings of experience. While gratifying success has crowned the labors of the latter class, so that the market is well supplied with a great many models and designs that are used and accepted as the best attainable under the circumstances, no one claims that a standard truck has yet been devised, one that will give satisfactory results and serve as a cure-all for the many minor evils in which the service abounds. The possibilities of making trucks better or worse are almost as wide as the range of human effort, for which reason it may not be idle to study the lessons that may be drawn from the logic of events and actual practice, with the hope of a nearer approach to a satisfactory standard.

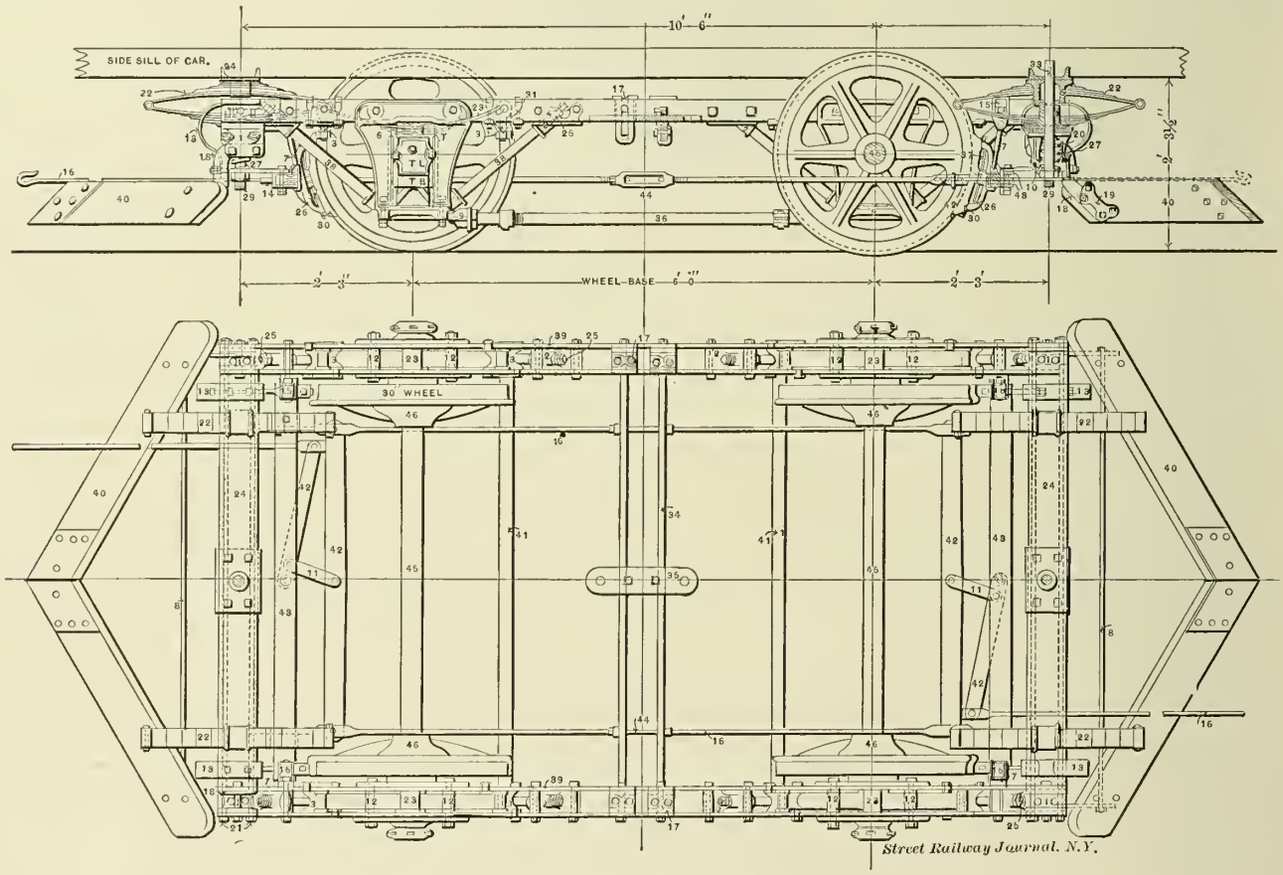


FIG. 1.—TAYLOR ELECTRIC MOTOR TRUCK.

By reference to the accompanying illustrations (Figs. 1 to 4) it will be observed that an immense amount of mechanical genius has already been devoted to improvements in truck construction, and that important changes are still being made.

Trucks are the fundamental features of an electric car, and the details include many parts, some of the most important of which are wheels, axles, journal boxes, journal bearings, motor bearings, frame, springs, guards and brake appliances. The importance of the car truck arises from the fact that it combines these parts with the motor, gears and a large number of auxiliary appliances under such conditions that the aggregate combination forms, in a mechanical sense, a car ; for that which is above the trucks is only the car body. There are four wheel trucks and six wheel trucks employed in electric traction, the latter being of the radial type and chiefly employed under exceptionally long cars (Fig. 3). A large number of eight wheel cars are also employed, and with these the wheels and other necessary appliances are combined in two sets of four wheel trucks, each of which helps to support the car body (Fig. 4). The primary object of this arrangement, and of the six wheel trucks is to enable long car bodies to be conveniently moved round sharp curves. Various other purposes are to be served in the construction of an elec-

tric truck, each of which must be considered in attempting to improve the details of construction, and to promote the ends of electric traction.

The mutual relations of truck and track are an important consideration, for no amount of skill or material expended in the building of a track will produce a structure that will give prolonged service upon an uneven and badly constructed track.

The essential features of an electric motor truck are strength and durability without too great weight. It would seem to be as simple a matter to design a frame that would support the motors and maintain the gears in proper relation, as to set up any machine in which gears are employed, but service develops many difficulties that must be met. The motor must be properly insulated, and one end must be flexibly supported to relieve the gears from sudden strains at starting, and to relieve as much as possible the shocks due to its own weight. While these points cannot be ignored, the design must be such as to allow of ready access to the different parts of the motor, and to allow of the armature and wheels being readily removed. The brake mechanism must be provided for

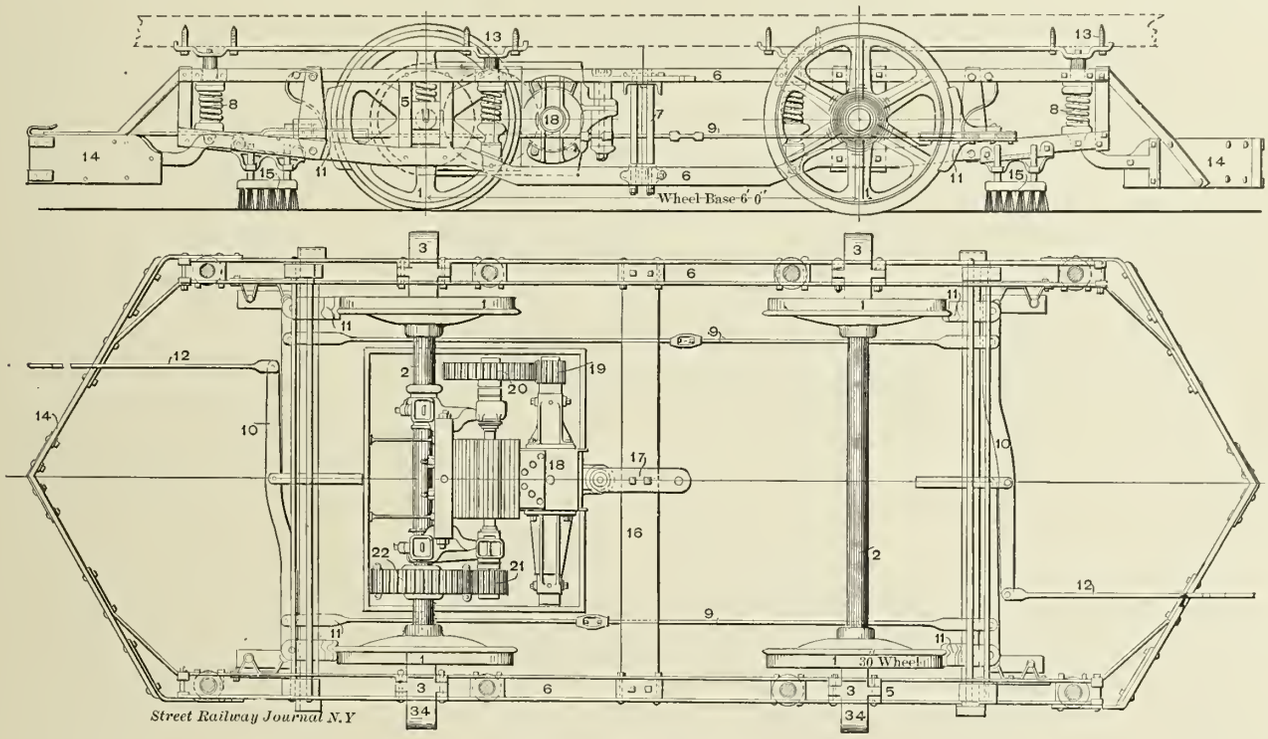


FIG. 2.—MANIER TRUCK.

both to insure reliable action and to admit of adjustment and repairs. Provision must be made for attaching the car body in such a manner that it may be readily removed; while if a long body is to be mounted upon a truck with a short wheel base, provision must be made to prevent side and end oscillation, both with light and heavy loads. The latter requirement is quite important, not only on account of the comfort of the passengers, but because of the destructive effect of the oscillation upon the wiring and the car body, and because it reduces the tractive effort of the wheels and affects the life of the wheels. The latter point has been generally overlooked, but a case is cited where trucks of different types are employed on the same line, both being equipped with wheels of the same make and operated under the same conditions, but on the one in which oscillation is prevented and the weight equally distributed the wheels have a longer life; and the car operates on a slippery track and through snow with much better results than the one lacking these provisions.

In case double trucks are employed, which carry only one motor, it is desirable to so pivot the truck that the driving wheels will carry a large portion of the weight in order to secure the maximum amount of traction. In connection with such an arrangement the idle wheels are made smaller than the drivers so that the truck will swivel without interfering with the steps or the car framing, permitting of the body being mounted several inches lower than where the wheels are all of the same diameter. In any construction, other things being equal, that type of motor truck which has the fewest number of parts and avoids the use of bolts and nuts is the most desirable.

In the manufacture and repair of car trucks, the requirements, as we have seen, are very exacting, and include a number of parts which must be specially manufactured for their construction. Among the auxiliary industries which perform important service in this direction, are those which manufacture wheels, axles and springs, and, although this work is usually conducted in independent establishments, it is important that some general knowledge of the characteristics of these parts and details of manufacture be had to serve as a guide in their selection and prevent disastrous mistakes, for the fortunes of a company may be made or marred by success or failure in the selection of these three items alone.

WHEELS.

Chilled cast iron wheels were used almost exclusively under street cars in this country until the advent of electric traction, and even now constitute the principal portion of all wheels manufactured for this service, but the manufacture of the various types of steel and steel tired wheels for motor cars is a growing industry, and the demand for them arises chiefly from the belief that they are capable of performing a greater amount of service, have a greater tractive force, and are safer under high speed electric cars. In regard to the relative economy, it is claimed for steel tired wheels that the extra amount of service which they are usually capable of performing, and consequent diminution of the number of changes of wheels, compensate for the difference in first cost. This theory is ably advocated on the one hand, and forcibly opposed on the other, by manufacturers of chilled wheels and some street railway managers.

There are records of the performances of both types of wheels made by reputable manufacturers that are very creditable, and in some cases, under favorable circumstances, a degree of excellence has been attained that has fully met or even exceeded all reasonable expectations, but unsatisfactory results have been reported in both cases where wheels were furnished at a price too low to afford compensation for the skill, care and labor necessary in the manufacture of a first class article. In making a choice between cast and steel tired wheels, one must be

governed somewhat by the reputation of the makers, and by the peculiar conditions existing on the line where the wheels are to be put in service. For instance: If the conditions are such that the flange of the wheel will be worn out before the tread needs turning down, it will not be economical to employ steel tired wheels.

The manufacture of chilled car wheels depends upon the principle that when certain kinds of cast iron are melted and poured against a metallic mould or "chill," that portion of the iron next to the mould is suddenly cooled and becomes white, crystalline and brittle, while the inner portion remains gray and more or less tough and fibrous. Hence by placing in the mould a metal ring having the form of the tread and flange, the molten metal surges against it as it is poured, causing the wearing parts of the wheel to become hard and very durable.

Formerly the "chill" consisted of an ordinary iron ring, but owing to its unequal expansion and contraction the finished wheel is apt to be irregular in shape and the chilled surface of unequal depth. To correct this, and take advantage of the laws of expansion and contraction, the "contracting chill" has been devised, which in some form is now almost universally used. The ordinary contracting chill is a ring cast in one piece, but having its inner surface divided into segments by means of thin slots, so small that the iron does not penetrate therein to any extent. As the metal is poured the entire ring expands from the heat, and as it cools the circumference contracts, keeping the inner surface in contact with the metal.

In order to increase the depth of the chilled surface and make it uniform, some manufacturers employ a "chill" in which the expansion and contraction are controlled by external means. One of the most efficient chills of this type is cast with a hollow outer rim, having its inner face or chilling surface divided radially into inch sections, by a saw cut, but further back by a wider opening to secure ventilation. The application is about as follows: The mould being prepared, live steam is passed through the outer hollow rim of the chill for a brief period, causing it to expand and carrying with it the chill segments, thus increasing slightly the diameter of the chilling surface. As soon as the pouring begins, the steam is shut off and cold water is admitted to the chamber of the chill, causing the rim to contract, thus holding the inner surface in contact with the metal as it shrinks in cooling. Another advantage claimed for this process is that the metal can be poured rapidly and while very hot, giving a more solid casting than with slow pouring.

As soon as the metal is set, the wheels, while still red hot, are removed from the mould, and immediately placed by means of iron trucks, cranes and tongs in the annealing pits, where they remain four or five days, and allowed to cool gradually, a process necessary to prevent cracking from unequal contraction. The annealing pits are usually brick lined wells about four feet in diameter, and of sufficient depth to receive twelve or fifteen wheels, placed one above the other. The pit being filled, an iron cover is placed over, and above this a bank of sand. In some establishments provision is made for heating the pits before the wheels are introduced.

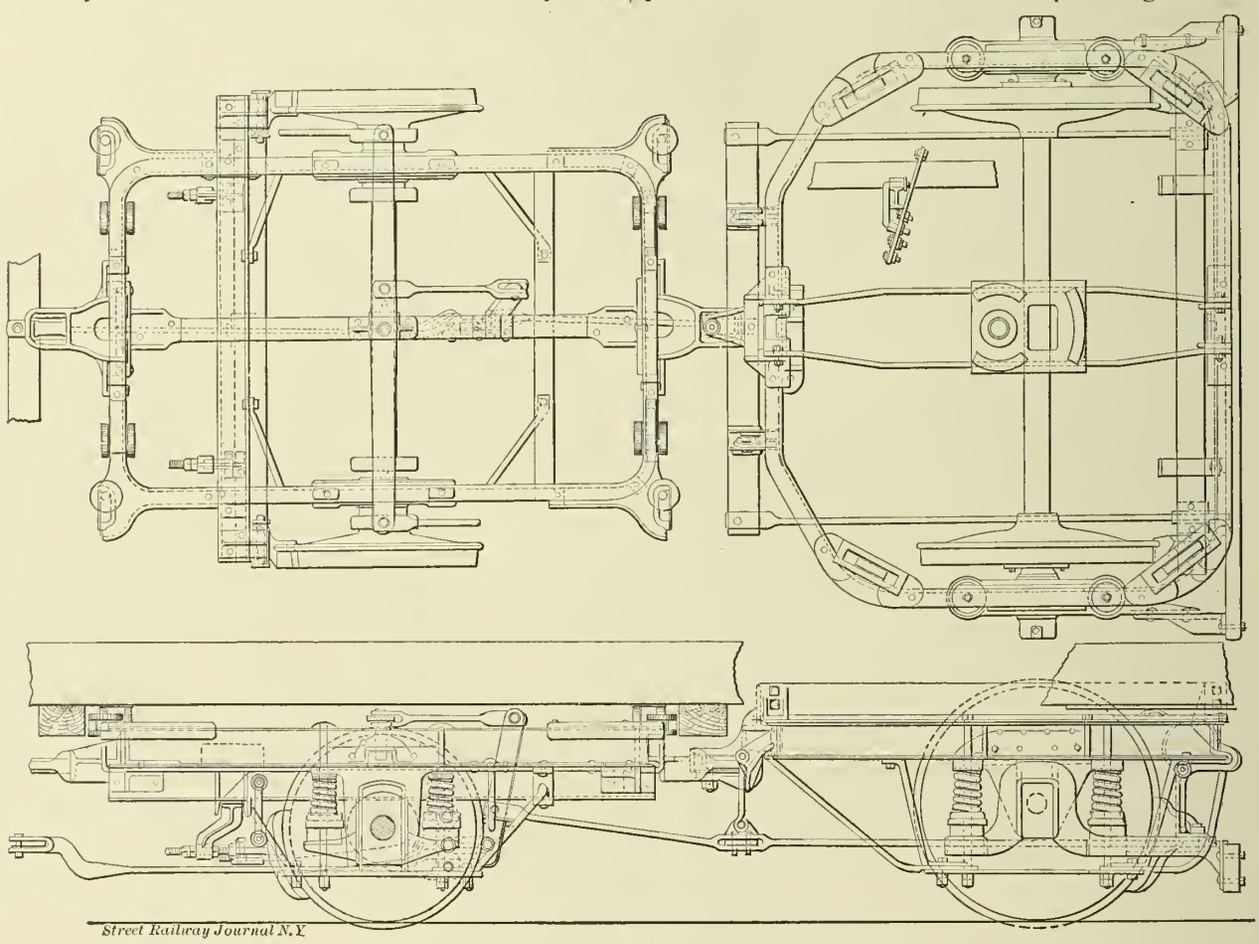


FIG. 3.—ROBINSON RADIAL SIX WHEEL TRUCK.

The wheels, when sufficiently cooled, are removed to the scratching room, or placed under a sand blast where the moulding sand which may adhere to the metal is removed, when the hub of the wheel is bored out to receive the axle, and they are carefully ground upon an emery wheel; which process removes the chill marks and renders the wheel perfectly cylindrical, a very important consideration, for if the wheel is not true the brake pressure will be greater at one point of the circumference than at another, resulting in the skidding or slipping of the wheel upon the rail, thereby producing a flat spot upon the tread which is rapidly enlarged thereafter, soon rendering the wheel unserviceable.

The process of manufacturing differs considerably in details in different establishments, special care being devoted by some to the nature of the raw material or mixture of irons used, by others to secure a perfectly cylindrical shape, while still others give special attention to the process of annealing.

It is obvious that in a process based on such principles as are enumerated above, the qualities of the product

depend largely upon the degree of care and skill exercised in the various stages of manufacture, ranking the business among the highest branches of the art of casting iron.

There is a considerable diversity in the depth of the chill of wheels made by the different manufacturers, the general range being from one-fourth of an inch through the intermediate fractions to three-fourths of an inch, the latter depth being necessary for a serviceable motor wheel. The diameter of wheels for electric motors is thirty-three and thirty-six inches, and the weight varies from 300 to 425 lbs. For horse and trail car service the weight is from 180 to 200 lbs., and for cable service the diameters are twenty-two, twenty-four and thirty inches, with the corresponding weights of 140, 160 and 240 lbs.

The patterns of wheels vary through a large range to suit the fancy of the truck makers, one firm, we are told, making more than twenty patterns of wheels for electric service. This is unfortunate, and it is hoped that a standard will be adopted in the near future.

All wheels are, presumably, subjected to a severe test, either by the manufacturers or the purchasing companies, or both, before they are put in service. The tests, however, are not as severe as in steam service, and, usually, no guarantee is required of the maker. In case it is found desirable to exact a guarantee, the specifications as to the design, essential points, inspection and manner of testing, may be modeled after those employed on certain steam lines, as follows: "First, that the wheel shall be truly cylindrical; second, that the body of the wheel shall be smooth and free from shrinkage, slag or blow holes, the tread from deep and irregular wrinkles, and free from sand or slag. Wheels broken must show clear gray iron, free from holes containing dirt or slag more than one-fourth of an inch in diameter or clusters of such holes, and the depth of white or chilled iron must not vary more than one-fourth of an inch from the standard depth round the tread of the wheel."

The life of cast wheels in horse car service, under favorable conditions, is about one year, and they are usually good for a mileage of from 25,000 to 40,000. In some cases, however, a mileage of 70,000 has been obtained. Under trail cars the average mileage is not quite so high, owing to increased speed. A good average for the driving wheels of motor cars is 30,000 miles.

Wheels are scrapped when broken, when the flange is too much worn or broken, when the chill of the tread is worn through, or when slid flat.

Steel tired wheels are manufactured in various styles, but the process in most cases is too complex to be readily described. The various types consist of a steel tire shrunk and bolted to a web or core made of paper, cast iron or corrugated steel plates having a cast hub. The merits of this type of wheel were noted above. As in the case of cast wheels, there is a notable difference in the respective merits of the steel tired wheels made by different manufacturers.

GLASS AND ITS PREPARATION.

Glass in large quantities enters into car building, and is employed for window, door and deck lights, also for Gothic windows and mirrors. Plate glass, of a quality suitable for ordinary glazing and for silvering or embossing, is made in this country, but English and Belgian plate are considered better suited for the finest mirrors.

The process of embossing glass is about as follows: The naked pane of glass is first heated to a temperature of about 120 degs., by being put in a pit over coils of steam pipes. A coating of a compound made of beeswax and rosin is then spread over the upper surface, and over this a sheet of tin foil is placed, to which it adheres quite firmly, and after cooling, the foil is covered with dark paint. A tracing of the required design is then made on the blackened surface by means of a stencil plate and chalk dust. Then by means of sharp needles, the portions of the lead foil necessary to show on the glass the figures and designs to be etched, are cut out. This work may be performed by young girls. The under side or back of the pane is then covered with paraffine, and with its covering is immersed in a bath of fluoric acid, which, in the course of an hour, eats out the exposed portion of the glass to the depth of one thirty-second of an inch, but has no effect upon the covered portions. The surface of the pane is then ground, which renders the raised portions translucent, while the etchings remain perfectly transparent. Another process is sometimes followed, in which fluoric acid and ammonia are employed, which render the exposed portions translucent.

In case the figures of men, animals or landscapes are desired, these may be painted in free hand upon the glass, the paint serving the purpose of the lead foil, in protecting the covered portions from the effect of the acid. The glass, being taken from the bath, is again heated to remove the wax and lead foil, when it is thoroughly cleaned

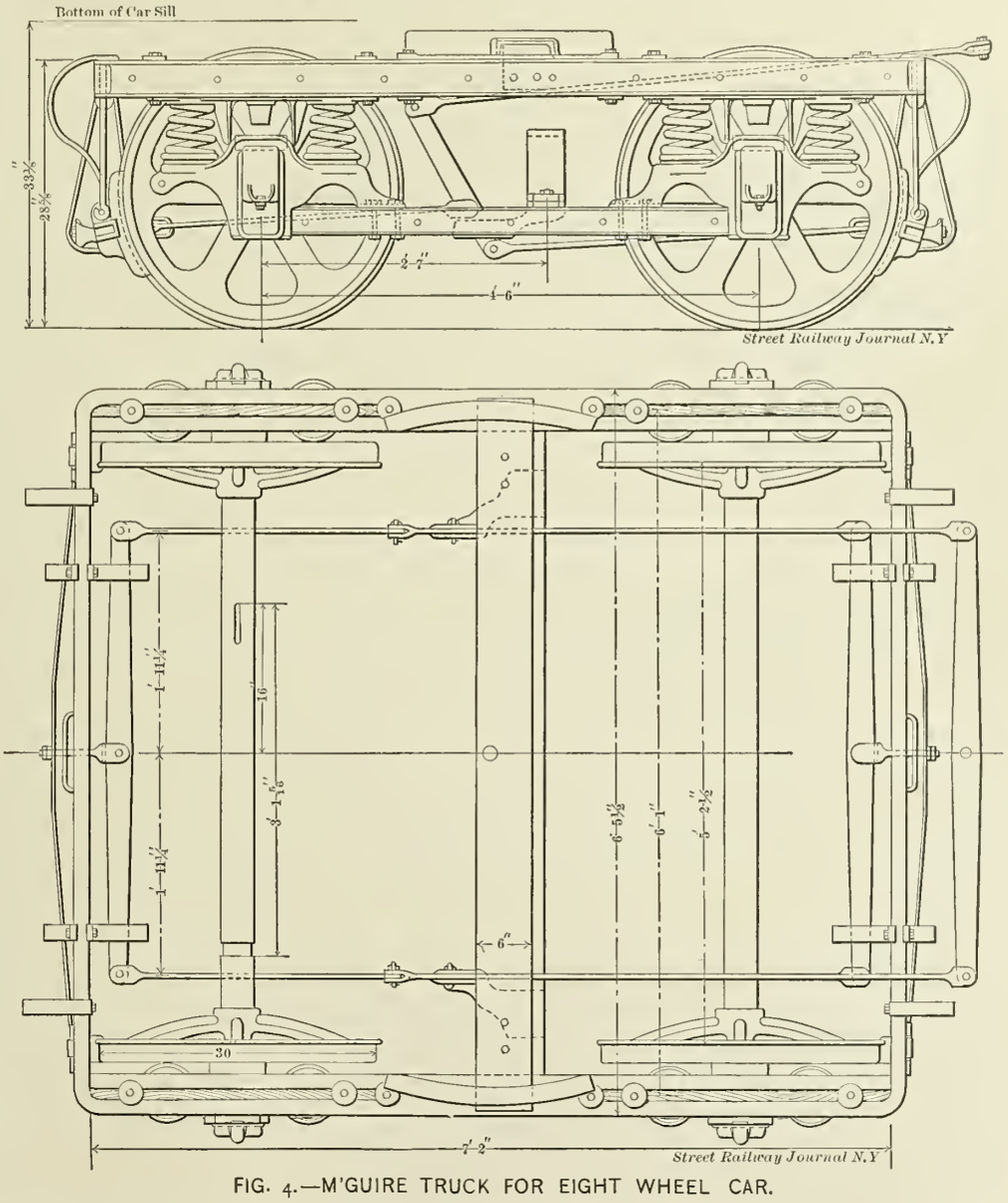


FIG. 4.—M'GUIRE TRUCK FOR EIGHT WHEEL CAR.

with soda water, dried and made ready for the glazier or for silvering, if portions require silvering. To protect the hands from injury while working the acid bath, workmen usually wear rubber gloves. Glass is also ornamented for car purposes by the sand blast process, by which means there are brought out upon the surface of the glass most exquisite representations of the tendrils, sprigs, leaves and flowers of the daintiest plants.

Beveled glass is made by grinding off the corners of the plates successively upon horizontal iron wheels sprinkled with fine sand, then upon a similar wheel covered with emery, then upon a horizontal grindstone having a peculiar grit, next upon a wooden wheel, and, finally, the edge is perfectly polished upon a wheel covered with felt and rouge.

Mirrors are made, preferably, as before stated, of English and Belgian plate glass. In the process, the plates are first cleansed with water, and then polished with rouge, (oxide of iron) which removes any surface defects. It is then heated by being placed upon a grated platform over coils of steam pipe, and the upper surface is covered with a solution of nitrate of silver and chloride of calcium, when the metallic silver is precipitated, and deposited upon the surface. The glass is then carefully washed, and after drying, the back is covered with a coat of red lead, and afterwards bronzed so that the silver is protected from oxidization.

Old mirrors may be renewed by first removing the paint by means of a lye bath, and then the metallic silver by means of nitric acid, when it is treated as above described for new glass. The silver for the mirrors is purchased in the form of nitrate crystals.

METALLIC TRIMMINGS.

These are usually of bronze and are sometimes plated or japanned. They include such articles as locks, hinges, door knobs, change wickets, dash and body grab handles and holders, window guards, lifts and catches, window blind lifts, sash springs, deck sash pivots and openers, ventilators, rail rackets, bells and gongs, bell strap guides, hooks, etc.

Trimmings ready for use are usually purchased from dealers who make a specialty of this line of work. Some shops, however, manufacture their own trimmings, which are turned out from specially prepared patterns.

The process of manufacture may be described as follows :

The material, which consists of copper (best lake), tin (English block) and spelter, is mixed in certain proportions, depending upon the desired quality of the product, and melted in small crucibles over sunken furnaces such as are commonly employed in brass foundries. The moulding is done in small iron flasks with a specially prepared moulding sand. Each flask may contain matrices for a large number of small parts so connected that the metal will fill each when poured through one or two openings. Long rods, such as dash rails and window rods, are usually moulded in coils and afterwards straightened. This can be done without fracture, provided the proper mixture of metals is employed. From the foundry the castings are placed in the "tumbler," which is commonly an iron barrel, which, being made to revolve on its axis, causes the parts to chafe against each other, till the rough surfaces are worn smooth. This process is sometimes hastened by the admission of water which can be introduced through hollow journal bearings. The parts next go to the filing and drilling department where the rough corners and ears are filed off and the screw holes are drilled and countersunk. The polishing follows, and this is done in the buffing department, which usually occupies a room by itself. First, the parts are ground smooth upon an emery belt, against which they are held by hand, and are then further treated upon a leather bound wheel covered with fine emery. The process continues through six or seven hands, and the trimmings are finally burnished upon a wheel formed of canvas discs upon which a little rouge is placed. The trimmings, except such as are to be plated or japanned, now bright and shining, are wrapped in tissue paper and taken to the store room. A silver and nickel plating department is provided with vats containing a solution of nickel salts or sulphate of copper, in which the trimmings to be plated are placed for about twenty minutes. The electric current for this work may be generated by a dynamo operated for the purpose, or may be obtained from the lighting plant or galvanic battery. After the plating the parts are thoroughly washed and dried. The japanning of trimmings is done in the ordinary manner. In some well regulated establishments slanting shelves or vertical boards are provided in the store, upon which samples of every pattern of trimmings are kept, numbered and named for ready reference.

THREE PLY VENEER.

A great variety of goods are embraced under this heading, and include seats, backs, ceilings, sides and panels. The manufacture of veneers is usually a process by itself, and car builders in most cases purchase the finished product from dealers. A few large car building establishments, however, manufacture it for their own use. The woods from which three ply veneers are usually made are maple, birch, oak and white mahogany. The veneer, with the exception of that made from oak, is shaved from the surface of a log by means of long knives against which the log is made to revolve, the shaving being from one-twentieth to one-eighth of an inch thick, and of any length and width, depending upon the diameter and length of the log. This process is done in the neighborhood of the growing timber, and the material in rolls and sheets is shipped to the veneer factory. The oak veneer is sawn from the log, which is first quartered lengthwise, and the quarters are then sawn into thin strips, beginning at the centre. The best material for oak veneer is obtained from dead trees from which the sap part has decayed.

At the veneer factory the material is cut into strips, small pieces being jointed and fastened together by narrow pieces of glued paper. The strip designed for the middle ply is so cut that the grain of the wood runs lengthwise, while those for the outside plies have the grain running crossways. This arrangement of the grain in the three parts gives strength to the finished veneer. The strip designed for the middle ply is now led through a pair of glueing rollers, in which both sides are thoroughly covered with a coat of hot glue, when it is placed between the two outside sheets, and the three are quickly transferred to thick wooden moulds or cauls which are then placed in powerful presses, where they remain until the glue is set and the ply becomes rigid, so that it will remain in the form (flat or arched) given it by the caul. The flat pieces are now dressed and polished in a sandpapering machine, and the curved or waved surfaces are scraped and dressed by hand. They are then made ready for varnishing and decorating or for the perforating bit, in case they are designed for seats or ventilated ceiling.

CAR SHOPS.

The arrangement and equipment of shops for the building and repair of cars will depend largely upon the amount of work to be done, and whether the product is for the trade or for home consumption. Repair shops are a necessary adjunct of every well regulated street railway, and whether a company builds its own cars or not (a practice which is not recommended) repairs sometimes amount to the same thing. The following particulars apply to shops in general, and may be modified to suit any particular case. The success of any manufacturing enterprise depends upon its compliance with the laws of rigid economy and industry, the adoption of the most approved processes in the preparation of the material, the use of the latest improved machinery, tools and appliances, and the employment of workmen thoroughly bred to the business who will fit all parts with exactness and nicety. To this may be added the employment of each set of workmen only upon one special branch of work (for which they are paid by the piece, by the hour or by the day) so that each shall attain perfection in his particular division, then holding the foreman of each department per-

sonally responsible for any defects that may occur in the work turned out from his department. The above presumes that the proprietors have had long experience and a reputation for honorable and fair dealing with their customers.

If a new business is to be established, great attention should be paid to the modeling and arrangement of the buildings to be occupied, and their location with reference to shipping facilities both for material and product. When it becomes necessary to occupy old buildings these should be remodeled to suit the business as far as possible. One, two or three story buildings may be employed, depending upon the value of property and the amount of space the plant is to occupy. Light, warmth, the exclusion of dust, and the adoption of such other means as will conduce to the health of the workmen, should be carefully considered, while no little attention should be given to protection against fire.

THE GENERAL OFFICE,

which may occupy a building by itself or one of the main buildings, should be equipped with all necessary office furniture and safes, and be furnished in as tasty and inviting a manner as the business can afford. Separate apartments are preferably provided for the timekeeper and bookkeepers, and a comfortable reception room should not be overlooked. The toilet arrangements, including closets, wash basins and lockers, are important, and should be ample and suited to the force employed.

THE DRAUGHTING

department usually occupies rooms in the vicinity of the office. These should have ample light and be furnished, according to the magnitude of the business, with draughting tools, tables, cases of drawers, safes or fireproof vaults for the preservation of all important drawings and specification details. A photograph or blue print room is also a necessary adjunct to the draughting department of a car shop.

THE STORE ROOMS

may be apartments near the main office and may be located on the ground or other floors, depending upon the character of the different classes of material. Each should be in charge of a keeper who should deal out materials only on the written orders of a shop foreman, which order should specify the number of the car order for which it is wanted, a receipt in all cases being required from the party to whom the material is delivered. Heavy parts, such as the malleable iron castings, journal boxes, springs, etc., are preferably stored on the ground floor, for which suitable bins and shelves, numbered and classified, should be provided. The store rooms for lighter parts may occupy some of the upper floors, and should be served by elevators for the speedy and safe transfer of the materials. The bolts and nuts, properly sorted and classified, may be stored in small bins or pockets, each of which should be numbered and lettered to correspond with the dimensions of the particular piece for which it is designed. Metallic trimmings should be stored in closed boxes classified and arranged upon convenient shelves.

Canvas, duck, curtains and upholstering material are preferably stored on spools and mounted in convenient positions, to be readily unrolled, measured and dealt out. Store rooms for this material are usually located near the the upholstering department, which is supplied with cutting tables, sewing machines aud other necessary appliances for making curtains, cushions, etc.

TRANSFER TRUCK TRACKS

and elevators are essential features of any car works. The first should be conveniently located and equipped with transfer tables of sufficient capacity to deliver the car body, while in process of construction, from one department to another. The second should communicate with every building, storehouse or yard, and be provided with flat trucks and cars to facilitate the transfer of material. Tracks should not only communicate with the buildings, but the floors of each structure should have tracks of uniform gauge with numerous turntables, by means of which cars or material can be shifted about, and, by means of the elevators, be transferred from floor to floor.

THE LUMBER YARD

will necessarily be located where space can be had, sometimes, in large cities, at some distance from the works. It is preferably located, however, within the same enclosure as the works. The lumber should be piled in sorts, and for the finer grades, both open and closed sheds should be provided, the sheds being partitioned and divided into stories of suitable height to provide for housing a great variety of material in position to be readily accessible. A few closed sheds are necessary for the storing of kiln dried lumber.

A DRYING KILN

is a necessary adjunct of the lumber yard, and is preferably constructed with apartments or ceiled chambers, with tight closing doors. The heat can be obtained from the exhaust steam of the power plant by leading it through coils of pipe in a separate chamber, and providing a power fan for driving the heated air through the flues which communicate with the various chambers. The inlet and discharge flues should be provided with gates or valves, so that the temperature of each chamber can be regulated to suit the conditions of the stock. The material should be piled in open order in the chambers, and each chamber should be provided with a thermometer. A record of the stock, including the kind, amount and date of being placed in the kiln, may be conveniently kept by having a slate attached to the outside of the door of each chamber, and housed in with a glass in front. A second kiln for seasoning the cabinet material is provided in many shops, and in some cases this is located directly above the boilers of the power plant, so that the radiated heat of the boilers is utilized for drying purposes. In other cases the blast fan is placed near the boilers, and the kiln is located in an adjoining department.

A steam chest and bending appliances are also adjuncts of the cabinet department.

THE POWER

for operating the machinery of car shops is usually derived from a steam plant. This should be conveniently located so that by shafting or belts the power can be transmitted to the different departments. Repair shops are frequently operated by power from the stable plant which also operates the mills for grinding and cutting the feed. Electric motors are employed to good advantage in some shops, while a few depend upon horse power.

THE HEATING AND LIGHTING

is also a function of the power plant, and by having the different buildings properly equipped with piping, either for direct radiation or the blast system, the exhaust steam may be utilized for warming purposes. An electric light plant is a desirable feature in the car shop equipment, for it is frequently necessary to continue the work at night. Arc lamps should be conveniently located for lighting the yards and approaches, and both stationary and portable incandescent lamps should be provided for bench and inside car work.

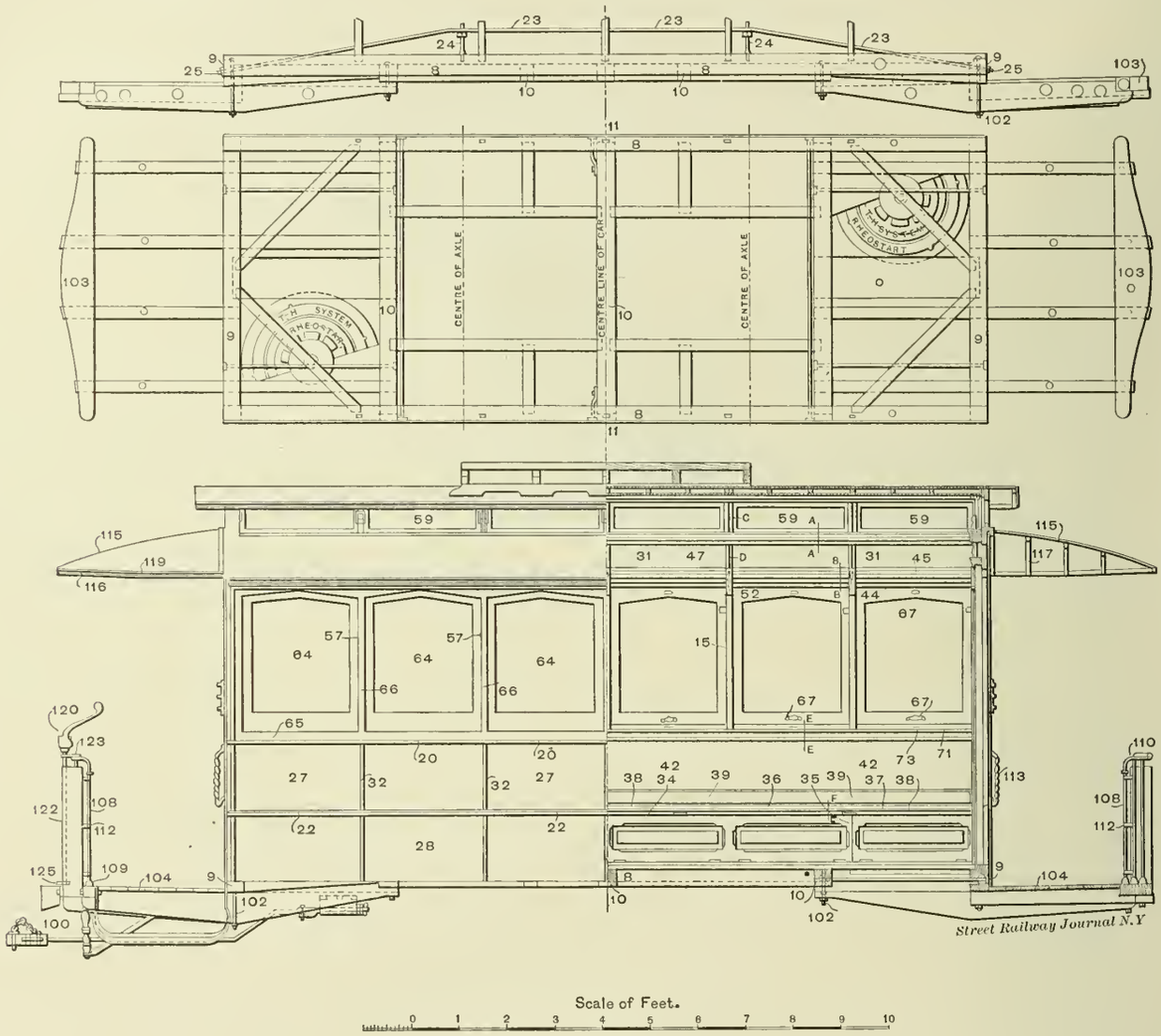
THE WOOD WORKING DEPARTMENT

is one of the most important in car building, and upon its location, equipment and management the success of a business largely depends. It may occupy a building by itself on the first or second floor of a building in which other departments are located. In any event it should be thoroughly partitioned off, that all the dust may be confined within its own limits. It is highly important in the arrangement of machinery in this department that ample room be given to each machine, so that all may be operated at the same time without interfering with each other or with the operatives; also, to provide that all the work may be done on the individual parts in their continuous passage through the mill without having to be carried back and forth several times, resulting in unnecessary steps and consequent loss of time.

In planning a repair shop provision should be made for handling longer timbers than those required for ca

construction proper; for it not infrequently happens that larger timbers, such as are required in the buildings, bridges or tracks, find their way into the wood shop.

provided, with flues over each machine for removing the dust and shavings and delivering them to the boiler room for fuel. A spiral separator placed at the terminal of the

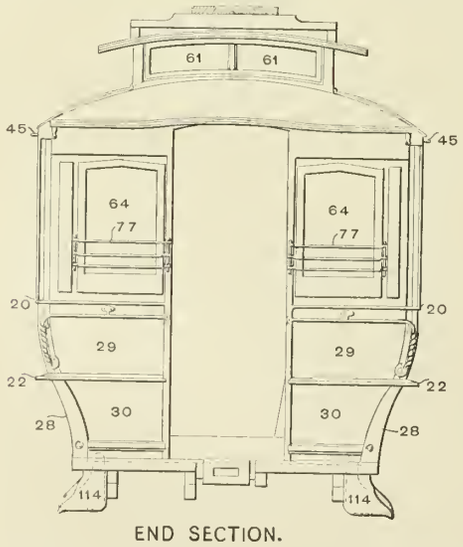


Scale of Feet.

FIG. 5.—SET OF SHOP DRAWINGS FOR SIXTEEN FOOT ELECTRIC CAR—THE LEWIS & FOWLER MANUFACTURING CO.

See page 149 *March issue.*

Due regard should be had to the safety and convenience of the operators by placing of the shafting, pulleys, belts and shifters in proper positions and housing them in. The best practice favors placing the shafting beneath



END SECTION.

the floor, openings being provided for leading the belts to each machine. Regard for the comfort and health of the men employed in this department, and for economy, requires that a system of exhaust pipes and conveyors be main flue will separate the dust and deliver the shavings in proper condition for the furnace. The exhaust may be produced by a fan operated at or near the engine room. For large shops small trucks and tracks should be provided for the speedy transfer of small pieces about the works.

The number and character of the machines that may be employed to advantage in this department depends upon the amount of work to be done. For repairs alone a very few will answer, but if a company builds its own cars it should have quite a number of the same patterns as are employed in commercial street car work.

The following are among the best machines in the market, and have been selected from the lists of a number of manufactories. New machines are constantly appearing, and any car builder who may require a special machine for shaping any piece, no matter how irregular, has but to apply to the makers of this class of tools and the desired device will be forthcoming.

LIST OF WOOD WORKING TOOLS.

Automatic cut-off machine.

Self feed rip saw and pendulum saw.

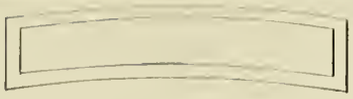
A four sided planing machine having a capacity for a 6 × 12 ins. stick.

A thirty-six inch and a forty-two inch band saw, with a Mohawk Dutchman guide.

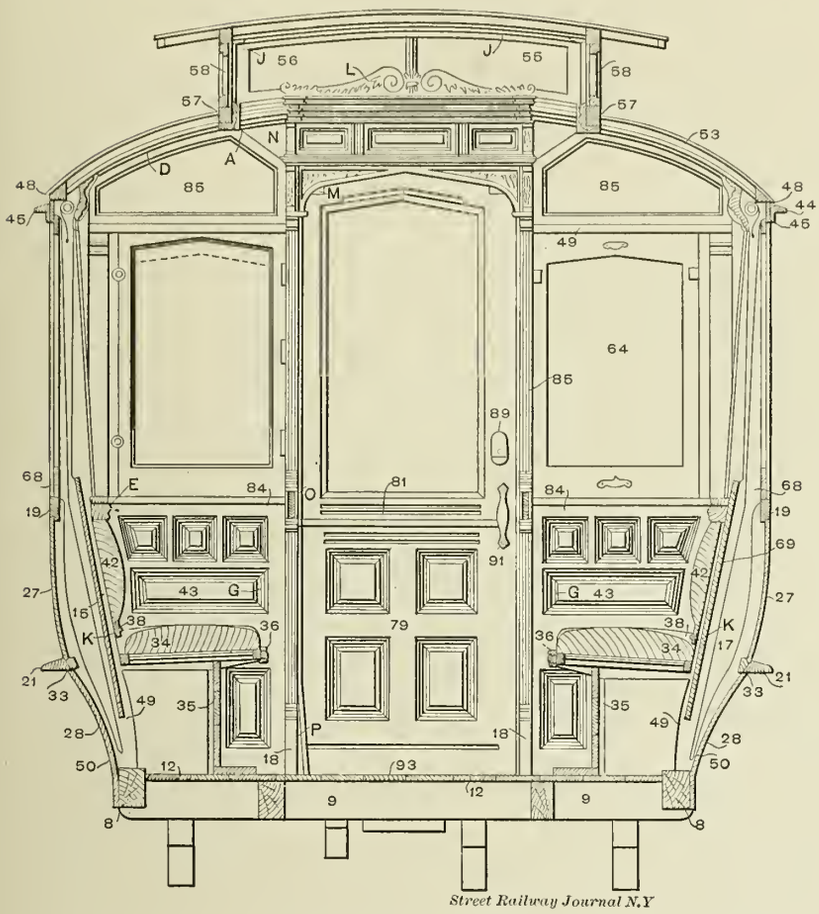
A Universal wood worker.

A six inch outside moulding machine.

A single spindle, horizontal boring machine.

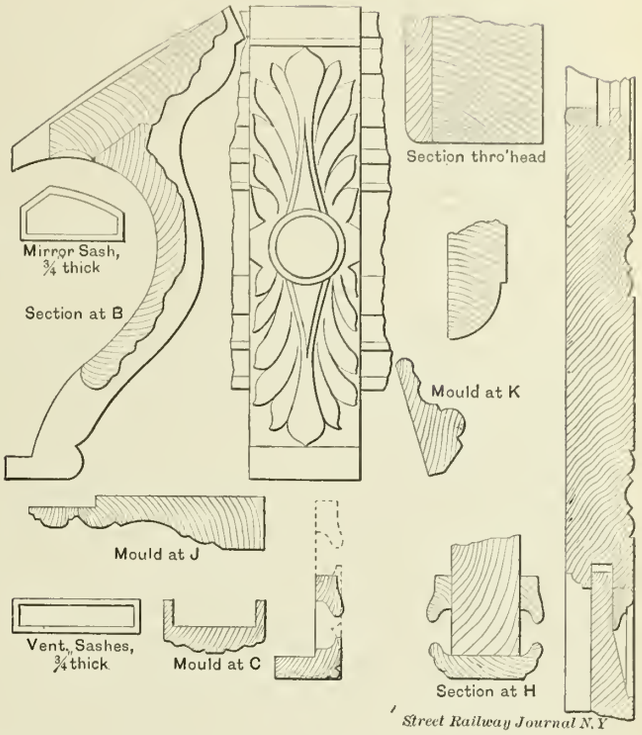


End Vent, Sash, 5/8 thick

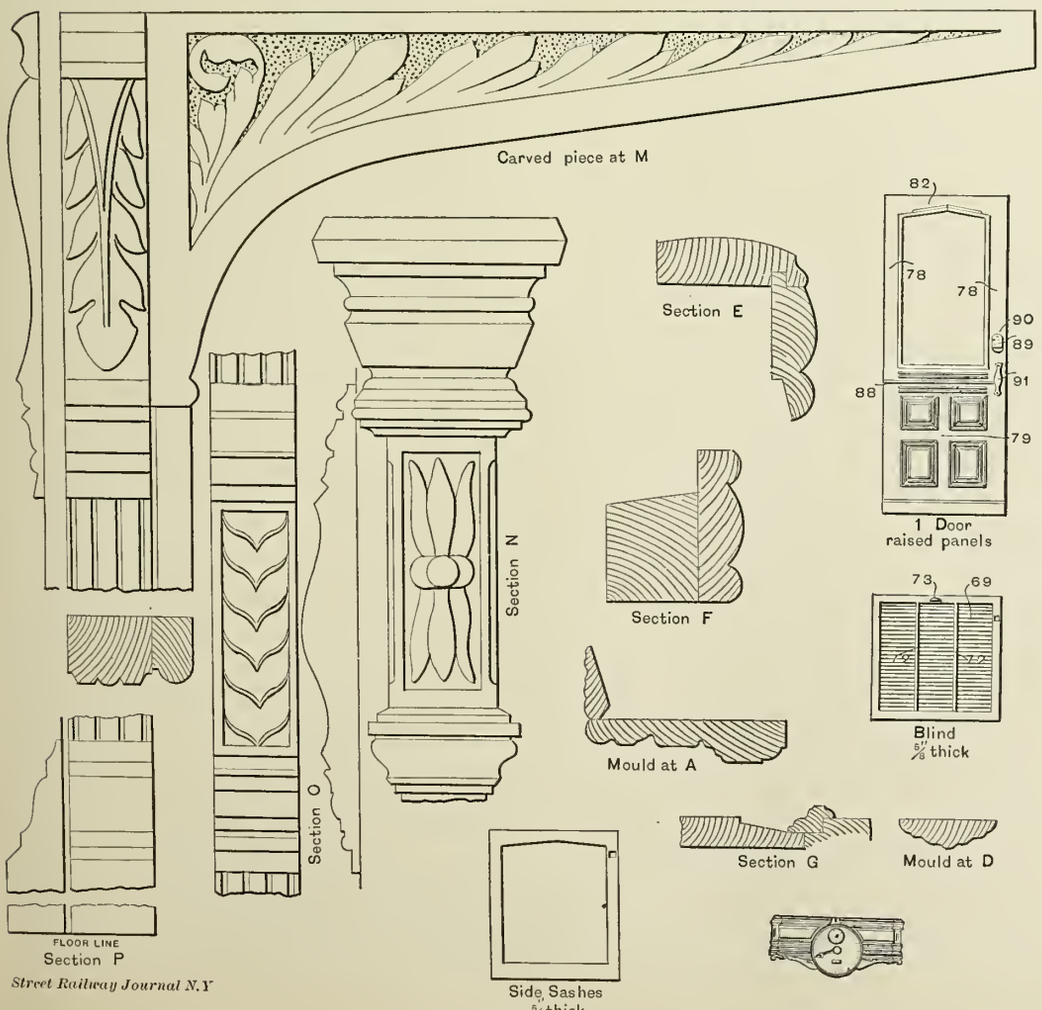


Street Railway Journal N.Y

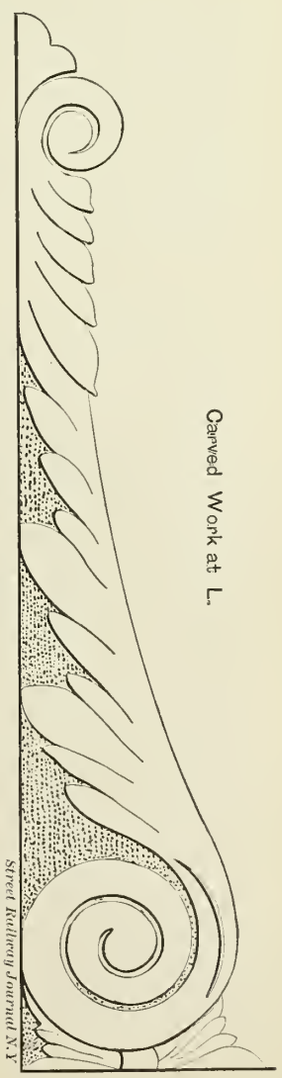
END SECTION ENLARGED.



Street Railway Journal N.Y



Street Railway Journal N.Y



A heavy end tenoning machine with double heads and copes.

An automatic mortsing machine.

A panel raising machine.

A wood turning lathe, medium size.

A buzz planer.

A complete sash, door and blind relishing and mortising machine.

An Invincible sanding machine.

A belt sander.

A scraping machine.

A planer for squaring up timber out of wind.

A fret saw.

A band saw filing machine.

An emery grinder for sharpening tools.

ERECTING SHOP.

In large works this department often occupies a building by itself; sometimes it is located above the wood working department. In this case, elevators of sufficient capacity for transporting material will also be found to be convenient. As before stated, this department should be carefully partitioned off to protect it from the dust of the machinery department. The temperature should be maintained at about sixty degrees to insure accurate fitting of joints, and lessen the liability of shrinking after being put in service. Carpenters' benches, chests and closets for tools should be provided, and also a system of suspended platforms to facilitate work upon the sides and roof of the car body. Numerous small trucks and horses, before referred to, are a part of the necessary equipment of the erecting shop, for they facilitate the movement of the body as the work progresses. A store room should be provided as an adjunct of this department where all finished parts can be delivered as they come from the wood mill, and stored until they are needed by the body frame builders.

CABINET SHOP.

This department may be provided for in connection with the erecting shop, or the work may be done in rooms set off from the wood mill. But few separate machines are required for this work, as the material is usually prepared in the wood mill and delivered ready for fitting. Screw clamps and tables should be provided, and there should also be provision for storing glass and glazing the sash. Wood mouldings with felt linings are now generally employed instead of putty for holding the glass in the frame; hence, this work properly belongs to this department.

PAINT SHOP.

This is one of the most important departments in car building and should receive careful attention. Besides being located in a convenient position to receive the bodies as they come from the builders, the rooms occupied by this department must necessarily be carefully partitioned to exclude dust and insects, and should be high, having at least fifteen feet between joints, with provision for abundant light on all sides. Light is not only necessary for doing good work, but it also hastens the drying and hardening of paint and varnish. Heating facilities should also be provided, so that a uniform temperature of at least seventy-five degrees can be maintained in winter. This high temperature is not required for the comfort of the workmen alone, but upon it depends the facility with which the paint and varnish can be laid, the depth to which it will penetrate the wood, and, not a little, the durability of the coat. Separate rooms should be provided for the different stages of work, especially in which to finish the cabinet work and veneers. The varnish room should be amply provided with tables, and with racks and frames for holding the spindles, sashes, headings, doors and panels in a horizontal position while the varnish is drying, so that a heavy coat can be laid on without danger of flowing. When dry, these parts may be stored in any position. When it was customary for painters to mix their own colors, the tops of painting tables consisted of heavy, flat stones; now that colors are purchased ready for use the stone is not necessary, and board tops are provided. It is convenient, however, in this connection, to have pieces of thick glass on which to place the colors.

The rubbing room is usually set off by itself, and equipped with benches, washing vats and other appliances, where, by means of pumice stone or rubbing bricks, the wood work is carefully polished and prepared for receiving its coat of varnish.

A store room for paints is a necessary adjunct of this department, from which the material should be dealt out to various workmen upon requisition from the head painter, as is required in other departments.

IRON SHOPS.

Under this head are embraced three departments, the foundry, blacksmith and machine shops, all of which should be located near each other. The former is not an absolute necessity in all car building establishments, as castings may be purchased or contracted for from commercial foundries. In case, however, such a department forms part of a plant, it should be equipped with the necessary appliances, including one or more cupolas with service elevators and blast fans, also trucks, ladles, sand pits, rumblers, cranes, flasks, core ovens and, if wheels are to be cast, with contracting chills, annealing ovens and wheel grinders

A pattern shop and store room for patterns are necessary adjuncts of the foundry. The former should be provided with wood lathes, band saws and other machines necessary for this work, and the latter with racks and shelves, properly numbered and so arranged that any pattern may be readily found when required. Good light and proper ventilation should not be overlooked in planning buildings for the foundry department.

The blacksmith shop requires for its equipment forges, anvils and, if the work is heavy, one or more steam hammers, bending machines, etc. To facilitate the removal of the smoke and foul gases from the forges, a flue with mechanical exhaust should communicate with each, and each should be served with an air blast for forcing the fires. Power cranes, trolley cranes and hand hoists, to facilitate the handling of heavy material, should in all cases be provided. The iron store room, with proper racks for storing the bar iron and steel, is usually located adjacent to the blacksmith shop, and here the power shears and punches for cutting the bars and plates to proper shape are also placed. Weighing scales, hand barrows and trucks complete the equipment of this department.

A machine shop with a more or less elaborate equipment of iron working tools, is a necessary department in any building or repair works. If for repairs only, both the blacksmith shop and machine shop may be located so as to flank the reception and pit tracks, from which they may be readily served with the parts needing repairs by means of overhead trolley tracks, with switches and crossings so located that communication can be had with every department. The overhead trolley and hand lifts may be employed instead of jacks for lifting car bodies and removing motors.

The following are among the most important iron working tools that will be required for commercial car building or for making repairs. These are manufactured in various sizes and may be duplicated according to the amount of work to be done: Axle lathe, radial drill, drill press, planer, key seating mill, wheel boring mill, wheel press and steam hammer. Some of these are illustrated in the accompanying engravings.

A portion of the machine shop is usually partitioned off for the grinding room, where are located the stones and emery grinders for polishing and finishing the close fitting or ornamental parts which enter into car or truck construction. Sometimes a separate building is employed for the truck erecting shop; for this only a few tools are required, but the overhead lifting arrangements should be ample. The tin shop, by no means the least important feature of a car building works, is usually located in the vicinity of the iron tool shop and may occupy a room on any floor. In this department are prepared the lamp flues, stove pipes, stove box lining, ventilating jacks,

thimbles and plates for roof work. Also lamp-oil cans, waste cans, water tanks, etc. The tools required embrace all the appliances found in ordinary tin or stove shops.

SHIPPING.

It is frequently necessary to ship cars that have been built for the trade over long distances, either by rail or by water, in which case they must be boxed or otherwise protected to prevent their being injured *en route*. The bodies may be shipped already mounted, or bodies and trucks may be shipped separately. When dismounted, false sills are sometimes placed under, to which the body is securely bolted. These sills provide for the use of rollers which facilitate the work of shifting the body about. All bronze rails should be carefully wrapped with burlap. In case boxing is not required, most builders provide canvas or waterproof covers which enclose the entire body, and may bear the imprint of the manufacturing firm. These covers being returned often do long service, and answer for various shipments.

Some companies own their own shipping cars which are usually of the platform type, and of sufficient length (fifty or sixty feet) to accommodate two ordinary bodies, upon which they are transported over the different steam lines to their destination. Frequently these shipping cars are provided with a housing of sufficient capacity to enclose and protect the largest street car body.

For export trade it is sometimes necessary to so construct the body that it can be knocked down after being finished and compactly packed for shipping. In this case, the sides, ends, roofs, hoods, platforms and bottom are so connected that by removing a few bolts each may be separated from the other parts, and after reaching their destination can be readily set up and securely united.

In case a car building establishment is not located near a steam line, it is customary to provide low platform wagons, on which the car can be transferred from the shop to the shipping station. These platforms, being provided with grooved or adjustable rails, provide for handling trucks of any gauge.

[END.]

Direct Connected Steam Generators.

By Walter C. Kerr.

So much interest has been awakened in the design of the steam generator (popularly known as the "Kodak"), illustrated in the issue of the Street Railway Journal for October, 1891, that it seems pertinent to examine the reasons for its existence.

The simplest glance at the application of steam power to electrical service will show that engineering practice has for the past ten years alternated from one extreme to the other; first with engines too small and too poor, then too large and too complicated, back to engines not sufficiently economical, and again to engines improperly proportioned to the electrical unit employed, and gradually settling down to a reasonable proportion in size of engine and resultant efficiency.

A compound engine running with high efficiency, whether condensing or non-condensing, of a simple construction and comparatively large size, directly connected to a moderately slow speed generator, is unquestionably the net result of all that is good out of all the experimenting. Such a device is, therefore, not a plan invented, but is rather an outgrowth of the very nature of the problem. It introduces no really new factor, but is characterized chiefly by what it omits; and notably the greatest omission is that of the transmitting devices, be they the simple direct belt or the complicated system of clutches, shafting, belts and pulleys still occasionally used.

The economy of space, and its influence on real estate, buildings, etc., is evident. The virtues surrounding the operation of an electric generator at the moderate speed of 200 to 300 revolutions per minute are equally apparent. The power wasted in transmission is an uncertain factor; small under the best conditions, enormously high under bad ones, and too great to be tolerated under any average service. Even in the simplest method, that of belting directly from the engine to the dynamo, the loss can scarcely fall below 2 per cent., and it has been measured as high as 10. Under more complicated systems of transmission this loss is found between the last shaft and the generator, and to it must be added the further loss between the engine and head line under the strain of ponderous belts. Moreover, this loss is largely at the mercy of the man who sets up the jack screw, sliding the generator on its base to tighten the belt, and hence, measurement under carefully pre-arranged conditions is no indication of the daily loss which may be and generally is incurred.

The difficulties surrounding the building of electric generators in large sizes, at speeds below 100 revolutions per minute, are of a formidable nature, while the construction of such machines to run at speeds of 200 to 300 presents practically no difficulties. Small generators, say, 100 to 200 H. P., may be driven by belt with no more inconvenience and loss than we are accustomed to tolerate, notwithstanding the power can be delivered more efficiently by direct coupling of shaft to shaft; when, however, units of 300 to 1,000 H. P. or more are driven, the mechanical difficulties and losses are unduly augmented as size increases, and direct connection appears not only a necessity, but a welcome one.

It is fortunate for the development of electrical industries that the past five years have been so fruitful in the production of simple types of compound engines more or less capable of performing such services up to any power within which it is expedient to build generators. The prime obstacle to the steam engineer in working out this problem has been the apparently fundamental impossibility of getting a non-condensing compound engine to show fair economy under comparatively light loads, but even this has surrendered unconditionally to a persistent investigation of the conditions. For this and other reasons the earlier attempts in direct connection were more or less unfortunate, the failures being due largely to the apparent necessity of high speed in the dynamos and inability of existing steam engines to meet their requirements. To be sure, the requirements themselves were not very well understood and it was not to anyone's discredit that judgment failed to perceive the limitations then surrounding the electrical service and the engineering attachments.

The past inability of moderate sized engines to produce the highest grades of efficiency has led many to the supposition that ultra-large units were essential to economy, but now within moderate sizes the highest efficiencies can be rendered in simple designs, such as the one which is the subject of this article. In the struggle for recognition, a large number of devices more or less on this order have been developed, and others are yet to follow. Some will be good, others worthless, and, as is customary, there will be all degrees of excellence between these extremes. The most common error in such matters is to fail of the mark through complexity, and it is on this basis, more than any other, that the "Kodak" generator makes claim to special recognition from the standpoint of both steam and electrical engineering. Something simpler to produce equal results may be produced, but if so, it is yet to be suggested. The compact, rigid, substantial design in which a strong bed plate holds two well proportioned and practically independent machines, coupled invariably shaft to shaft, yet with full provision of flexibility for misalignment, and elasticity against short circuits, is simply a good engineering plan in which well known and well tried articles are fitted for the varying loads and the peculiar emergencies of electric railways, and involving no uncertainties as to efficiency or continuous running qualities.

The scale of importance which electrical railway work has now assumed and the experience that has been gained in construction of electrical power plants would seem to be sufficient to provide against serious error in determining units, in selecting electrical and steam ma-

chinery, and in properly connecting them for efficient service. The progress in these lines is all towards greater simplicity, and those who permanently invest for returns cannot hope to accomplish their desires through methods that are rapidly becoming obsolete. All the connections heretofore made between electrical generators and engines form collectively an item that is doomed, because unnecessary, occupying valuable space, expensive to buy, maintain and operate, and a source of frequent accident. That such connections should have ever existed would not be altogether creditable to engineering had they not filled a somewhat necessary, but temporary, gap during the interval in which development could bring electrical generators and steam engines into such relations that each could meet all the requirements of the other.

This direct coupled type of steam generator stands to-day the best and simplest device by which the heat of steam can be turned into current on a wire with minimum opportunity for impairment, mechanically or economically, through any of the exigencies of the unusually severe service for which it is adapted.

Who Pays the Taxes When a Street Railway Franchise is Taxed?

By J. M. Batchelor.

One of the most important questions relating to street railway interests is a matter frequently put before many of our state legislatures, whether street railway companies should or should not pay into the state treasury a proportion of the receipts which the roads earn. Particularly is this issue an exciting subject for debate in Western and Southern town caucuses in consequence of the requests for street railway franchises, due to the rapid development of these neighborhoods.

If a town is young it is glad enough to get anybody to build new street railways, and it asks no concessions from the investors in them; in fact the town is willing to take some of the stock itself rather than get no road at all. But as the town grows and several street railways are in existence, reaping, say, from 4 to 6 per cent dividends, the people begin to demand compensation for these dividends, and advocate that the granting of new charters should contain a clause to that effect.

In numerous cases these expectations on the part of the public authorities prevent a town's development, for capitalists are not disposed to take risks in a business where the profits are so curtailed that even if the business comes out without positive loss the highest possible gain is too small for the chance of getting it.

There is a strikingly odd feature in this subject which the public generally should more closely observe; which feature is well illustrated in the case of Nebraska concerning its treatment of steam railways. Before the railways were built no kindness towards the roads' constructors was considered too great, as the people found many of their otherwise valuable lands almost worthless in consequence of a lack of proper transportation facilities. After the roads were built, however, and there was no further opportunity for the investors in them to withdraw, even if they would, the state legislature passed anti-railway laws, restricting the railways' income, and contrary to the letter of the state charters these roads held; and in a minor way the state practically confiscated—through a restriction in profits—the steam railways of the state. Had the state bought out these roads, that would have been another thing, but it did not buy them out, it merely took a certain control of the investor's property without compensation. The consequence was—what any business man in the state should have foreseen—capital for railway investment was driven from the state. As is well known, Nebraska has considerable territory so far undeveloped in consequence of a deficiency of railways. The inhabitants of this state have just begun to realize that the anti-railway laws they had so energetically supported because they supposed investors were getting too much for nothing, meant a cessation of further railway construction. They have now turned about, and, through their legislature, offer extra inducements for the investors to come back again; but up to date they have not been successful; consequently these inhabitants are realizing that they committed a species of business suicide in adopting their short sighted policy.

The illustration applies very well to the newer or more rapidly growing cities in many parts of the country, and these towns may well heed the lesson in relation to street railways. But the older cities—those having more or less street railways to supply immediate wants in case no more were built—look upon the granting of further franchises in another light. They frequently say their city has attained a large growth, and the giving a company the right of street railway service in any district not fully provided is giving something for which compensation should be obtained.

Admitting this claim in certain cases, although there are others where the claim is largely overrated, it would appear that the interests of the inhabitants of the district through which a proposed line is to run would be best subserved, if any allowance granted for the franchise should be put in the shape of better cars, more frequent service or even reduced fares—after they were earned—rather than by any tax on the franchise itself. A general tax on a franchise is too wide in its distribution of benefits. On the other hand, if a road reduces its fare by the sale of tickets or otherwise—say, whenever 10 per cent. net earnings are cleared—and thus divides the extra profit with the road's patrons, the best results are obtained, because such reduction in fare tends to develop a locality by the reduced cost of living there; and the inhabitants already located get the benefit of what they have done toward making that locality what it is.

All taxes imposed upon street railway charters rest upon the patrons of the line; they have to pay the taxes whatever they are. This is a point not sufficiently appreciated by the makers of the law; many of them seem to reason that a tax on a street railway franchise, comes out of the investors' pockets; but this view is an error. The road must earn its expenses, its taxes and all costs; otherwise it becomes insolvent. Earnings mean what the road's patrons pay to it. Then a tax on a franchise of this kind is merely a tax on the people who make the tax; that is, they tax themselves. If they look at the matter in this, its true light, they will appreciate the absurdity of imposing such taxes.

Meetings of the Massachusetts Street Railway Association.

The members of the Massachusetts Street Railway Association dined at Young's Hotel, Boston, February 24, and talked on "Snow Plows."

About twenty-five members were present, and in the absence of the president, Mr. Charles B. Pratt of Worcester, because of illness, Mr. Amos F. Breed of Lynn occupied the seat of honor.

The last meeting was held March 9, and fourteen companies were represented. Vice-President Amos F. Breed occupied the chair.

After the records of the previous meeting were read and approved, the question of taxing street railway corporations came up for discussion, and the prevailing opinion among those present was that the franchise tax of to-day, in its amount and method of assessment, is just and equitable and ought to continue without change, except in the distribution of money thus collected. It was thought that this money should be distributed among the towns and cities according to the number of miles of track in the cities and towns through which the tracks extend.

The next meeting of the Association will be held on April 13 next, at Young's Hotel, Boston. The subject to be discussed is "The Rights of Patentees in and to Electrical Appliances."

We have received from the secretary of the American Street Railway Association copies of three interesting law cases, being Nos. 11 and 12 of Vol. VIII., and No. 1 of Vol. IX.

Works of The American Car Co., St. Louis.

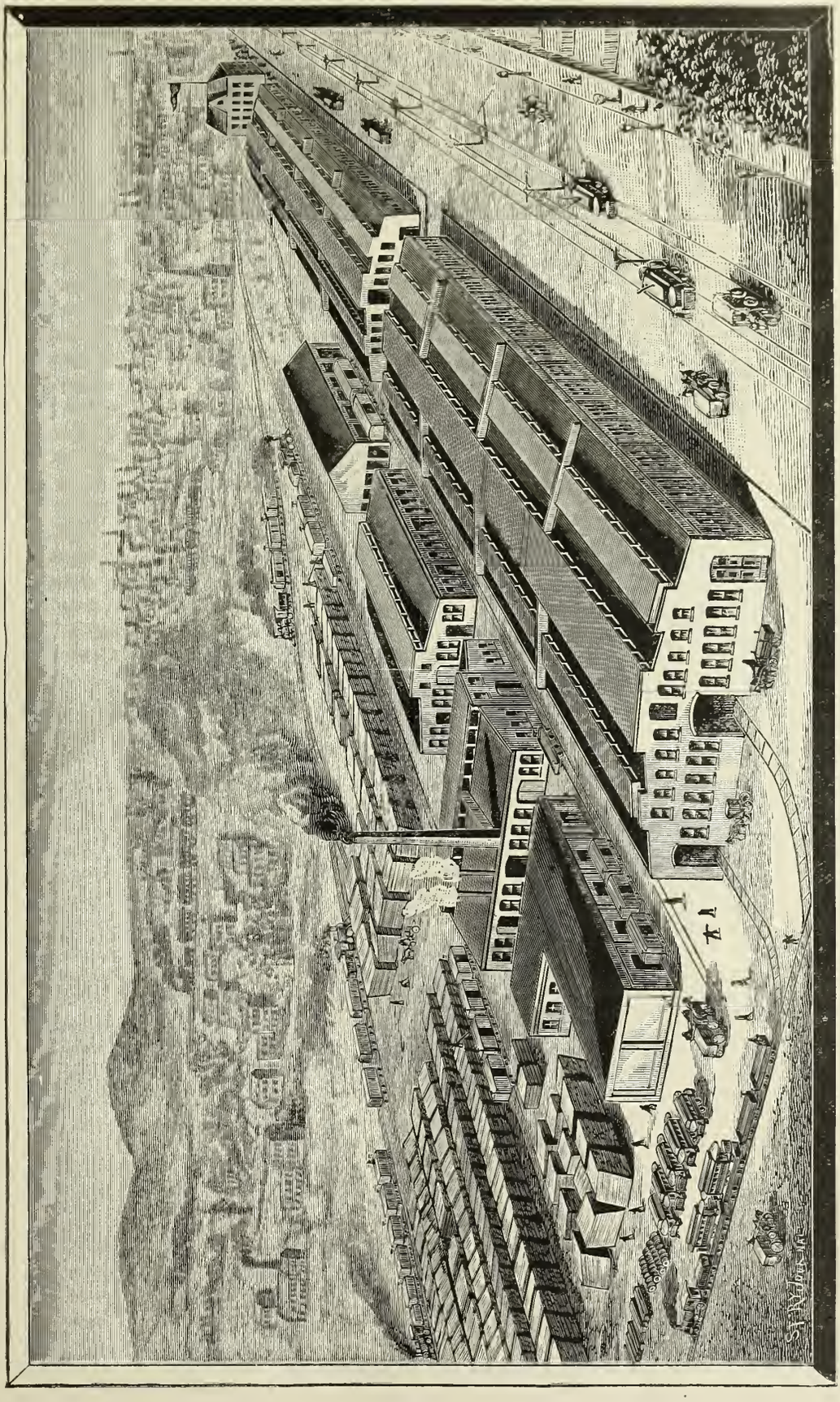
In the foremost rank of enterprises that have commenced operations in St. Louis within the past year, may be cited the works of the American Car Co, organized for the especial manufacture of street, elevated and suburban railway cars.

The name of this company is an important addition to the already long list of car builders n this city, and their advent has established the fact that more street cars are built in St. Louis than in any other city in the world. The reasons for this are most natural. St. Louis is the fine lumber market of the country, and is located to compete successfully with Eastern, Northern and Western builders, both in cost of production and in delivery to markets in any section of our country.

The works have the most advantageous location that could be selected, the site, covering about ten acres, is at Tower Grove Avenue and the crossing of the Missouri Pacific, the St. Louis & San Francisco, and the Oak Hill & Carondelet railroads, the latter being practically the city terminus of the St. Louis, Iron Mountain & Southern Railroad.

The premises have a shape tending to a lengthened triangle — the thoroughfare running along the right — and shipping connections with the three railroads on the western and southern sides. The buildings cover the greater part of the premises, excepting about three acres used for lumber yards. Everything in connection with the works is laid out so systematically that we have no difficulty in describing the succession of buildings and departments in their regular order.

In planning the works, a perfect economy in handling the materials in progress of manufacture, has been closely studied. This has been one of the special aims of the company in the selection of the site, and in the construction of the buildings, which are at present six in number and form two rows or branches converging at the paint shop. On the left are the blacksmith shops and machine shops, the engine room and boiler room, following which come the lumber kilns. On the right are, first, the office building, next the paint shop, occupying the large building following, and the buildings of the erecting shops, varnish room and cabinet shop and mill. All the buildings are substantial brick structures, but one story in height. As may be seen by the cut, most ample consideration has been given to the all important subject of good light, the machine and blacksmith shop and engine and boiler room buildings being surmounted by one single lantern, and the other buildings with three rows of lanterns, as well as very large and high windows. Be-



WORKS OF THE AMERICAN CAR CO. ST. LOUIS.

tween the two rows of buildings runs the main railroad switch, which has a branch passing through the lumber yards.

Now that we have described the general configuration of the grounds and buildings, we shall proceed to speak of each one of the latter separately and in detail. We first visit the office building, which is situated on Tower Grove Avenue and the railroad tracks. Here are situated the general offices and draughting rooms. The present building is a frame structure, and is to be replaced by a neat edifice with ample office accommodations, and draughting and photographer's rooms designed according to the latest methods.

From the office we go to the lumber yards. Here there are at present piled up over 2,000,000 ft. of lumber, valued at $50,000. It is all of the very finest quality and thoroughly seasoned. The yards measure 275 × 450 ft., or over two and three-fourths acres.

The blacksmith and machine shops occupy a substantial building measuring 175 × 175 ft. A railroad track runs through its centre from north to south, and the railroad cars deliver at its doors the heavy material to be made into the various necessary shapes. The blacksmith shop and the machine shop each measure 75 × 150 ft. In the blacksmith shop, the roominess of which is most noticeable, are eighteen forges and four furnaces. There are two steam hammers of the Bement & Miles type, and two of the Blakesley type. One novel and very interesting machine, the invention of Mr. William Sutton, president of company, makes a complete steel car step at one blow.

We next enter the machine shop. Here we find a large punching machine at work. This, together with a shearing machine, was made by Hills & Jones. There is also a large Niles wheel press of 100 tons pressure capacity, as well as many other machines which belong to this department. A railroad track passes through this shop, enabling the shipment of trucks and delivery of wheels, axles, etc.—of which there are a very large number on hand— with the greatest facility. Between this building and the engine and boiler house are two large wells, and above them, supported by the walls of the two buildings, is a storage tank having a capacity of 40,000 gals. The city water is entirely too muddy for use ; well and artesian water have to be used in its place.

Adjoining the machine shop is the power house. It is a brick structure measuring 50 × 80 ft The boiler room measures 31 × 80 ft. The boilers are three in number and are of 120 H. P. capacity each. They were made by the Springfield Boiler & Manufacturing Co., of Springfield, Ill. The water supply for the boilers is obtained from an artesian well inside the boiler room itself. It was necessary to bore down 300 ft. to obtain the proper quality. A vertical pump sends the water direct into the boilers. We noticed two small pumps for ordinary uses, and a purifier. The engine room is 20 × 80 ft. The equipment consists of one Hamilton-Corliss engine of 250 H. P. capacity, but which can deliver 300 H. P. on the fly-wheel. This engine supplies the necessary power for the entire works, with the exception of the fans and the lumber kiln exhausts, each of which derives power from other engines to be spoken of hereafter. The cylinder of the engine measures 22 × 42 ins. A 250-light incandescent dynamo supplies the necessary light for the entire works. It is operated by the Hamilton-Corliss engine by means of a pulley attached to the main pulley shaft.

One of the most valuable and interesting features of the works is the drying kiln. It occupies the brick building without windows and lantern shown in the cut on the left. It consists of five separate and distinct chambers, each one of which measures 20 × 40 ft. In each one of these is laid the lumber to be dried, and record is kept of its kind and quality, and of the time required for each to undergo the process. The timber rests on rafters, and thus it is thoroughly exposed to the heat coming from a series of pipes, with which each chamber is supplied. The temperature at the time of our visit was eighty degrees. The heat drives out the moisture from the timber, and an exhaust fan is connected with each chamber by a large pipe, through which the vapor is taken and deposited in the form of water at the rear of the building. A room also in the rear contains the twenty H. P. Sturtevant engine which operates the exhaust fan made by the same company. It is claimed that grass green poplar, bass and cherry woods can be dried here in forty-eight hours ; three inch and four inch oak right from the saw, in two weeks, and ash in eight days, all of these showing no signs of checking whatever. At the time of our visit there were two kinds of lumber in one kiln, that which seasons the quicker being above. Green timber is never put in the kiln, but only selected lumber from the company's stock, which has had thorough outdoor seasoning. The wood mill being situated opposite the kiln, lumber is taken from the latter to the former ready to be cut into various shapes and forms.

We next enter the mill. This department occupies one large room, measuring 150×150 ft. On account of insufficient room and facilities, an addition is to be added which will measure 150×300 ft. This will give a total mill room of about two and one-quarter acres. There is an almost endless variety of wood working machines and tools, a number of which were made in St. Louis by Hall & Brown, and others came from the East.

Adjoining the mill is the cabinet shop measuring 75×150 ft. In this department the delicate framing and joinery work are performed. The monitor roofs are here erected, and call forth a great deal of skill in bending wood to the required shape. The main and foot panel boards are bent to graceful curves by being put on a series of steam pipes so placed that they form a curved surface. Where the panels are laid on the pipes they are drawn down to the required curvature. Platforms of various sizes are being built. Seat backs of fine burl oak, bent, stand up ready to be placed in the cars, as well as veneered ceilings of the same wood. In the southwest corner of this department is the heating apparatus, of the Sturtevant system, which supplies a uniform temperature as well as a change of air throughout all the buildings. It is arranged as follows :

Within a large iron box is a series of coiled steam pipes supplied with steam from the boiler room, and kept at a constant temperature of sixty degrees in the winter. These pipes fill the large iron box with heat, and connected with the latter is a fan operated by a twenty H. P. engine. In connection with this engine and the one in the lumber kiln, is used a rubber belt. The fan sends the hot air throughout all of the departments, by means of galvanized iron pipes. Not only are the buildings heated, but there is a constant and most perceptible change of air, found to be so by a continuous warm draught encountered by passing from one department to another. During the summer months cold air is sent through the buildings in the same manner as the hot air at present.

We next enter the varnish room. This department measures 50×150 ft. In one part of the large room are window sashes of cherry wood varnished so smoothly and brightly that they will reflect any image, and furnished with the heaviest plate glass. Again we see fine wood seat backs highly polished and varnished, and veneers for ceiling decoration. On the latter is bestowed some of the most artistic work executed in the shops by means of stencils. Handpainting is also done in this department which very often requires great talent, and attains to a high degree of excellence.

Passing through the erecting room, 100×150 ft. in size, we enter the last department, the paint shop. This department at present only measures 150×300 ft., and can accommodate about 150 cars. The company now has in course of erection a mammoth paint shop measuring 400×300 ft., occupying about three acres, and capable of accommodating about 260 cars at one time. Twelve tracks will run through the building from east to west, and corresponding to these will be twelve doors entering on to the main railroad switch. Thus the newly built car can be run on to the flat railroad car without any unnecessary lifting or hauling. Between the new paint shop and the erecting shop there is to be a large transfer table, fifty feet in width, running the width of both buildings. To give a good idea of the insufficiency of the present

quarters in the painting department, it was necessary to rent one-half of the large cotton compress building east of the company's premises, and at the present time 200 cars are being painted there alone. It is in the paint shop that the street car appears, as we are accustomed to seeing it, in a complete state.

The process of painting a car never strikes the ordinary run of mortals as being a difficult and tedious one. They think that two or three coats of paint are put on, then the lettering, and the whole completed in a day or two. Every car first receives, in the erecting shop, a coat of white paint, which serves as a base for every color. After entering the paint shop it receives different coats of the color chosen. The foreman of this department has a reputation for his fine and durable work. After this painting is completed, the car is ready for the interior decorations, such as the carpeted or upholstered seats, the veneered ceiling, the lamps, the brass mountings and the last finishing touches. It is then mounted on its truck, and after it has received a canvas covering, is ready to be shipped to any point in the Eastern or Western hemisphere, as the case may be.

At the time of our visit the company were building some very handsome cars equipped with cabs, for Cincinnati. The cabs of these cars were not as cumbersome and heavy as some we have seen. Each side door where passengers enter swung on hinges, and was provided with a drop sash. Some of the cars had sixteen foot bodies, and others eighteen foot. There were a number of open cars for Peoria, Ill., with seven benches, the end ones of which were double, and having an aisle down the centre. The company have adopted a style of their own in shaping the panels of these cars to a compound curve.

The monitor roof is the style of roof generally put on the company's cars, but, of course, they can build all kinds, and to suit the fancy of the most fastidious. There were also cars for Chicago, for which point the company have already built several hundred cars, Washington, D C. and Omaha, in various stages of completion. They are also at present remodeling one of the twenty-two foot cable cars formerly used on the St. Louis & Suburban Railway. As this road now employs electricity as a motive power, the large cars are to be equipped with two four wheel trucks, each of which is to be fitted with a fifteen H. P. Thomson-Houston S. R. G. motor. Seven feet four inches of one end of the car is being made open, and when the whole is completed it will have the appearance of the Market Street cable cars in San Francisco.

Three hundred men are at present employed in the works, some of them by the piece work, and still others by the hour. The wood mill men all belong to the latter class. Till very recently there was a night shift employed in addition to the day force, the many orders on the company's books rendering this necessary, but the new mill has relieved all pressure and the regular day's work of ten hours has been resumed.

The American Car Co. was incorporated under the laws of the State of Missouri, in August, 1891. The officers of the company are: William Sutton, president; Theophile Papin, Jr., 1st vice-president; Ferdinand Meyer, 2nd vice-president; Emil Alexander, secretary; Louis H. Tontrup, treasurer. These gentlemen are well known citizens and prominent in many large business enterprises in connection with the new growth of St. Louis, and their connection with the American Car Co. has brought it at once into the foremost rank of St. Louis' great industries. Messrs. Sutton & Alexander are the practical conductors of the works. They were the organizers of the Laclede Car Co. with which they have been connected until recently. Mr. Sutton has also been connected with various other car building works at different times.

That these gentlemen thoroughly appreciate the growing requirements of the street railways throughout the country in the way of modernized equipments is demonstrated by the number of orders now under way in their establishments.

Mr. Alexander, with justifiable pride, pointed out to us that some 275 cars stood in the paint shop and annex about completed, making the daily output about seven cars. When the annex to the mill is completed, the company will have a reserve capacity of twice again that number and will be ready to make delivery of five or 500 cars at any time wanted.

When we consider that the works have been in operation but six months, we do not wonder at statements that the street railway companies are declaring larger dividends and growing faster than ever.

A New Electric Line in France.

The projected new line of the Puy-de-Dôme is to connect with the electric tramway from Clermont-Ferrand to Royat. The first section, of 1,500 metres, will use a rack rail and will have grade of one in five. The second section is 11,000 metres in length, with smooth rail and grades up to one in seventeen, which will be followed by a third section of 1,000 metres of rack rail of various gradients on one in eight to one in five. Finally a fourth section of 400 metres of cable, and an incline of one in two. This last section will probably be replaced by a tunnel of one in four, with rack rail opening out on the summit of the Puy-de-Dôme. The difference of the altitude between the two termini is 1,000 metres (or 3,280 ft).

The entire line will be operated by electric power, using an overhead wire and return current through the rails. The power station, which will supply current to both the Puy-de-Dôme railway and to the Clermont-Ferrand tramways will probably be placed near the junction of the two lines.

The rack rail sections and smooth rail sections will each have a special type of vehicle, and a special device will be used to facilitate the transfer of passengers from one set of cars to the other.

The overhead wire will be of silicon bronze and will be supported on iron poles. The span wire construction will probably be used. The generating station will have a capacity of 300 H. P. The management is also studying whether it will not be possible to utilize this current from the motors on the down grade to charge accumulators at the generating station. The power will probably be furnished by turbine wheels.

We are indebted for the above facts to Mr. Chigot, engineer of bridges and causeways, Clermont-Ferrand, Departement du Puy-de-Dôme.

Notes on the Columbian Fair.

FOREIGN participation in the Exposition, up to the present, embraces seventy-two nations and provinces.

CANADA has been given 68,471 sq. ft. of space in the various buildings, exclusive of space yet to be granted in the agriculture and live stock departments.

THE Bethlehem Iron Co. of South Bethlehem, Pa., will make an extensive exhibit, including steel rails, shafting 125 ft. in length, guns, projectiles, and various naval appliances. The company will also erect a full size model of their famous 125-ton steam hammer, said to be the largest in the world. It will be to all appearances a perfect duplicate in every respect. It will span the main avenue of Machinery Hall, and will rise to a height of ninety feet. At the last Paris exhibition great attention was attracted by a similar model shown by the Creusot works, but representing only a 100-ton hammer.

SEVEN of the World's Fair buildings are now so far advanced that they are fast assuming the appearance of finished structures. The rough carpentry work on them is practically done and the ornamental and finishing work is in progress. These buildings are the Woman's, Horticulture, Transportation, Mines, Administration, Forestry and Fisheries. Five more—the Government, Fine Arts, Agriculture, Dairy and Illinois State—are erected to the roof lines. The Electricity, Manufactures and Machinery buildings are being advanced rapidly.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
World Building, New York.

The Street Railway Companies of Chicago have recently been granted privileges which will enable them to provide a much better service for the public. There has been of late much complaint of the inadequacy of the service, but the fact seems to have been that improvement was impossible without the grant of facilities which an unreasonable municipal council refused to concede. With increased looping privileges the cable companies can respond much more successfully to the tremendous demands made upon them in a city which depends for transportation wholly upon the surface cars.

A Comparison of Miles and Cars belonging to the street railways in the United States at the close of the years 1890 and 1891, is given on another page. The basis of the table is the directory of street railway companies published each month in this paper. While we realize that all directories of this kind are more or less inaccurate, and that, consequently, any table compiled from one has a margin of error, it is believed that the table referred to is as accurate and complete as it is possible to make it. Reports had to be sent in from all parts of the country, but all have shown a cordial desire to co-operate in keeping our street railway directory correct, and to all we herewith extend our thanks for the furnishing of statistics.

The Electric Railways of Chicago at the present time are located in the outlying districts, and it has been generally assumed that overhead systems would not be permitted on streets nearer the centre of the city. The City Council has, however, recently passed ordinances which authorize the use of aerial wires on the crosstown lines within five or six miles of the heart of the city. The overhead system is well adapted for these roads, which are comparatively short. More rapid transit is demanded than is possible when horses are used, and the traffic is not sufficiently heavy to warrant the use of a cable. Perhaps when these roads are electrically operated, and the merits of electric railways are more perfectly understood, the prejudice against the trolley wire may be less pronounced, and electric lines can be more generally utilized as adjuncts to the cable systems.

Car Building as presented in this and the preceding number, will, we think, be found to be a valuable treatise on the subject. Already several parties to whom the matter was submitted before publication, have commented favorably on its practical value, and one has added in his communication, "It would have saved me much labor and expense could I have had such help in my early railroad experience." The article, with important additions, and a larger number of illustrations, will constitute one of the fifteen chapters in our forthcoming handbook (Trams), which has been for some time in preparation, but the publication of which has been unavoidably delayed. We will, however, have it ready for delivery within the next few weeks. The work is intended to cover the entire street railway field, and will treat the subject in every detail.

The Desirability of Exhibition Roads at the World's Fair was urged in these columns in the February issue. Until within the last few days it has looked as if the authorities would refuse to entertain a proposition with this end in view. We have just received information which warrants us in announcing that in all probability three tracks, which will be parallel to the Baltimore & Ohio tracks at the southeastern corner of the Exposition grounds at Jackson Park, will be used for the purpose. It was thought at first that electric cars only would be exhibited in operation on these lines, but it is now considered not improbable that other systems of street car traction will be shown. It is certainly hoped that this plan which now seems likely of adoption will be favorably considered by the authorities. The trials of the various methods of street car propulsion, which would be illustrated would form a most attractive and instructive exhibit to a vast number of persons who will visit the grounds.

The Question of One or Two Motors for an electric car equipment was recently debated in the Chicago Electric Club, and it is interesting to note the opinions that were expressed. First of all, it was conceded that at the present time its tendency was toward the single large motor. Those advocating this form of equipment emphasized the electrical advantages to be gained by having a large machine instead of two smaller motors. On the other hand it was maintained that the mechanical difficulties connected with transferring power to the axles were easier of solution with two motors than with one. It was also urged that if the two machines were run in series electrical difficulties would be greatly decreased. There is a great deal to be said on both sides of the question, and there is a great deal in the remark made by one of the gentlemen in discussing it, that success in operation with either system depended in a great degree upon the superintendent. At the present time when so many roads are changing their equipment, this question is of especial interest, and it is well worthy the careful study of railway men.

Enterprise is One of the Chief Characteristics of the Street Railway Man, although one might not reach that conclusion after perusing the daily newspaper. The readiness with which so many companies have substituted improved forms of motive power within the last few years is striking proof of the statement. Street railway companies are always on the alert to secure improvements, which will increase the value of the service that they render to the public. An interesting illustration can be found in Chicago at the present time. The newspapers of that city never cease their attacks on the railways, but one of them, which is the most bitterly opposed, whose president is conceded to be the most thoroughly abused man in Chicago, never ceases its trials of new forms of motors. At the present time there are in operation on the lines, cable cars, an imported tramway locomotive, a gas motor, electric cars with underground conductors, and contracts have been signed for the operation of one line by compressed air. In what industry can a more enterprising search for improvement be found?

They Yield Ungracefully to The Inevitable, as the following editorial cut from a leading New York daily, will indicate:

"Brooklyn is to be cursed with a trolley system. The people seem to like it, and the Railroad Commission permits them to have their way."

In our February issue we expressed surprise that the New York papers, which ordinarily treat public themes with great dignity and fairness, should lose their heads when treating on the trolley system, and continue to parade the danger spook, after it had been shown over and over again that their utterances in this direction were based on ignorance and misconception. It is time now for the papers to recognize the fact that the people do like the trolley system, that they are bound to have it, and they regard it in the light of a great blessing rather than a curse. Such flings as the above are undignified, and while they may do for a street gamin who has been worsted in an encounter with his fellow, they indicate a mind too narrow to deal intelligently with questions so vital to the well being of the people of a great city. It is unfortunate for the reputation of the public press, that it has generally opposed the introduction of electric traction, and had it not been for the technical press there would not be a car wheel turned by electricity in any city of our Union. We would not call attention to this unpleasant fact, were it not that in certain localities the same farce is being again enacted. Papers with a national reputation are bending their energies to prevent the introduction of the trolley in a neighboring city, with inevitable defeat staring them in the face. It would save much humiliation on their part, and much trouble in street railway circles, if such publications would join the party of progress, and lend a hand in the development of these industries which promise so much for the comfort of thousands of people, and an enormous increase in the value of real estate.

"We Go Fast Enough and do not need any more improvements or discovery in locomotion," said a well known Brooklyn divine recently, "we do not need any more labor saving apparatus, we have enough now to throw millions of people out of employment; but the world agonizes for improvement and discovery in the matters of physical health." We do not deny the latter statement, but do not at all agree with the first assertion, for facts do not bear out the claim that labor saving appliances have narrowed the field for individual employment. Machinery has taken the place of muscle in certain trades, and compelled some men to learn other trades; but at the same time other machines have bred new trades demanding skilled labor for their operation so that numberless enterprises have sprung up, giving in the field at large employment for a greater number of laborers at better wages and more congenial employment than would ever have come to men had mere hand work been the prevailing method as of old. "We want the race to live longer, and be more comfortable while they do live," was a statement made in the same connection as the above. We admit this also, but claim that such a condition is possible, for city people at least, in the near future, only by improved means of transit. No one is satisfied with the present speed of street car and railway trains. Each of those who daily patronize the former would save from ten to sixty minutes a day, depending upon the distance traveled, a result by no means impossible, and which requires only a little figuring to determine how much even ten minutes a day would add to the average life of man. Popular errors like the above remaining unrefuted tend to subdue inventive efforts; hence, we urge the need and invite the best inventive talent of the age to address itself to this subject. We do not hold that higher speed on existing surface lines with the present forms of track and rolling stock, is safe or desirable, but we do believe that there are possibilities of rapid transit upon some form of an elevated structure, that will virtually annihilate space and be at the same time safe and agreeable.

The Table of Statistics, published on another page, giving a comparison of mileage and cars of street railways in the United States for the years 1890–91 shows, among other points, an increase during the year of 3,300 electric cars, or a total at the end of 1891 of 8,892 electric cars. If we could reckon all the results of the important change in street railway methods connected with the adoption of electricity as a motive power, we should find that they are far reaching and affect nearly, if not every, industry in the country. While acting as a stimulus in many lines and creating new sources of supply and new industries, the change has affected some industries adversely, and is destined to have still greater effect. Take the question of horse provender alone, for example. If we consider that six electric cars, owing to their higher speed, can perform the same service as ten horse cars, the service of 8,892 electric cars corresponds to that of 14,920 horse cars. That is, the latter number of horse cars would be required to do the same work as the less number of electric cars. It would evidently not be fair to assume from this that this number of horse cars would be in operation to day were it not for electricity, since the equipment of many lines has been made possible only because electricity was available as a motive power; but, taking these roads into consideration, it can be stated with a fair degree of accuracy, that of these 14,920 horse cars 10,000, or about two-thirds, have been taken from our streets. If we allow an average of eight horses per car for operating these cars, the total number of horses relieved from service is seen to be not far from 80,000. Taking up the question of feed, then, and allowing a ration per horse

per day of ten pounds of hay, eight pounds of corn and six pounds of oats, we would have a gap in consumption, so soon as the present number of horses can be reduced, of 136,000 tons of hay annually and 4,171,428 bushels of corn and 5,840,000 bushels of oats during the same period. While this is only a small proportion of the total amount of produce raised and horses employed in the country, it shows that the effects produced by the introduction of electric cars are far reaching and of considerable magnitude, even in some of the industries not directly connected.

A Petition has been presented to Congress by the Metropolitan Railroad Co. of Washington, asking for an extension of the time within which they are to be required to change to some form of mechanical traction. It will be remembered that Congress enacted a law on August 6, 1890, requiring, among other provisions, that certain street railroads in the District of Columbia substitute for horse power some form of mechanical traction other than the use of overhead wires, within two years of the date of the act, and in case of failure to make the required change "such company shall forfeit its charter." The company state in their petition that the time is too short in which to perfect the change, that they have spent $242,000 in an effort to comply with the laws by operating their cars with storage batteries, all the necessary buildings and machinery being in place, but that it will be utterly impossible even with an unlimited amount of money to put all the lines in operation on this system by August 6, but express their confidence of being able to do it within a short time thereafter. The committee to whom the matter was referred have recommended that the time be extended for one year, so far as it applies to the Metropolitan company. This is fair, and it is hoped that the members of both houses will be reasonable in the matter and grant the extension. In the meantime there is an opportunity for the street railways throughout the country to come to the assistance of the Washington company by using their influence with their represenatives in Congress and persuade them to grant the extension. At the same time the act was passed we commented on it quite severely, for it seemed to be an unjust measure, and particularly hard on the above company, for while other lines were in a position to adopt cable traction, the lines of this company, owing to the numerous curves, could not with advantage be equipped with this system. It seemed to us at the time premature and unfair to exclude the trolley system, and we are now of the opinion that the interests of the people of the district will be greatly promoted, not only by the extension of time to the Metropolitan company but by the repeal of that clause that prevents the use of overhead wires. The success that has attended the operation of the trolley system in a large number of the cities of our land during the last two years and the favor with which it has been received by the people, should convince Congress that it is not an undesirable method to be employed in Washington. Doubtless many of the members are already familiar with the operation of electric lines in their own towns, and should not presume to deny the people of the District of Columbia the facilities which others enjoy.

Mob Rule reigned supreme in the city of Indianapolis during a good part of last month. The claim of ex-operatives, who had voluntarily left the service of their employer, to dictate how he should still conduct his business and whom he should employ, was tacitly admitted by the citizens and municipal authorities by their failure to prevent the open enforcement of this claim It is a dangerous doctrine to champion that an employer has not the legal right to employ new helpers in his business, when the old ones are no longer willing to work on the terms offered. But this was the claim advanced in Indianapolis by the street railway strikers; the guardians of the law made no attempt to deny it, and the street railway service became suspended in consequence. Of course, during the disturbance, considerable property belonging to the railway company was destroyed by the strikers and their sympathizers. Before the curtain was rung down on this travesty on justice, which, however, so far did not differ materially from many like events in other cities, the judiciary was called upon to interfere, and rendered a decision which was so peculiar that it demands special attention. A citizen, not financially interested in the company, filed an application late at night during the strike, with Judge Taylor of the Superior Court, for a receiver; an application which was granted after an *ex parte* hearing, by the appointment of a former employe of the company to take charge of the road, though no claims of insolvency were made against the company. In other words, Judge Taylor laid down the new principle of law, that if an employer does not pay his employes the wages they desire, his property can be taken from him. Judge Taylor said in explanation of this, after the property had been returned to the company:

> By the contract between the city of Indianapolis and the Citizens' Street Railroad Co., the company was bound to furnish car service on all its lines within the city limits, each and every day, and during the hours for business and travel for each day. I am not sure that the very words are stated, but that is the substance of the agreement, and it is one of the essential provisions of that contract. The company has broken that contract, and it might fairly be held, that far, to be in a failing condition, a state of quasi-insolvency or bankruptcy—inability to perform its obligation.
>
> Sec. 1,222 of the statutes of this state provides for the appointment of a receiver, and it specifies the cases in which a receiver may be appointed by the court. I shall not set forth these specifications in detail, but refer only to the seventh which is in these words: "And in such other cases as may be provided by law, or where, in the discretion of the court or the judge thereof in vacation, it may be necessary to secure ample justice to the parties." Now the parties to this contract are the citizens of Indianapolis, and the Citizens' Street Railway Co., and the justice to be secured is the compliance with that contract by that company, wherein it had failed and was helpless through its own act or failure to fulfil.

It is a new proposition, and one which it might possibly be well to compare with the Constitution before acting upon that the law will take when through its own negligence it fails to protect. In fact, it would not require a very vigorous imagination to picture a judge who upholds this doctrine as hanging a prisoner first and trying him afterwards. But another point in the statement demands attention, and that is, that the city of Indianapolis is made synonymous with its citizens, and that any citizen can bring action on a contract in which the city is a party, if he thinks that the contract has been broken by the other side. Usually such action is brought through the city's officials or constituted head, and it would be interesting to know Judge Taylor's reasons for extending the right.

The Government Control of Railways was made an important plank in the platform adopted at the recent

convention in the city of St. Louis, of delegates representing, what they call, the people's party. While this body doubtless is in an infantile condition, it has put forth one phase of an important issue which is more and more coming to the front. And it is none the less significant to the street railway interests, because street railways were not mentioned in the plaform, for it is reasonably safe to say, should the larger railways be subjected to government control, street railways would quickly be looked upon as worth similar attention. Government control of railways wherever it has been tried has not proved a success; the reasons therefor are apparent enough when one reflects upon government methods in the conduct of industrial enterprises; usually, employes so engaged, while they may or may not do their work thoroughly, feel that their positions are secured by many considerations besides the actual merit of their work. Outsiders should not be deceived in this particular by affairs which the government at present control and which seem to give efficient service, as, for instance, the postal department. In regard to this the post offices of a country have never yet been in the hands of private parties; in fact, the latter are restrained from engaging in such business in this country, and it has frequently been said that such restraint is due to a fear by the government, that they would, in competition with the government, get all the business. However this may be, the numerous attempts of private parties, under one guise or another, to do the postal business in New York and other cities, were so successful in point of a reduced cost to the public, and other advantages in connection with quick service, that they were steadily getting all the business out of the Government's hands; and in consequence, the latter felt itself obliged in self-defense to make a special law meeting such cases, prohibiting private individuals or corporations repeating the attempt. The latest news from Australia, where the Government has control of the railways, shows that no dividends have been declared since it took them from private ownership, and that the average rates of fare are considerably higher than our own, both for passengers and freight. The Australian situation is, in many particulars, much like that which one might reasonably expect to develop in this country, should our Government take control of the railways; and because of this similarity it is interesting to note some facts in connection with it. The construction of the Australian railways has been a source of grave charges of dishonesty and corruption, and great discontent prevails, particularly among the farmers, regarding their present management. But these roads have different gauges, and there is no competition between them; not alone because the Government has control of them all, as each road has certain localities which it monopolizes. Each of the colonies took charge of the roads in its district; and, some time after, the cares of the management proved so heavy, that the colonies appointed commissioners to look after the business, giving them almost complete control. These commissioners are not exactly the Government, for they stand between the Government and the people; and at the present time they are in great distress in not knowing how to make both ends meet. One of these commissioners recently said in public that the managers were not able to cope with the situation, that they were ignorant of what would be best for the interests of all concerned, and unless money was obtained from outside sources, (which means a special appropriation by the Government to make up the deficit) the outlook was dubious. He recommended that the railway employes be consulted, as heretofore—according to English usages—a respectful distance has been maintained between the roads' employes and the commissioners, consequently the commissioners have not yet learned how to run railways. This commissioner said the deficit was due to "the working of non-payable lines, the construction of which was the outcome of political jobbery; also to the free carriage of persons and property of those not connected with the department, and the running of trains to suit the convenience of the public." The experience of Germany in the Government control of railways, while not so bad as that of Australia, shows no advantage to the people over our system; in fact, freight charges and passenger fares average higher than in this country, while the service, in point of speed and public accommodation is far worse. Only a short time ago the Rhine miners were loudly complaining against their inability to get cars enough to transport their products; not that the railroads were overworked, as is now the case with some of our granger roads, but the Government was indifferent, preferring that commerce should adapt itself to the railway service, rather than the railway adapt itself to commerce. This matter became so serious that almost a riot was developed before the Government consented to make any change in its regular routine. Results of this description seem to be a part of all attempts at government railway control; it is a common observation that governments move indifferently to the requirements of the people, and if the public does not like it they are at liberty to do the other thing. This same experience took place in England some years ago, when, at the instigation of the public, the Government took control of its railways. Before that there was great dissatisfaction, particularly among the smaller towns, at discriminations in favor of one locality at the expense of another; and to remedy that and other matters which the people thought inseparable from monopolistic control, they finally urged the Government to interfere and run the railways in behalf of the public. The programme was carried out according to their wishes for several years, until the indignation of the public could stand it no longer; then they again literally obliged the Government to again put the old corporative control in power, for the people had learned, as they are now beginning to do in slower moving Germany, that railway abuses are far more numerous under government than under corporative control. And what was worse to them, such abuses were not remedied at all, or, at least, infrequently, by the Government; but with corporations, while rectification of abuses was frequently slow, they commonly were granted when the people asserted their wants in a vigorous way. It should be unnecessary for our country to go all over this vast experience; if the advocates of government control of railways will examine what has already taken place abroad, they can easily learn that private corporations are much easier moved to do justice, where local abuses exist, than could possibly be the case where the Government is obliged to frame a statute for each instance.

Herr Wermuth, the Imperial German World's Fair Commissioner, has already received nearly 2,000 applications for space from the intending exhibitors of his country.

By a recent decision of Judge Marshall J. Clarke, the control of the Atlanta (Ga.) Traction Co. has passed into the hands of Messrs. Lanier, Hoppie and Stewart. This is the result of a long law suit.

Legal Intelligence.

Ordinance—Forfeiture of Charter—Constitution. This action was brought to have it determined that the defendant has forfeited, and that it be excluded from all rights and privileges under its charter or franchise. The theory advanced was that the law does not permit any incorporated town or city in the state to grant authority to any individual or corporation to lay railroad tracks through the streets or public highways whereupon cars can be propelled by the force of electric power. The trial court entered judgment against the defendant; the latter appealed.

Held, That where the constitution (Calfa.) provides that no act shall be passed extending the charter of any corporation or remitting the future of a franchise. During the pendency of an action to forfeit the charter of a street car company operating under a city ordinance, Acts of Cal., 1891, were passed, one amending Civil Code, s. 467, so as to invest municipal corporations with power to authorize street railways to use electricity as a motive power, the other ratifying existing ordinances granting such power.

Held, That the acts did not extend the company's franchise or charter, and, as there had been no decree of forfeiture, there was none to remit, and therefore the acts were not repugnant to the constitution.

2. Where the code provides that work on the construction of a street railway must be commenced within a year from date of the ordinance granting the right of way and the filing of the articles of incorporation, and must be complete within three years thereafter, *Held*: That when the complainant in an action to forfeit a charter did not state when the company commenced the construction and thereby show that the three years had elapsed within which the work must be done, it failed to state a cause of action. Judgment reversed and remanded.

People v. *Los Angeles Electric Railway Co.*, Calfa. S. C., Oct., 1891.

Motor Car—Injury to Horse—Evidence—Verdict. In an action against a street railway company for the negligent injury of plaintiff's horses, where the evidence showed that plaintiff's driver was holding the team beside the track; that when they saw the motor coming they grew uneasy and when it was about 125 ft. away one of the horses "danced" on to the track and remained there until struck by the motor; that the motor was not going at the usual speed, but was going so fast, that it would have been unsafe to step on or off it. It did not appear whether the motor could have been stopped after it was seen by the engineer that the horses were on the track.

Held, that there was no evidence of negligence on defendant's part to support a verdict for plaintiff.

Coughtry v. *W Ilamette St. Ry. Co.*, Oregon, S. C., Nov. 9, 1891.

Injury to Child in Street—Negligence of Parents—Driver's Conduct. 1. In an action for injuries to a child four years of age, who was run over by a street car, the question whether his presence in the street alone was due to the negligence of his parents is for the jury, where it is shown that he was left alone in a room with the door shut for a few minutes before the accident, and escaped therefrom without anyone's knowledge, and that he had never been known to go on the street alone before.

2. In such action evidence of the careless and inhuman conduct of the driver of the car after the child had been injured and carried home is incompetent, and its admission is reversible error, as its tending is to inflame the jury and augment the damages allowed. Judgment reversed, and new trial awarded.

Barry v. *Second Ave. St. Ry. Co.*, N. Y. S. C., Dec. 7, 1891.

Car Shops Burnt at St. Louis.

About 8.50 o'clock on Tuesday night, March 15, the car shops and general offices of the Missouri Railroad Co. were destroyed by fire. Private watchman Van Bibber discovered flames issuing from the eastern end of the paint shop, and immediately turned on an alarm. The Fire Department responded very promptly, but as the first alarm called but five or six engines, second and third alarms were turned on. By the time the latter arrived the flames had gained such headway that the car houses adjoining (see cut) were in danger, and the firemen confined their efforts to the latter, as it was impossible to save the shops. On the first floor of the burnt building were nine cars and on the second floor twelve cars in various stages of repairs. Among the cars burnt were several which were to be operated on the new Forest Park extension of the electrical division. A portion of the west wall fell, and going through the roof of the car house on that side demolished a snow sweeper. Two new sweepers just received from the Thomson-Houston company had narrow escapes, as well as several cars. In a pile of half burnt papers we noticed a copy of the Street Railway Journal.



RUINS OF CAR SHOPS AND OFFICES OF THE MISSOURI RAILROAD CO., ST. LOUIS.

The offices occupied a portion of the second floor. The safe contained $5,000 at the time of the fire, which was gotten out in safety. The paint shop, car shop, repair shop and motor shop occupied the remainder of the building. The total loss to the company was about $54,000 $27,000 on the building, and $27,000 on the cars. The insurance carried was said to be light. The company's lines were in no way affected by the fire, and soon after the fire were running on time as usual.

The Story of a Belt.

THE CONNECTION BETWEEN ENGINE AND GENERATOR.

Within the last few years the prime transmitting agent in power stations has necessarily been a subject for careful study. When electrical machinery was introduced it was realized at once that successful operation was practicable only when the connection between engine and generator was as nearly perfect as possible. In a system which is primarily nothing more than a comprehensive scheme for distributing energy, it is obvious that any unnecessary loss of power should be peculiarly noticeable. In the early history of the electric railway especial difficulty was experienced in procuring belts suited to the exigencies of the extraordinarily severe service. In spite of widely fluctuating loads and high engine speed, absolute steadiness was essential in the delivery of power to the generator pulley—a condition which is attainable only when the belt is strong, straight, true, evenly balanced and elastic. Under the stimulus of this increasing and exacting demand, American belt makers have introduced many improvements and refinements in manufacture, with the result that the best belts produced in the world are made in this country.

The manufacture of leather belting for electric railway plants is an interesting process which involves the application of the nicest skill, and the use of specially designed machinery. The following description, with the accompanying illustrations, of one of the largest establishments devoted to this industry, that of the Jewell Belting Co., of Hartford, Conn., will, it is believed, prove the truth of the general statement. As an introduction to the subject a brief sketch of the history of the company is presented.

The business was founded by Pliny Jewell, in 1848, in very unpretentious quarters, and with capital correspondingly modest.

From time to time his sons were taken into the business; first, Marshall, afterwards Governor Jewell, then Pliny, Jr., Charles A. and Lyman B. Jewell, in the order named. The demand for the product was at first confined to Hartford almost exclusively, but Mr. Marshall Jewell, soon afterwards entering the firm, expressed his confident belief in a vigorous policy for the extension of the business into new fields. He became the first traveling salesman, and subsequently his brothers followed his example. The business has grown steadily since that time, until, to-day, the prosecution of the industry is distributed in the group of buildings shown in the illustration (Fig. 1), and the belts are used in transmitting power in every country on the globe where machinery is in operation. But not merely were the members of the partnership practical and sagacious business men; they were fully as competent in the manufacture and handling of leather



FIG. 1.—WORKS OF THE JEWELL BELTING CO.

Mr. Pliny Jewell, the president of the company to-day and Mr. Lyman B. Jewell, the present vice-president are practical tanners, curriers and belt makers, and both are able to perform the manual work in any department of the establishment.

The business of the Jewell company embraces the stages preliminary to belt making. The heaviest and best steer hides which, for the most part, are purchased on the Chicago market, are tanned at the Jewell tanneries at Jellico, Tenn., and Rome, Ga., where the best oak bark is to be obtained. It is found more economical to send the hides to the bark than to reverse the order.

The belly being removed at the tannery the leather in its rough state is delivered at the belt factory. The first step in the work is to cut the shoulder from the hide, or "butt," as it is termed. This operation is performed by the workman, shown to the left in Fig. 2, after which the cutter at the right carefully examines the butt to determine what particular width of belt can be cut from it.

From the heaviest and largest butts centres are cut,

from twelve inches to forty-eight inches in width. In belts designed for electrical service only those parts are employed which have the centre line corresponding to the line of the backbone. The material, being cut, is sorted and placed in piles where it remains until required for use.

The currying processes follow and, as a preliminary, the leather is thoroughly soaked, after which it goes to the skivers, shown at work in Fig. 3, who by means of long knives such as are used in ordinary currying shops remove all remnants of the flesh which may adhere to it. This is a tiresome operation, as the workman must bend over his beam continuously, and it requires the exercise of great skill to avoid cutting away any portion of the fibre.

The next work is performed by scouring machines which are illustrated in Fig. 4. This machine consists of a sliding frame, which carries at each end a stone which rubs the surface thoroughly while a stream of water is allowed to flow over it constantly.

It is essential that the stretch of the leather be removed, and this necessity is constantly kept in view throughout the process of manufacture. The preliminary stretch, and the most powerful, is that exerted upon the leather by the machine shown in Fig. 5. The view represents a centre which was cut for a forty eight inch main driving belt. The leather is fastened in a sliding frame, which is attached by chains to a windlass. By the multi-



Fig. 2.—Cutting the Hide.

plication of gears a tremendous tension can be applied to the piece.

In the farther end of the room, illustrated in Fig. 6, are located two stretching machines designed for narrower belt widths. The three machines in the foreground are employed for what is termed "stoning." The leather is here thoroughly rubbed by a stone attached to the arm of the machine, and the object is simply this: The strength of the hide lies in the fibres. The work expended on the hide tends to compact it and thus add to its strength, and it is for this reason and for removing the stretch that, in all the processes through which the leather passes, the work is directed along the line of the longest fibres.

Fig. 7 illustrates the process of "stuffing" and table setting. The term "stuffing" is perhaps self-explanatory; it consists in the application of grease to the leather and rubbing it in. This operation concludes the currying of the leather.

The preliminary work has now been accomplished, and what is, more properly, belt making commences. The first stage consists in cutting the leather into strips of varying width. The operator first examines it carefully to determine how wide the strips can be cut, and to detect any imperfections such as cuts or scratches which might weaken the belt. As soon as he determines by his eye the general width which is to be cut from a particular piece, he sets his cutting gauge and strips the leather, pulling it against the knife blade in the manner shown in Fig. 8. The two men at the bench to the left beyond the stripper are engaged in "fitting"; sorting, perhaps, would convey the idea more closely. The heaviest pieces are selected for what is termed in the Jewell factory the "short



Fig. 3.—The Skiving Process.

lap extra," and other strips make the "short lap standard" belt. In addition, the strips are arranged by widths. The fitters also mark the leather to indicate how it is to be scarfed in order that the belt may be even throughout its entire length.

The scarfing machines are illustrated at the left in Fig. 9. They slice off the wedge-shaped piece at the end of each strip where it is to be lapped in the belt. The men who are working at the tables at the right in the same view are engaged in what is technically styled "pointing." They finish the work of the scarfing machine by the aid of a knife and a square by bringing the lap to a perfect "feather" edge in order that the joint may be true and of the same thickness as the rest of the belt.

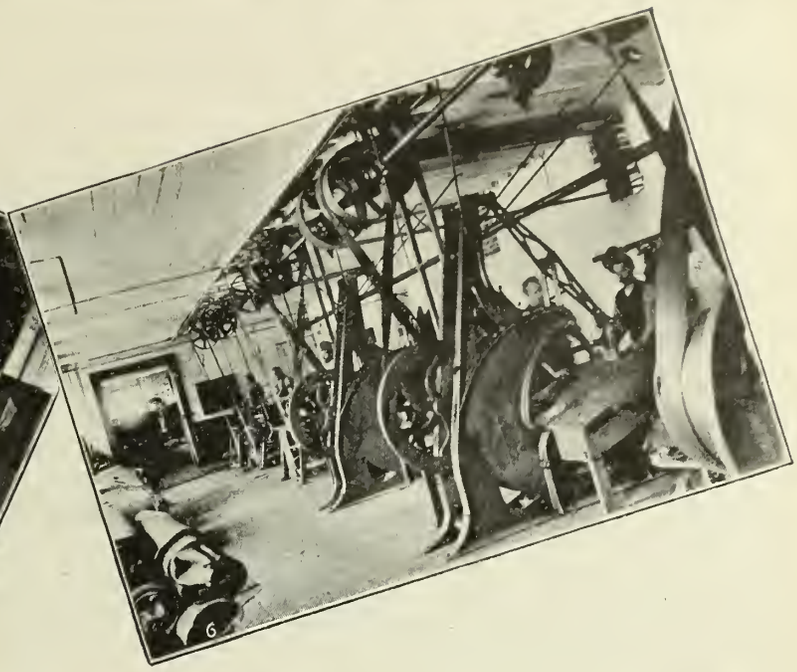
The process of joining the strips is then begun. For single belts the operation is performed as shown in Fig. 10. The laps are covered with cement, and pressure is applied at the points of junction by means of the presses



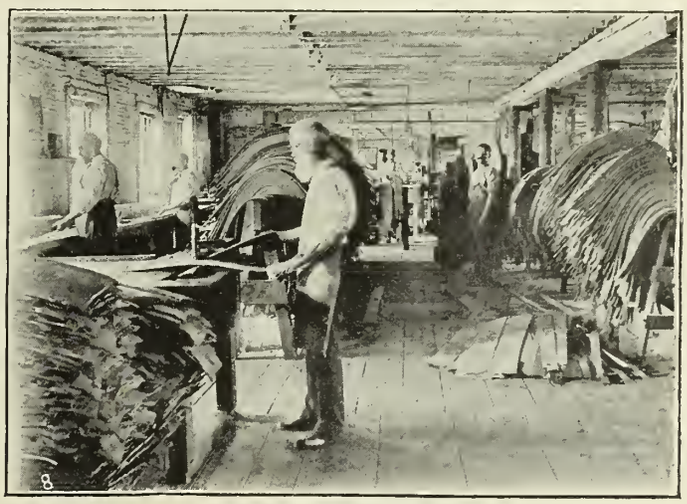
Fig. 4.—The Scouring Process.

which in operation and general design are not materially different from those employed in offices for copying letters. The smaller belts, which are used for a variety of purposes, are strengthened at the laps by rivets or staples. These fastenings are applied by automatic machines











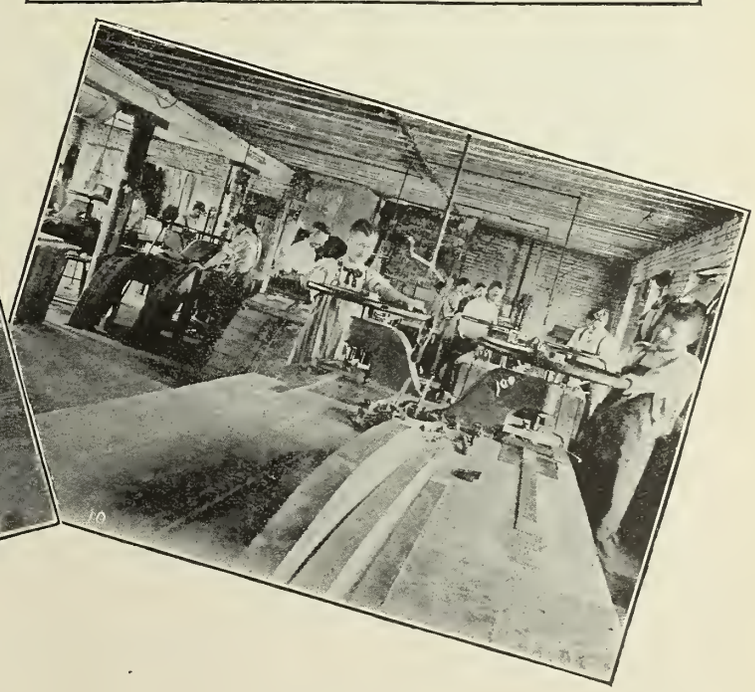


Fig. 5.—Stretching the Leather for a Forty-Eight Inch Belt.

Fig. 6.—The Stoning Room.

Fig. 7.—The Stuffing Room.

Fig. 8.—Sorting and Stripping the Leather.

Fig. 9.—Scarfing and Pointing the Leather.

Fig. 10.—The Joining and Cementing Room.

which are shown in Fig. 11. Both are extremely ingenious inventions. That at the left of the view is the riveting machine. The rivets are fed from a little hopper which is not shown in the view. Before the blow descends which completes the operation, the burr is placed in position automatically. In the stapling machine at the right, the wire used for the fastening is fed from a coil at the top. The wire is formed into the staple, driven into position and clinched automatically. It may be remarked incidentally that the patents on the stapling machine are controlled by the Jewell company.

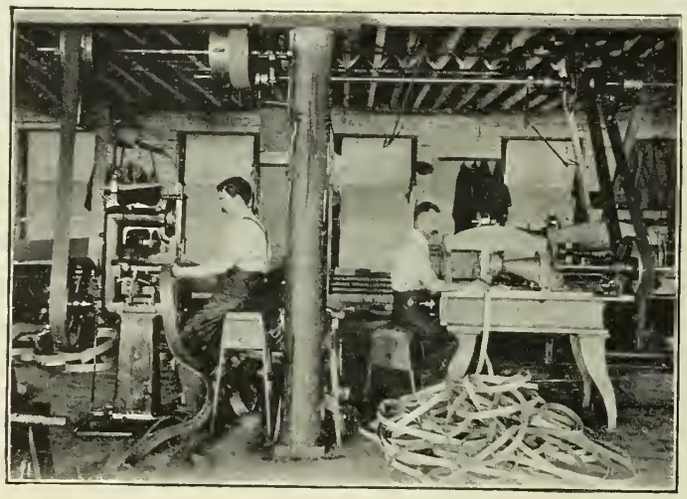


Fig. 11.—Riveting and Stapling Small Belts.

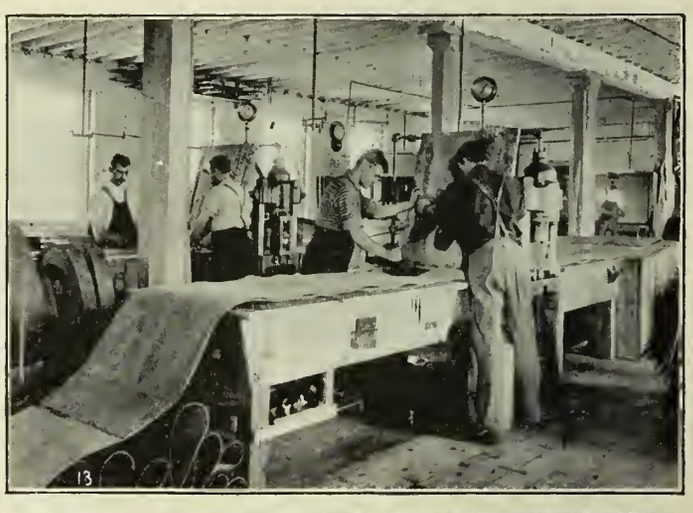
Much more formidable appliances are employed for uniting the centres that compose wide double and three-ply belts. Inasmuch as belts designed for use in electrical stations are put together without any form of metallic fastening, the utmost pains must be taken with the process of cementing. First of all the cement is selected with the utmost care. It is applied hot with the brush, and pressure is then applied at the lap by the hydraulic presses, shown in Figs. 12 and 13.

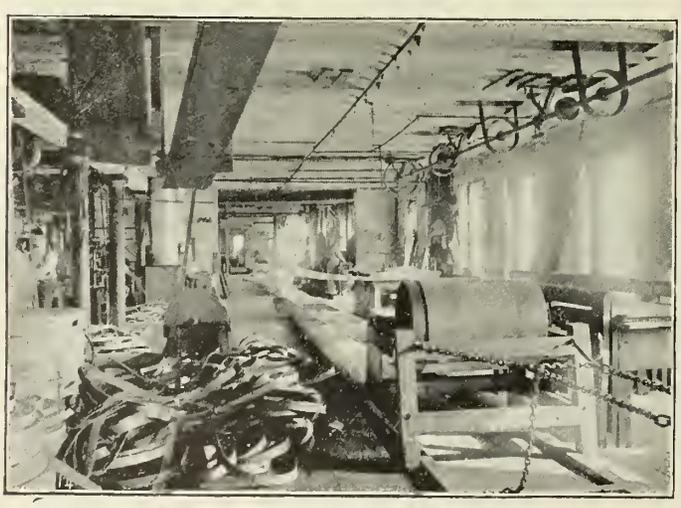
Fig. 12 shows on the press a forty-eight inch, three-ply belt designed for use in an electric station in Canada. The photograph was taken while the men were applying the cement. As soon as this work is completed the cemented section is pushed under the clamps, and a pressure of more than 175 lbs. to the square inch is applied. The machine is built to work on widths up to seventy-six inches, and it exerts a total pressure of 500,000 lbs. The belt shown in the cut is three-quarters of an inch in thickness. Some idea of the amount of leather required to make it may be gained from the fact that every eighteen inches of its entire length represents all the choicest part of a single large hide.

The belt presses, illustrated in Fig. 13, are smaller than those shown in the previous view, but are identical in design. They are adapted for belts up to thirty-two inches in width, and each machine applies a pressure of 250,000 lbs.

As has already been remarked, it is one of the great objects in the manufacture to remove the stretch of the belts, although the effort must not be carried so far that elasticity is lost. Should that quality be gone the belt no longer hugs the pulley tightly, and will no longer do its work well. The ideal condition would include minimum stretch and maximum elasticity. After the general completion of the large belts in the Jewell factory they are operated in the stretcher shown in Fig. 14. Here the stretch, which would otherwise be taken out in the operation of the belt in the first few days of actual use, is







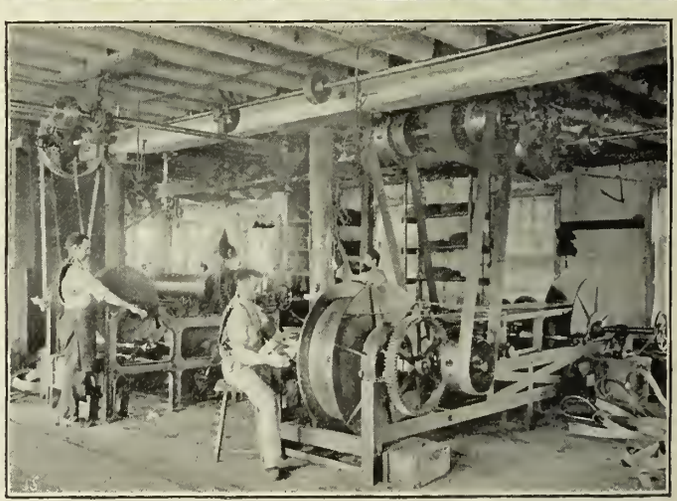


Fig. 12.—Cementing and Pressing a Forty-Eight Inch Belt.

Fig. 13.—Cementing and Pressing a Thirty-Two Inch Belt.

Fig. 14.—Removing the Stretch from a Main Driving Belt.

Fig. 15.—Stretching, Measuring and Trimming.

very effectually removed. The belt runs over two pulleys which are connected with power. The pulley in the foreground is located on a carriage, which is attached by chains to a windlass. All the slack resulting from the continued motion of the belt can be taken up, and it can be kept tant over the pulleys. The final stretch of the narrow single belts is effected by means of the machine shown at the right in Fig. 15. The belt is wound from the drum at the front of the machine in the foreground to the drum at the farther end. As the belt passes from one

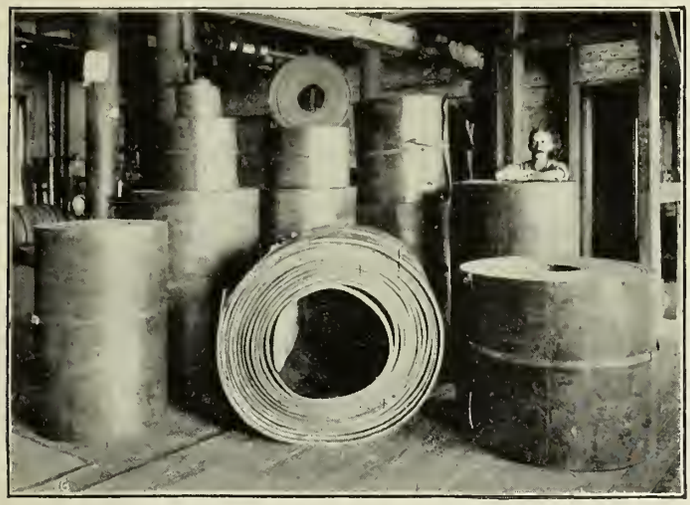


Fig. 16.—A Group of Big Belts.

drum to the other a brake is applied at the unwinding drum with such force that the leather is subjected to considerable tension. The strain is sufficient not only to remove the stretch but to indicate, by breaking the belt, a cemented joint that may be in any way defective. As every workman who makes a joint applies his mark at that point, the responsibility for the faulty piece of work can be properly placed.

In the background of the same view is represented another ingenious machine. As the belt winds from drum to drum it is trimmed and measured. The measuring

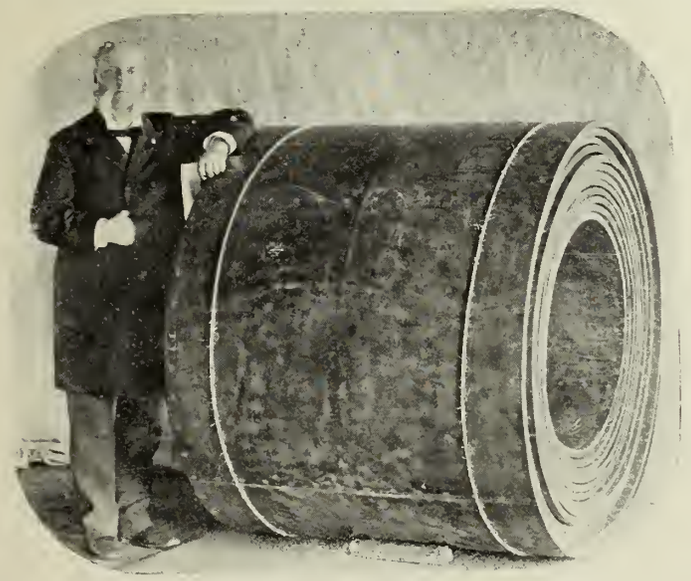


Fig. 17.—The Heaviest Belt in the World—Weighs 2,730 Lbs.

mechanism, located under the cylinder shown in the centre of the machine, marks the length every foot, and every ten feet stamps the quality and brand of the belt.

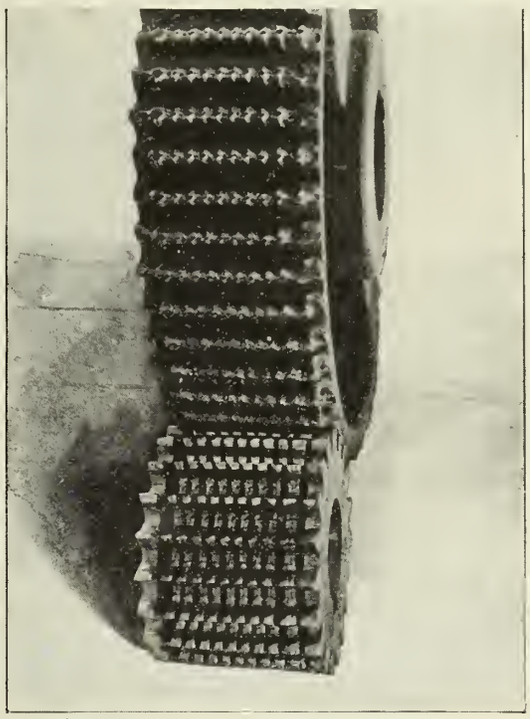
In Fig. 16 is shown a group of belts that happened to be in the factory at the time the other photographs illustrating the plant were taken. Most of the large belts were made for electrical stations. In Fig. 17, is a view of the heaviest belt ever manufactured in any factory. It is four ply, forty-six inches in width, 158 ft. long and weighs 2,730 lbs.

The visitor who inspects the several departments which have here been briefly described will find that his visit has been extremely interesting and instructive. He will be struck by the fact that so careful an economy is exercised that not a scrap of leather is wasted, but, especially, will he be impressed with the time, patience and ingenuity which have been devoted to the manufacture of what is ordinarily regarded as an exceedingly commonplace product.

Chamberlain's Wave Pinion.

In the article which appeared in our last issue, pages 171-2, accompanying the illustrations of the Chamberlain Wave pinion, so much stress was laid on the term "composite" that the impression might obtain that it was a composite pinion pure and simple. This pinion, though composite in its construction, differs radically from the old style known as composite pinions.

Every railway manager will recognize the accompanying figure as showing the wear produced by this old style composite pinion. The Chamberlain Wave pinion entirely prevents such wear, for it is so constructed by the crimping or bending of the plates that the peripheries of



OLD STYLE COMPOSITE PINION.
From a photograph, showing wear on intermeshing gear.

the plates are caused to describe wave lines, so that the steel portions of each tooth do not travel in the same plane, and cannot therefore wear grooves into the intermeshing gear, as shown in the illustration.

On the contrary, actual practice has demonstrated that a pinion constructed in this peculiar manner distributes the wear evenly over the entire surface of the intermeshing gear, so that the teeth of the gear are worn perfectly smooth and straight faced. Thus the life and efficiency of the gear wheel is increased, the whole face of its teeth being available so long as the gear is used, and the non-resonant fibre layers make the pinion less noisy than solid metal.

According to the generally veracious *Boston Traveller* an iron eating worm, which lives on railroad rails, has been discovered in Hagen, Germany. Though less than one inch long its rate of consumption is thirty pounds of steel rails per week.

The Berlier system of metallic railway tunnel for electric cars has been examined by a commission in Paris, and approved. There are now a number of administrative formalities to go through, so that active work will, probably, not be begun until the month of May.

Baggage, Mail and Express Cars for Electric Railways.

One of the many uses to which electric railways connecting towns and villages may be put is the transporting of baggage and express matter. Cars for this purpose, vary in dimensions and designs to suit the requirements of the various roads over which they are operated. We illustrate four different types of merchandise cars which have been designed and built by the J. G. Brill Co., of Philadelphia.

Fig. 1 shows a twenty-one foot car body mounted on Brill's well known No. 13 truck. This car is running on the line of the East Liverpool & Wellsville Street Railway, at East Liverpool, O. It is sheathed on the inside of the top rail with hard wood tank and grooved boards, and provided with hinged seats against the wheels of the car so that when they are dropped they fall flush with the sides and do not occupy the space necessary for express or freight matter, and when raised the car can be utilized for carrying passengers. It has a four foot door on either side to admit all kinds of freight and express articles, and is arranged as a motor car equipped with Short motors.

Fig. 2 is an eighteen foot baggage, mail and express car; it has monitor deck roof and radiating draw bars, but is not arranged with seats inside for carrying passengers. It has the necessary large door on either side and is a trail car. This car is in operation on the Jamestown Street Railway, Jamestown, N. Y.

Fig. 3 is a sixteen foot trail car with hinged seats on the inside for passengers, the seats being precisely the same as in the first car shown. It has large doors, windows and radiating drawbars. It is operated on the West Chester Street Railway, of West Chester, Pa, and is a trail car.

Fig. 4 is a plain, flat car body with stanchions for supporting the roof and the trolley. This car was specially designed for hauling oysters in barrels. The floor is lined with zinc, crowned in the centre so that all water drains through the sides and not through the trap doors on to motor. The body is mounted on Brill's No. 13 independent rigid motor truck and equipped with Edison motors. This car is in operation on the Hampton & Old Point Railroad, of Hampton, Va.

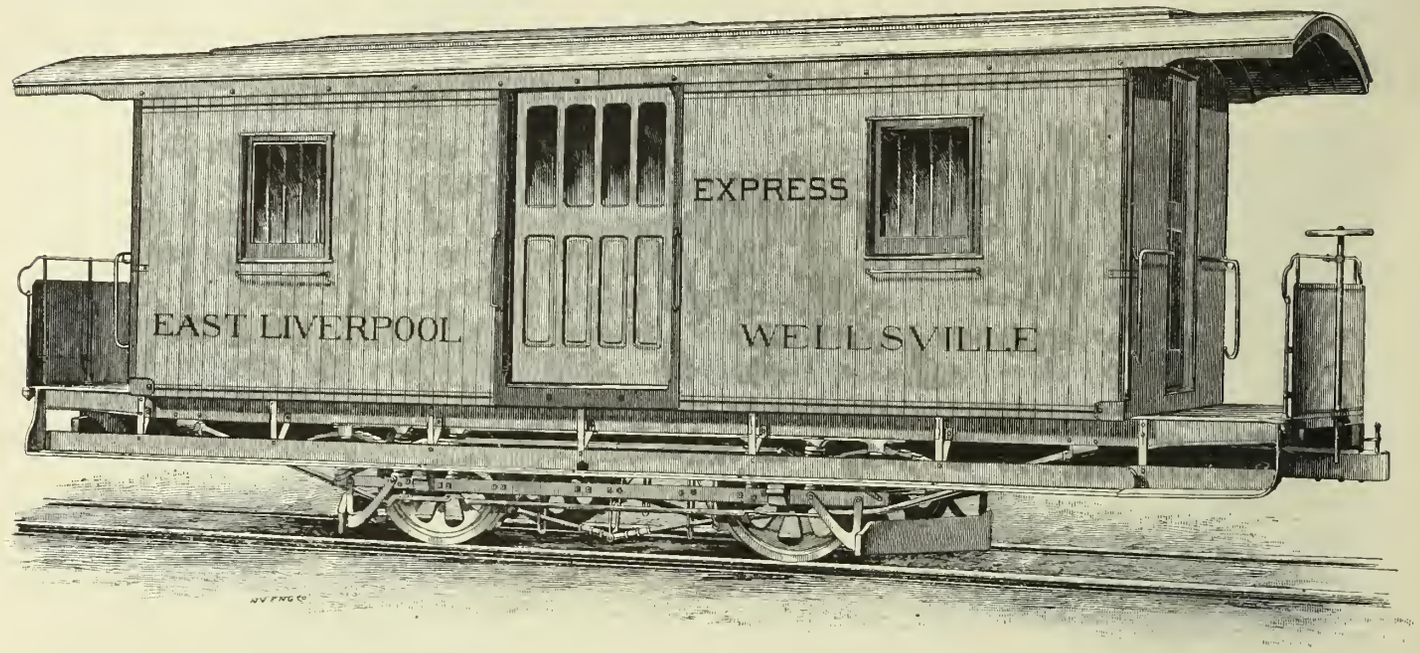


FIG. 1.—EXPRESS CAR—EAST LIVERPOOL & WELLSVILLE RAILWAY.

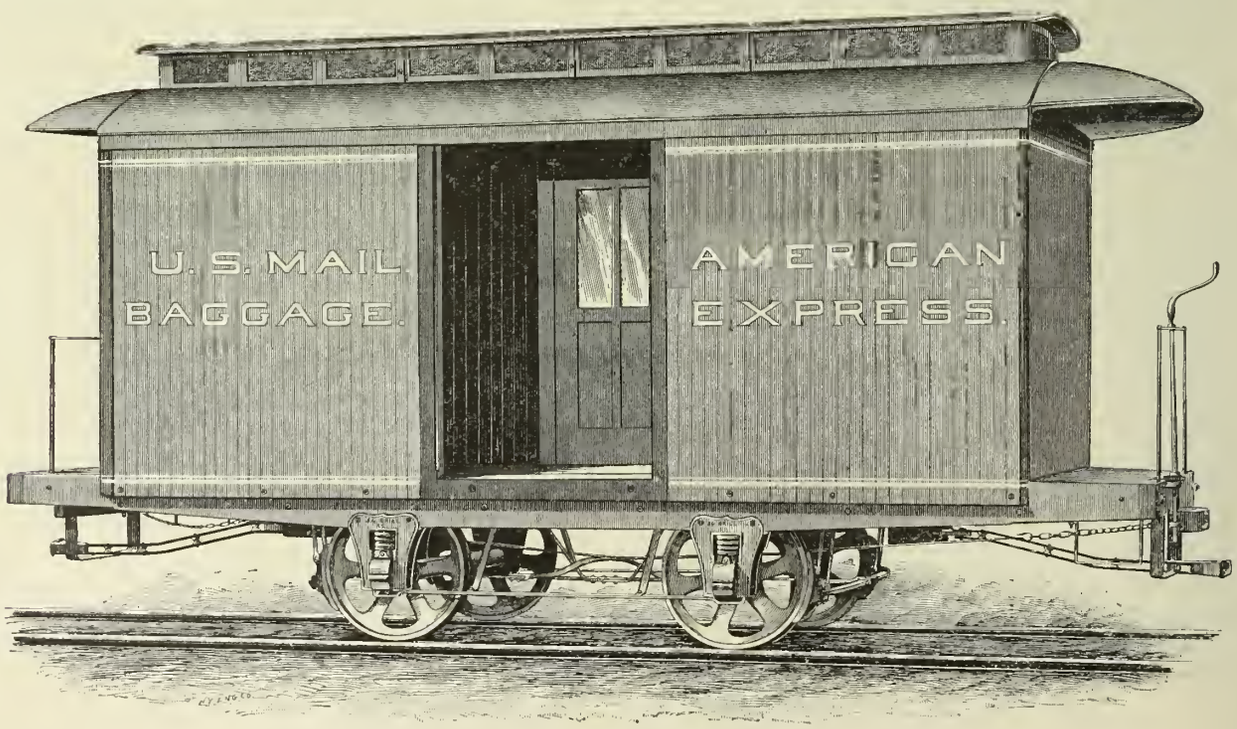


FIG. 2.—MAIL AND EXPRESS CAR—JAMESTOWN STREET RAILWAY.

Ottawa, Ont., Electric Railway.

In the last issue of the Street Railway Journal a description was given of the system employed by the Ottawa, Ont., Electric Railway in removing snow along their right of way.



FIG. 3.—EXPRESS CAR—WEST CHESTER STREET RAILWAY.

The road, which consists of eight miles of double and four miles of single track, was constructed in seven weeks, and cars were put into service in the latter part of June of last year. The excellence of this service in all kinds of weather has been favorably commented upon by the press and public. The climatic difficulties made the question of running in winter a subject of much interest. Though much snow has fallen, the cars have never lost a trip, and their warmth and comfort combined with their smooth running have made the service a luxury.

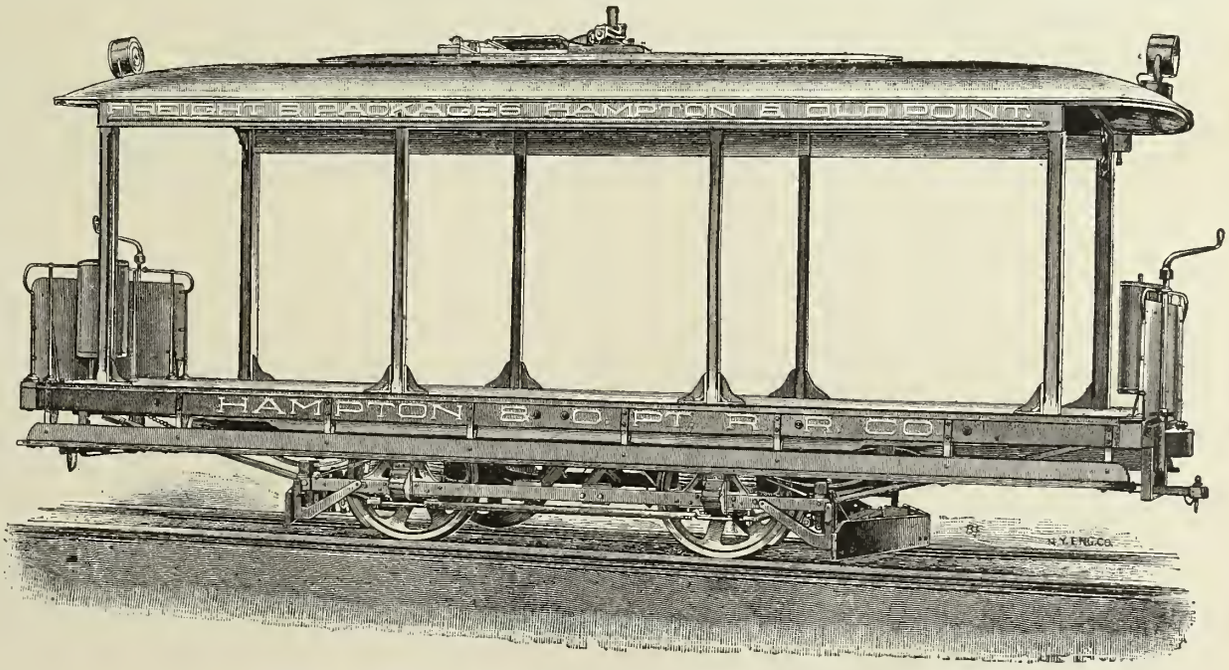


FIG. 4.—OPEN FREIGHT AND PACKAGE CAR—HAMPTON & OLD POINT RAILWAY.

The officers of the electric railway are J. W. McRae, president, G. P. Brophy, vice-president, J. D. Fraser, secretary-treasurer. The rails used are fifty-two pound Johnson girder and forty and fifty-six pound T. The gauge is standard, four feet eight and a half inches. The car bodies, which are of the ordinary and vestibuled types, were manufactured by Patterson & Corbin, of St. Catharines, Ont. Brill trucks are used. The electric system employed is that of the Westinghouse Electric & Manufacturing Co., with two single reduction motors, twenty H. P. to each car. The plant consists of sixteen cars. The dynamo room is located at the famous Chaudière Falls, where two turbine water wheels drive two 100 H. P. Westinghouse compound dynamos; a third machine is kept in reserve. The difficulty in supplying steady current by water wheels was at first a matter of serious difficulty, as, owing to the frequent stopping of all or nearly all the cars at the same instant, the water wheels were liable to race. By an ingenious mechanical device the water wheel gates are now raised and lowered instantly, and by the introduction of a novel electric device sufficient load is kept on the dynamos at all times to keep down the speed of the water wheels. This device consists of several coils of iron wire which are connected in shunt to the trolley circuit and are so arranged that any current from twelve to seventy-two amperes may be made to flow through them. The wire is kept cool by being immersed in water which is changed as it becomes warm. This useful device was designed by T. Ahearn of the firm of Ahearn & Soper, the builders of the road and its principal owners.

Several fifty H. P. motor cars have been ordered by the Mt. Adams & Eden Park electric road of Cincinnati.

The American High Speed Engine.

A new high speed engine, peculiarly adapted to direct coupling with electric railway generators, has been recently put upon the market by the American Engine Co. of Bound Brook, N. J. The purpose of the inventor, Elmer S. Smith, was to construct an engine that should gain a much higher speed than had ever been attained by high speed engines, with, at the same time, a greater economy in the use of steam, as well as less mechanical friction. To do this he avoided the ordinary paths, and set to work, as he says, to devise a machine as one would who had never seen the steam engine as heretofore constructed. The engine illustrated herewith as the result of his labors and study, is not a rotary engine, and yet the motion of its parts is such that there are no dead centres. It takes steam and exhausts four times at each revolution, and may be run up to 1,000 revolutions per minute, yet maintaining a constant speed even under varying loads.

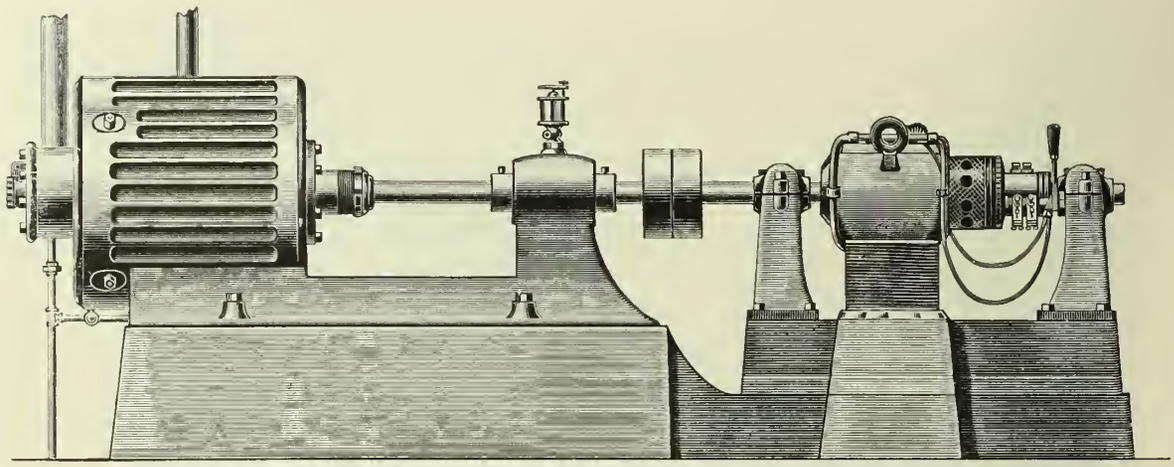


FIG. 1.—AMERICAN HIGH SPEED ENGINE, DRIVING A THOMSON-HOUSTON GENERATOR.

The general appearance of the engine connected to a dynamo is illustrated in Fig. 1. Fig. 2 shows the outer parts of the engine in transparency and the working parts in full lines. In the same engraving 1 is the bed plate; 2, cylinder; 3, cylinder head; 18, follower pin; 5 and 6, partition blades; 53, crank disk; 48, spherical bushing; 64, stuffing box; 67, pulley; A, steam chest; B, exhaust chest; C, live steam pipe; D, exhaust steam pipe.

The cylinder is bolted to the bed and projects into the steam chest, which gives it a live steam jacket, outside of which is a cast iron jacket, which prevents all radiation. The cylinder has a circular opening at its centre through which projects the stem F, located centrally on the piston, and through which steam is admitted from the steam chest (7) to back of the piston, its area being so proportioned as to balance the pressure of the steam acting on the face of the piston, thus preventing the excessive friction without detracting from the action of the steam for service on the piston. The partition blades (5 and 6 in Fig. 2) are four in number, there being two directly opposite those shown dividing the space between the piston and the cylinder head into four compartments. These blades have a pivot connection with the cylinder head, which allows them to accommodate the movements of the piston.

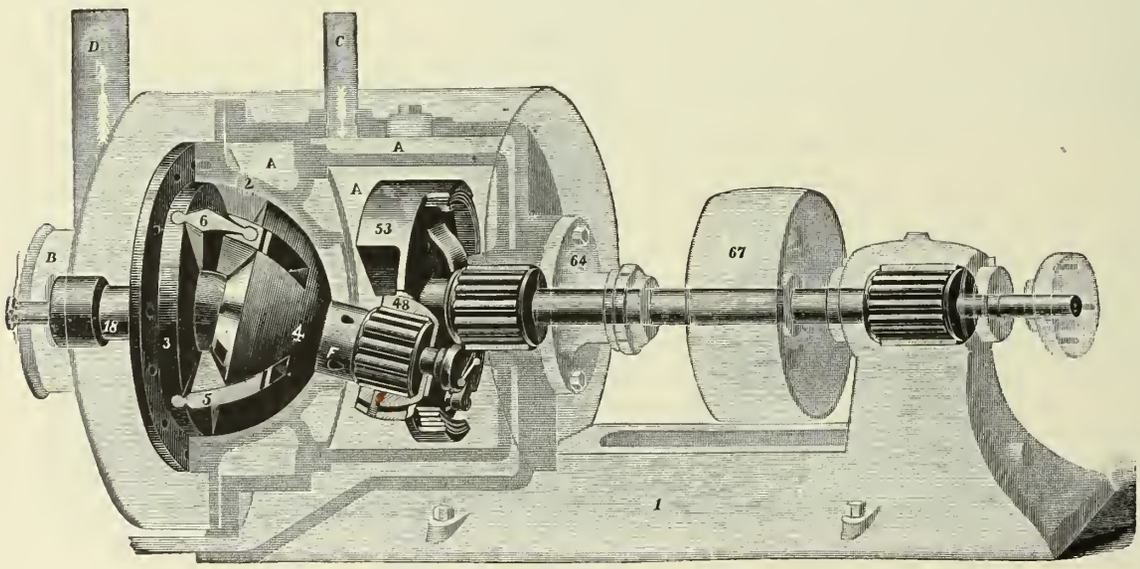


FIG. 2.—WORKING PARTS OF AMERICAN HIGH SPEED ENGINE.

The steam is fed into these compartments successively by means of a main and cut-off valve, which are all cylindrical in shape, and revolve with the crank disk or main shaft, while the piston is stationary, in so far as revolving is concerned.

In Fig. 2 a port will be observed in the compartment between blades 5 and 6; one of these exists in each compartment, and is opened for the passage of steam, and for the exhaust.

From this general description it will be seen that the piston, unlike that of any other engine, has a wobbling or gyrating movement, which imparts a rotary motion to the crank disk, and hence to the shaft, and that as there is no forward or backward movement, there can be no dead centre.

The governor, Fig. 3, is inclosed in the steam chest (A Fig. 2) and is the simplest form of an automatic governor. It consists of two weights, Q, Q^1, Fig. 3, pivoted to the rear side of the crank disk, on diametrically opposite sides of the engine shaft, and connected with the stem of the cut-off valve by steel rods q, q, and a carrier plate R. The latter is secured to the projecting end of the cut-off valve stem, and is provided with two ears r, r, each having on its inner side a spherical socket, in which the spherical head of one of the links or steel rods, q, q, is seated, the opposite spherical heads of the steel rods, or links are

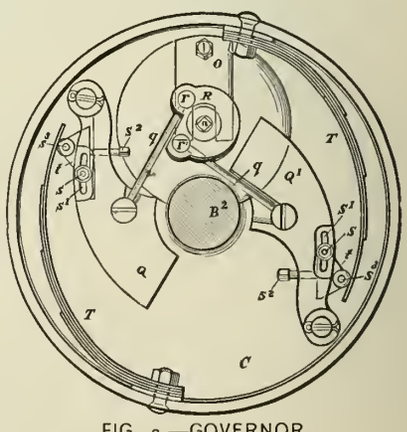


FIG. 3.—GOVERNOR.

seated in spherical sockets in the governor weights. The governor weights swing in a plane at right angles to the engine shaft, while the carrier plate R turns in an oblique plane at right angles to the cut-off valve stem.

The spherical connection of the links, or steel rods, with the governor weights and the carrier plate permits these parts to move freely, although arranged at an angle to each other.

T,T, Fig. 3, are the flat, tapering springs which resist the outward movements of the weights. These springs are secured to the peripheral rim of the crank disk, and bear with their free ends against adjustable bearing pieces or rollers, t, t, secured to the outer sides of the weights. As the governor is inside of the steam chest, the perfect lubrication of the parts is secured.

The engine is compact and self-contained, taking up little room in proportion to power developed. It will work as well vertically as horizontally, and it may be hung overhead if desired, so as to be coupled directly to the main shaft. For marine use, elevators, etc., it is provided with reversing gear, and where a high degree of economy is desired, it is compounded.

A Novel Boiler.

A new type of boiler, devised especially for use with locomotives, but recommended by its manufacturers for the generation of steam for all power purposes, is shown in section and elevation, in Figs. 1 and 2. As will be clear, it is similar to the ordinary tubular locomotive boiler, but is provided with two fire boxes. One of these is at each end of the boiler; and connects with a flue at the opposite end to which it is situated.

The length of the tubes can be made to suit the location and the fuel to be used. If bituminous coal of good quality is to be the fuel, the tubes can be from twelve to twenty feet long, but a length of sixteen feet would probably give the best results.

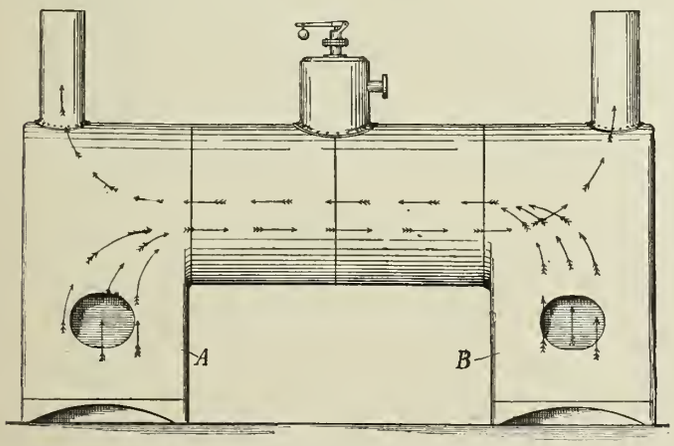


FIG. 1.—DOUBLE TUBULAR BOILER.

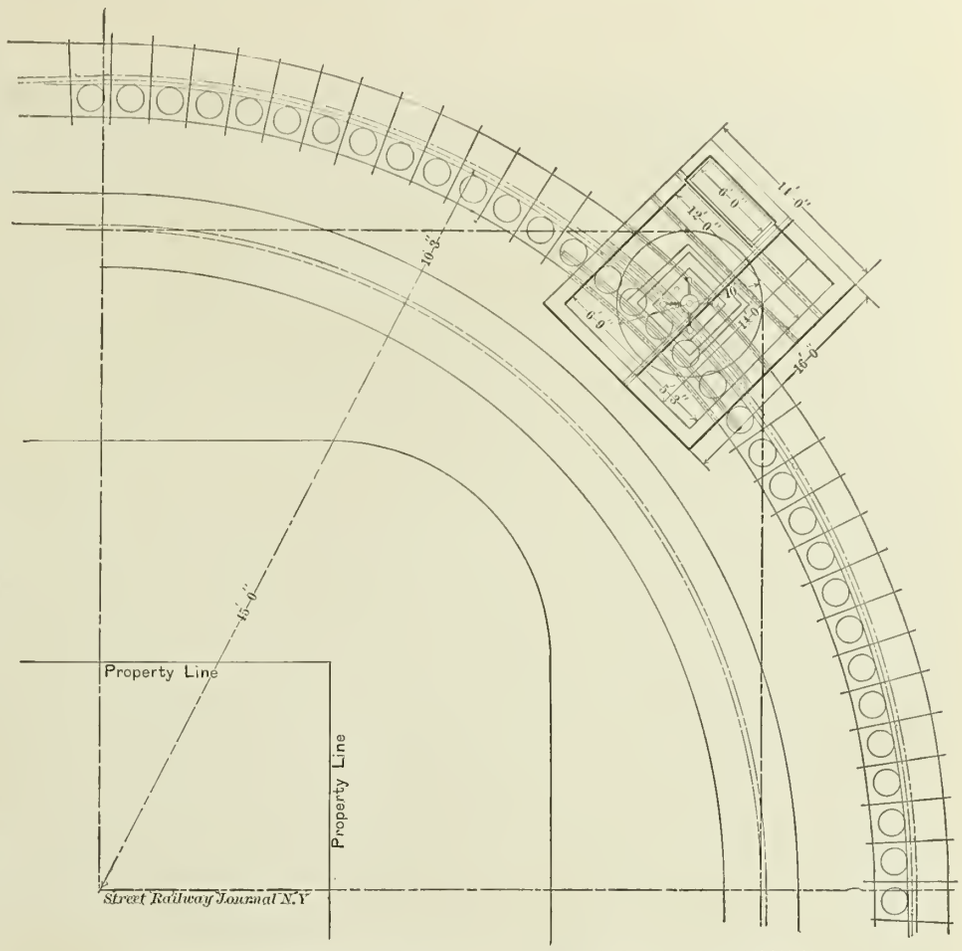
This arrangement not only reduces the strains on the boiler by equalizing the total amount of heat applied at any section, but gives a gain of heating surface in the same space, permitting the use of smaller boilers.

Another advantage claimed is that smaller fires can be better handled, and give better results than large fires, and that this form of boiler gives a fire box of only one-half the size required in the ordinary locomotive type.

Further particulars may be obtained of the inventor, H. C. Goulding, 16 Larned Building, Syracuse, N. Y.

Cable Curve Construction.

An interesting example of curve construction for cable railways in which two methods of construction are combined, is shown in the accompanying diagram. The engraving is from the engineer's plans for the corner of Union and Baker Streets, on the line of the Presidio & Ferries Railway of San Francisco. The line is laid with double track, and the outside conduit is equipped with a number of horizontal sheaves twenty-two inches in diameter, the distance between centres being from twenty-seven and a half inches to three feet and more. The cable for the inside track is carried around a large horizontal sheave ten feet in diameter, the cable running in a blind conduit under the outside track, the pit being 16 × 14 ft.



CURVE CONSTRUCTION—PRESIDIO & FERRIES CABLE RAILWAY.

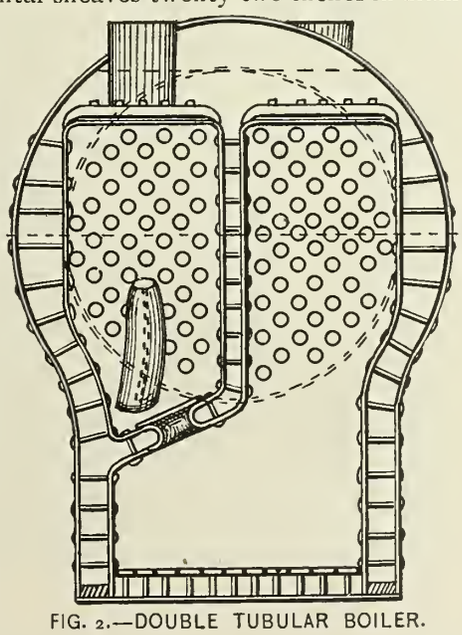


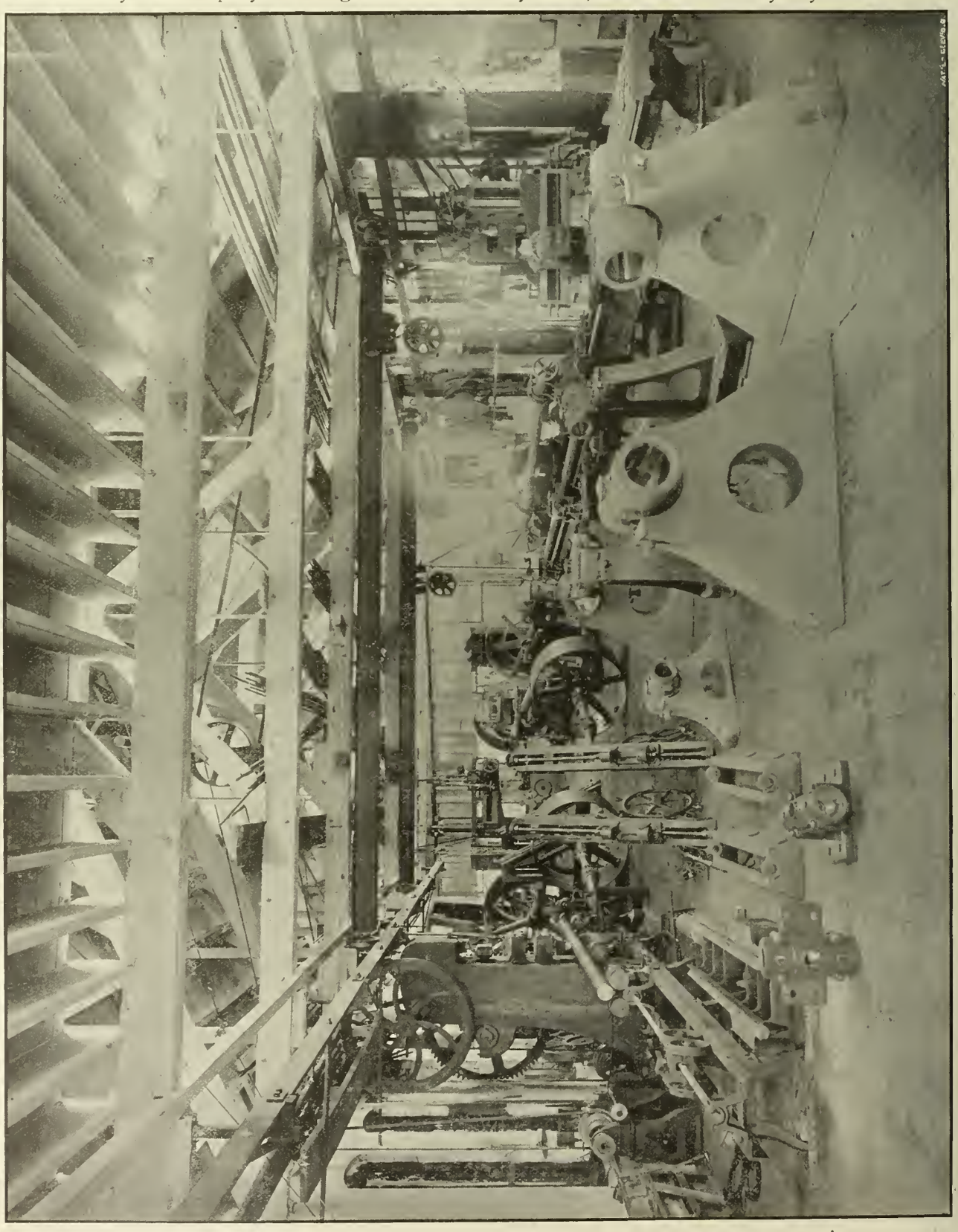
FIG. 2.—DOUBLE TUBULAR BOILER.

The cars on the inside track descend a grade while passing this corner, drop the cable upon entering the curve and pick up the cable upon leaving the curve.

The Duluth (Minn.) Street Railway Co. have amended their articles of incorporation to include the suburbs of Lakeside, West Duluth, Lester Park and New Duluth, in their field of operation.

An Inside Glimpse of the Hill Clutch Works.

In the accompanying two engravings are given views of the interior of two departments of the Hill Clutch Works, and from these a fair idea of the extensive business carried on by this company can be gained. A full idea can only be acquired by an actual visit to the shops themselves, and an inspection of the variety of work carried on.



SHAFTING AND ERECTING DEPARTMENT.—HILL CLUTCH WORKS, CLEVELAND, OHIO.

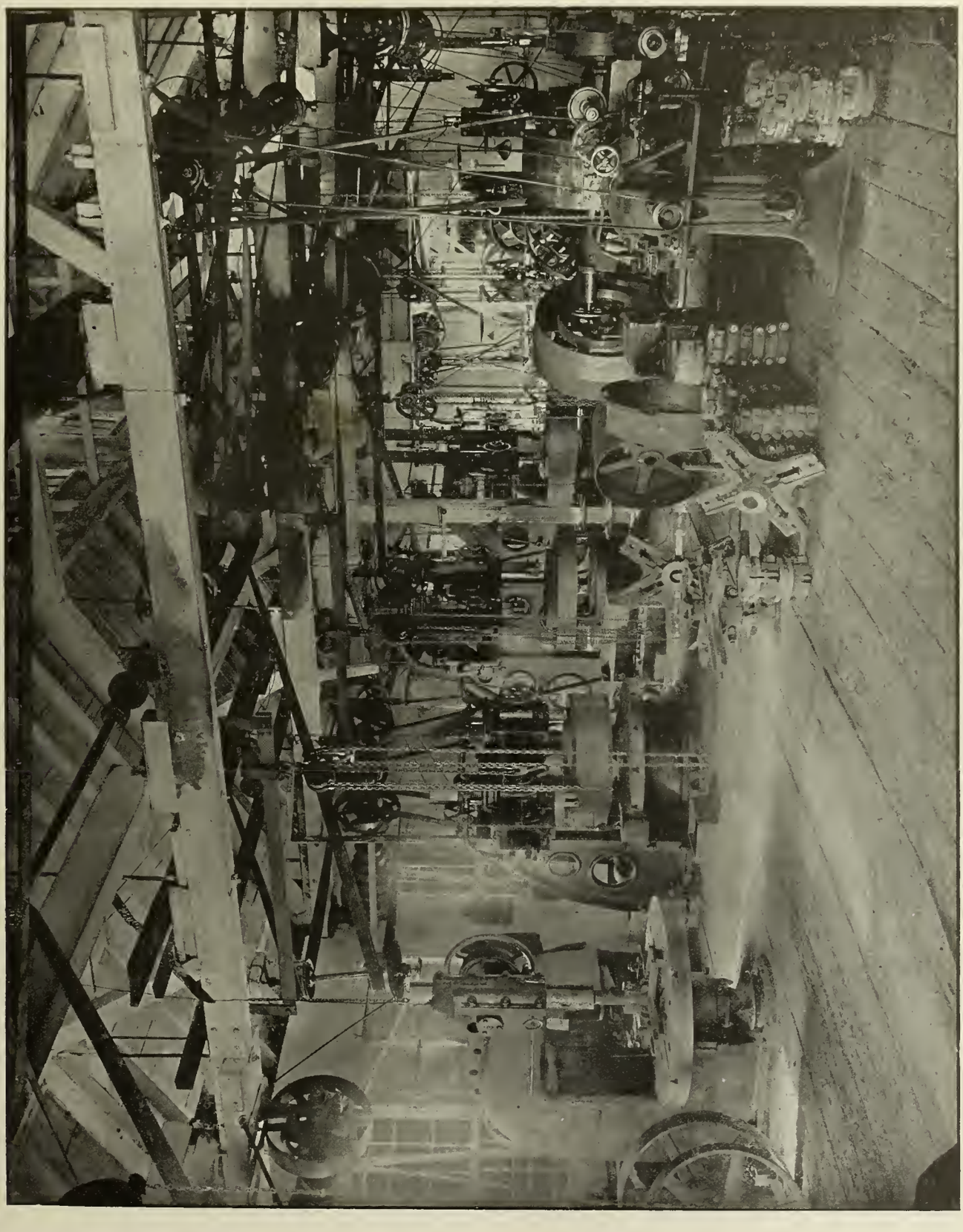
Fig. 1 shows the shafting and erecting room. In this department the shafting is received from the forges and mills in the rough state. It is first placed in the large machine shown on the left, where it is carefully straightened. This machine will straighten a shaft ten inches in diameter. From this machine, it is taken to the lathe, which is located in the right and rear part of the room. Here it is turned perfectly round and polished. This lathe will turn easily a piece of shaft thirty-three feet long and twelve inches in diameter. It is then taken to the key seater, where the necessary key seats are cut. This machine is located in the rear and centre of the room. It is then put back in the straightener and carefully tested, and if found to have been sprung in handling, is made straight once more. This prevents the sending of the shafting away in an imperfect condition.

There is also in this department a large open side planer, used for planing clutches, floor stands, or any other large pieces of machinery, and in the rear part of

the room is a very large radial drill. This room is also made the place where all work is erected and run. By this method of testing, any small mistakes are readily discovered and corrected. The clutches and pulleys are placed on the shaft, and it is then put in its bearings, which are placed as they will be when the machinery is erected in the plant where it is going, thus saving the purchaser a great amount of annoyance and expense.

Fig. 2 shows part of the machine shops. In this department are located the lathes, planers, mills, boring machines, key seat cutters and drills used in finishing the clutches, pulleys, bearings, floor stands, etc. In the back part of this room is a specially designed tool for turning off the wooden shoes used in the jaws of the clutches. When these wood blocks leave this machine they are absolutely correct, insuring a much better contact with the clutch ring, and consequently, less wear on the blocks.

The shops and offices are lighted throughout by electricity.

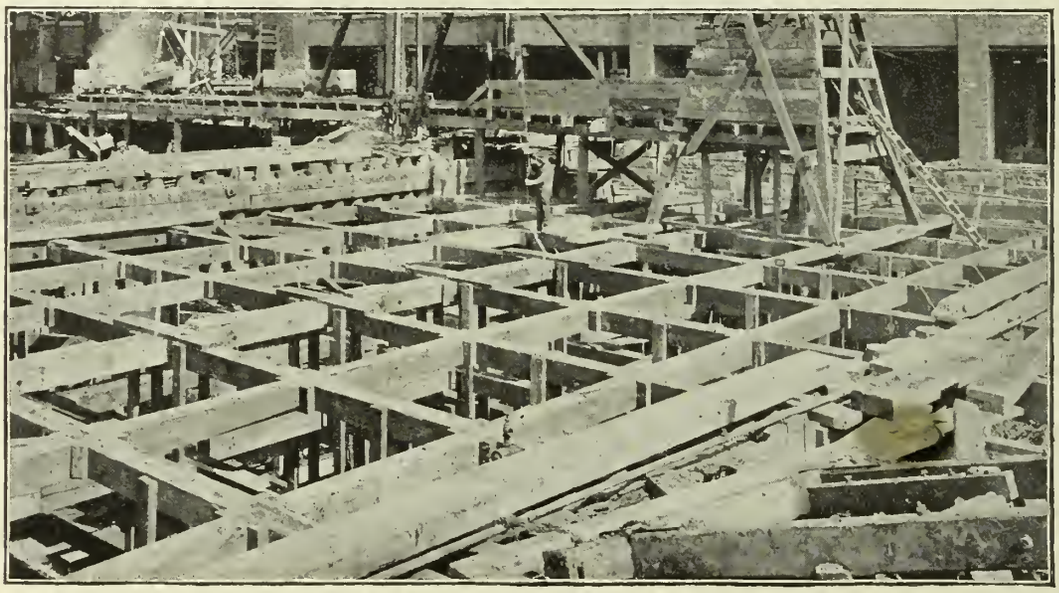


PART OF MACHINE SHOP.—HILL CLUTCH WORKS, CLEVELAND, OHIO.

A DECISION in favor of Mr. John N. Stewart was recently given in his plea for an injunction against the city of Ashtabula, O. The decision was given by the full Circuit Court bench, Judges Woodbury, Laubie and Fraser. The city of Ashtabula, some two years or so ago, tore up his track at night, and declared his franchise forfeited, and Mr. Stewart has been suing for redress, which has been finally granted.

West Chicago Street Railway Tunnel.

Perhaps the most important engineering work now in progress in Chicago is the tunnel, which the West Chicago Street Railroad Co. are building under the Chicago river. When completed, the tunnel will be used by all the cars of the company operating on lines lying south of Madison Street. The excavation is being made entirely in private property, 150 ft. north of Van Buren Street, and extends from the west side of Franklin Street on the east side of the river to the east line of Clinton Street, on the west side, a distance of 1,540 ft., and passes under several large buildings and the tracks of several railroads.



COFFER DAM FOR WEST CHICAGO STREET RAILWAY TUNNEL.

Five hundred and twenty feet have been excavated, and work is now in progress in the river section. The illustration shows the coffer dam which has been built for the purpose of prosecuting the work. At this point the Chicago River is 184 ft. wide from dock line to dock line, and it was necessary to leave a channel of sixty-three feet so that navigation would not be obstructed.

In the space covered by the coffer dam, shown in the engraving, 107 ft. of the arched structure is to be built. Under that portion of the river now used as the channel, the tunnel has already been completed. In the construction of this approach it is necessary to excavate to a point twenty-eight feet below the bed of the river. The earth is removed in cars to an elevator leading to a small tramway track shown at the left of the illustration. The load is then dumped into the river, where a dredger is constantly at work. The delays which attended unloading the cars into the scows demonstrated that it was cheaper to handle the excavated earth twice by dumping it into the river and removing it when convenient by dredgers.

The original plan provided for underpinning buildings under which the tunnel was to be located, and carrying the foundations below the excavation. It was left, however, to the option of the contractor to follow this plan or to take down the structures, and restore them. He decided upon the latter course. The building, which is shown directly back of the coffer dam, has just been restored over the completed tunnel. The structure is 82 ft. in width, 100 ft. deep and 7 stories in height. Two buildings are still to be taken down and restored, the one five stories and basement on the east side of the river, and the other six stories and basement on the west side.

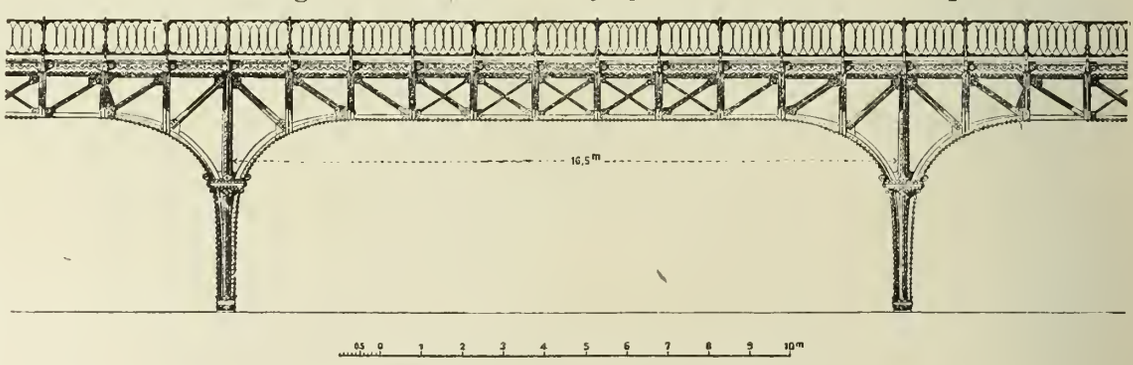
The length of the tunnel proper—that is from portal to portal, and excluding the approaches—is 920 ft. The gradients vary from 5.46 per cent. to 10 per cent. The masonry is of brick in seven rings aggregating thirty-two inches in thickness. Under the railroad tracks for a distance of 200 ft., the masonry is made somewhat stronger. The bricks are laid longitudinally with the tunnel with edges toward the centre and with toothing joints. The work has been carefully watched to see that all joints are perfectly filled by pressing the bricks into the mortar. Joints between courses do not exceed half an inch in thickness, and between the rings are not less than half an inch. The bricks used are hand made and hand burned and are of standard dimensions.

The river section of the tunnel covered by the coffer dam shown in the illustration will be completed June 1. How soon the entire work which was begun in February, 1890, will be finished cannot be estimated, as injunctions prevent the contractors from prosecuting the work at several points.

The cost of the structure, which includes merely the construction work, and excludes the purchase of rights of way and buildings, will be $1,000,000. The tunnel was planned by S. G. Artingstall, and the resident engineer is C. V. Weston. The contractors are Joseph Downey and Charles Fitzsimons.

An Elevated Railway Project in Berlin.

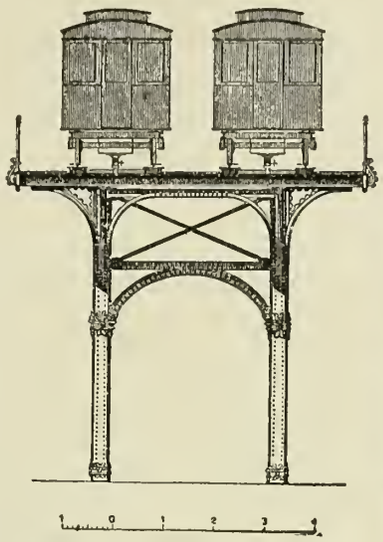
Nearly simultaneously with the proposal of the General Electric Co. of Berlin to construct an electric underground road in that city, as noted in our March issue, comes the proposition of the well known firm of Siemens & Halske to cover the whole of Berlin and its adjacent suburbs with a net work of surface, elevated and underground railways. The chief engineer of this company, Herr Schwieger, has prepared an elaborate set of plans, from which it appears that the aim of the designer was to connect the important centres in the district rather than to follow along the leading lines of traffic as they exist now. Electric power will be used. The minimum radius has been fixed at 327 ft. and the maximum grade at one in forty. The maximum wheel load is assumed to be 1.65



PROPOSED ELEVATED ELECTRIC RAILWAY IN BERLIN.

tons, but 3.3 tons has been taken as the basis of computation for the elevated structures. The standard gauge is adopted, and as the cars have two four wheel trucks like those in use on many lines in this country, it is believed that there will be little trouble in moving around the sharpest curves. Each truck carries a motor, and all the the wheels are to be fitted with electric brakes.

The elevated structure is designed for a double track line. The trusses, of which but two are employed, are eleven and a half feet apart, and supported every fifty-four feet by columns, their combined weight being estimated at 0.4 of a ton per foot.



SECTION OF PROPOSED ELEVATED ELECTRIC RAILWAY—BERLIN.

A Hand Hack Saw.

A hand hack saw, which is capable of cutting a half-inch bar of steel, is always convenient and often a necessary part of the equipment of every street railway. The convenience of having one at hand often repays its cost ten times over. A most convenient saw of this kind is shown in the accompanying cut, and is manufactured by the Millers Falls Co., 93 Reade St., New York. Many thousands of these are in use in all parts of the world, and they will do much of the work of files in one-tenth of the time and at one-tenth of the cost. One saw blade will cut a half-inch bar of steel 250 times, and can readily be replaced when worn out or broken.



Quincy in a Snow Storm.

A heavy snow storm commenced in Quincy, Mass., on the afternoon of March 1 and continued until the morning of March 4. During this time the snow fell in abundance and drifted badly.

It was with hard labor that the West Quincy line was kept open during the storm; but by running the cars night and day, and with the help of a large snow plow drawn by eight horses, it was done.



FIG. 1.—SNOW SCENE IN QUINCY.

On March 2 and 3 neither teams nor cars were able to go through Washington Street on which the Quincy Point line lies. Some of the drifts were thirteen and fifteen feet high. On the fourth, however, the men began to clear the tracks in the morning, and at two o'clock the cars were running in as quick time as ever. In riding through these drifts, nothing but snow could be seen on either side of the car. In the afternoon of the same day about 175 men set to work to open the Neponset line and at eight o'clock that night it was cleared. This line lies on a barren piece of land which is exposed to the wind in every direction, and for half a mile at a stretch there were drifts all along the tracks from six to seven feet high. We are indebted to Mr. Benj. J. Weeks, superintendent of the Quincy & Boston Street Railway Co., for the accompanying views, which show the difficulties with which the company had to contend.



FIG. 2.—SNOW SCENE IN QUINCY.

Atlantic Avenue Electric Contract.

The Atlantic Avenue Railway Co. of Brooklyn, N. Y., have given their order for electric motors to the Westinghouse Electric & Manufacturing Co. The contract is for 100 car equipments or 200 motors of thirty H. P. and four generators of from 250 to 780 H. P., making in all 2,000 H. P. One hundred motors, it is said, will be delivered in June and the remainder in December. The track material will be furnished by several manufacturing firms. The cars are to be ready by July, and the entire plant will be complete before December.

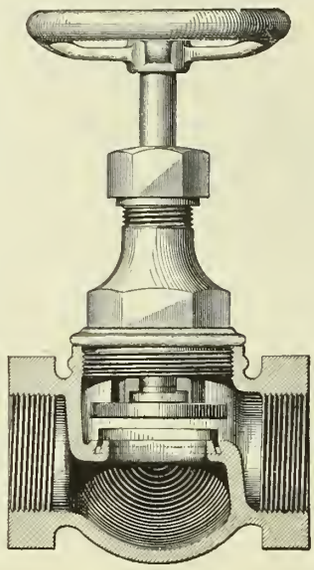


FIG. 3.—SNOW SCENE IN QUINCY.

The Roy Valve.

In the accompanying illustration is shown the Roy valve, which has been designed to avoid many of the troubles often met by steam engineers with this part of their steam equipment.

It contains a method of making a joint that is a radical departure from the usual manner of joint making in a valve body, and assures a tight joint under all conditions. It also provides a seat that will not be injured by the ordinary force of a wrench applied to the valve handle, and which will afterwards be efficient when operated in the usual manner.



ROY VALVE.

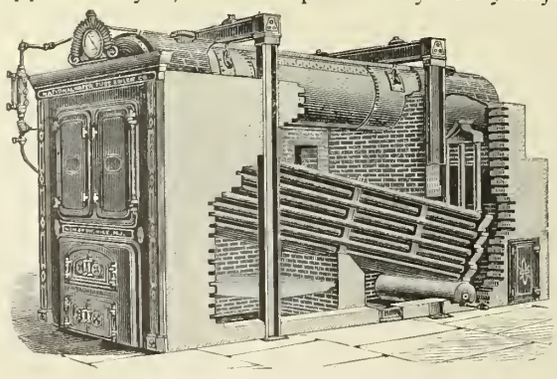
This result is attained by the use of a jointless ring of expansive material inserted in the body, and which is as simple in application as a washer. Any kind of malleable material is used, such as copper for steam, iron for ammonia, and lead alloys of different kinds for water. The ring rests on a conical base, and its action, to compensate for distortion of the joint, is as follows: A ring resting on a conical base will make contact on its entire inner edge, if both ring and base are true. If the base be distorted, the ring will touch on two or more spots, depending on the degree and nature of the distortion. When a pressure is put on the upper edge of the ring by means of a flat disk, the ring is forced outward by the prominent points on the conical base, and drawn inward to fill the depressions. The plane of the top surface of the ring remains undisturbed, but free to move laterally on the face of the disk, and an extraordinary degree of distortion is thereby provided for. The accompanying illustration shows the general arrangement.

These valves are manufactured by the Roy Valve Co., 15 Cortlandt Street, New York.

The National Water Tube Boiler.

This type of boiler has been adopted in a number of electric lighting and power stations, where it has gained a reputation for simplicity of construction, accessibility for internal and external cleaning, durability, and other points important in a generator of steam.

As will be seen from the accompanying engraving, the steam and water drum, while resting on the brick work is not supported by it, but is suspended by heavy adjusting bolts and links from iron beams, which are supported upon four iron columns, placed on suitable foundations. By this system of hanging boilers from overhead beams by means of links and bolts, the entire boiler is free to expand and contract without putting any strain whatever on the brick walls, and, if necessary, it could be removed without disturbing them.



NATIONAL WATER TUBE BOILER.

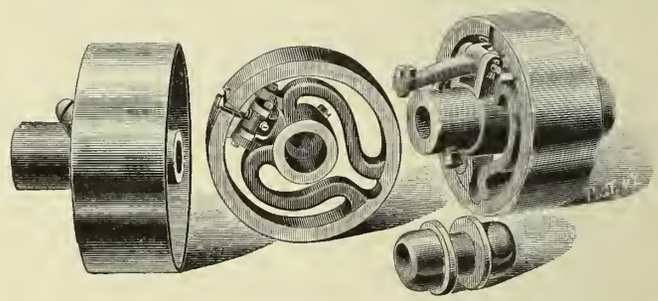
The water tube part of the boiler is composed of a number of sections made up of the best grade, lap welded, wrought iron tubes, expanded into headers by the usual method of expanding tubes. By this means the water contained in the boiler is subdivided into small quantities, and destructive explosions are thereby avoided, as any possible rupture would be but the giving way of a single tube, which, in many cases is less in diameter than that of the safety valve of the boiler. This, in such event, would act as a safety valve to the whole boiler and gradually empty it of its contents.

To facilitate the cleansing of the boiler these headers have suitable openings opposite the ends of the tubes, exposing to view the interior of the tubes. Any or all of the tubes in the section may be removed, if desired, through these openings, without disturbing the header, and new ones replaced in the same manner. If it should ever become necessary, any header may be removed without disturbing the others or removing any part of the walls of the boiler.

For further particulars the National Water Tube Boiler Co. of New Brunswick, N. J., should be addressed.

Friction Clutch for Screw Machines and Lathes.

The accompanying illustration represents a new and improved friction clutch, which has been designed by the Garvin Machine Co. of New York, especially to meet the requirements of their screw machine and turret lathe work. By reference to the cut, it will be seen that the friction proper consists of a spring ring, which is caused to expand by the drawing in of a taper bolt; this bolt being operated by the usual finger and sliding cone. It will also be seen that the friction ring has no direct connection with the hub, being connected thereto by two curved arms, which extend as far as possible to the opposite of the hub. This feature greatly increases the elasticity of the ring, and allows it to fill in all directions, giving a perfect bearing. Double provision is made for taking up all the wear by means of the usual adjusting screw, with set nut on the outer end of the finger, and also by screwing the taper bolt into the nut, which is pivoted to the inner end of the finger. This allows of a readjustment, should the clutch wear sufficiently to use the full length of the outer screw, by screwing down the taper bolt, and returning the outer screw to its original position.



GARVIN CLUTCH FOR LATHES.

The pulleys are made with long and ample bearings; the inner hub extending inside the friction beyond the face of the pulley, and is provided with an efficient, self oiling device.

These clutches have withstood the most severe usage, and have proved especially serviceable under high speeds and heavy loads, giving a quick and positive reversal, with a smooth and easy motion, which latter feature is most important in countershafts, which are constantly reversed.

The board of directors of the Third Avenue (New York) Cable Railway, at a meeting held March 15, decided to close a contract with Mr. Thomas E. Crimmins to complete the work of road construction for that railway. Under the terms of the new contract this part of the work is to be completed by September 1, 1892. The contractor who had charge was Wm. Wharton, Jr., & Co., of Philadelphia.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Lang Lay Cable in Chicago.

Chicago, January 22, 1892.

Editors Street Railway Journal:—

We recently purchased a Cradock Lang lay rope, which was in service some five weeks, when, on account of an unavoidable accident, it was cut in two and so badly kinked for 300 or 400 ft., that the piece had to be cut out, and, consequently, the rope was made too short for our main line. Having no rope of the same lay, we were compelled to remove it, and some time in the future it will be placed in what is known as our South Clark Line, being the proper length tor that place. Everything indicated that the wires were of much better quality than any rope we have had heretofore. J. M. Roach,

Second Vice-President and Superintendent North Chicago Street Railroad Co.

Track Brakes.

Los Angeles, Cal., March 10, 1892.

Editors Street Railway Journal:—

The article in your February number on the subject of track brakes, over the signature of Mr. Pfingst, master mechanic of the West End Street Railway, is from such high authority that it is with extreme diffidence I venture to take issue with him as to the value of track brakes. The article very frankly admits his lack of actual experience in the use of this device, and then proceeds to condemn it. One would hardly have expected such sweeping generalization from the results of so few experiments. Mr. Pfingst apparently views the track brake as an emergency brake, or one to be used when the wheel brakes refuse to work; this is not the view ordinarily taken by those who use track brakes. If I may be permitted to refer to the considerable experience of Pacific Coast roads, I venture the assertion that not one would attempt to operate with one or a dozen wheel brakes and no track brakes. Suppose the wheel brakes are set so tight that the wheels are locked and skidding, the track slippery and the train going with increasing velocity down a 10 or 15 per cent. grade, extra wheel brakes will do no good; but a track brake will stop a train under such circumstances with ease and quickness, and this has been proven in our practice not once, but many times.

Our method is to use the wheel and track brakes together. That is, to stop the car we first apply the wheel brakes and follow this with the track brake; by this means we keep the brakes in working order. We find no difficulty whatever in passing guard rails and switches, as is found by Mr. Pfingst.

I would call attention to the fact that the impetus due to the revolving armature after shutting off the current renders the track brake in electric work still more necessary, and also that the weight of the motor, instead of being deducted from the effective might against which a track brake works, should be added, as the motor is supported at one end on the channel bars extending from side to side of the truck frame. Several years' daily observation of the results of using track brakes has convinced me of the utility of the device and of its economy in many ways, not the least of which is the saving of flat wheels, as Mr. Pfingst very justly points out. As a safeguard I maintain that there is nothing that will take its place; and I believe that any manager who once uses a well designed track brake will not willingly abandon it.

One great element of value in the use of track brakes is the fact that full control of the train is had at all times. With both sets of brakes a train need never be out of the control of the men in charge, and there need be no undue strain put upon either set of brakes. Working one as an auxiliary to the other will prolong the life of car wheels, brake mechanism and rolling stock generally.

Fred. W Wood.

Manager Temple Street Cable Railway.

Return Circuit for Electric Railways.

Lynn, Mass., March 7, 1892.

Editors Street Railway Journal:—

There is some discussion at the present time in the electrical papers, in reference to the advantage of maintaining a good electrical contact between the wheels and rails in electric street railways, in which the rails are used as part of the circuit.

In the early days of the electric railways, the writer saw the difficulty—but necessity—of maintaining a good, uninterrupted contact, and conceived the idea of applying water for the purpose. Later, he applied for a patent, and in June, 1889, was granted a broad patent for an electric railway sprinkler, patent No. 404,559. There are several advantages to be derived from the use of water in this connection, some of which may not have been brought to the attention of street railway men generally. The large saving of power is, of course, one of the chief advantages. Mr. L. E. Marple, of Nashville, Tenn., has stated that on the electric railway in that city he has actually observed in practice a saving of 33⅓ per cent. on a rainy day as compared with a dry, pleasant day. Even this would not represent the actual saving of a wet rail over a dry rail, for the reason that the line leakage is considerably greater during wet weather. A much greater tractive force in generating plant is provided for in electric street railway practice than is provided for in steam railways, for the same number of tons hauled under the same conditions of grade and curvature, the difference exceeding two to one. That this difference is large and ought to be reduced is obvious. The more modern electric street railways provide good rails and a well graded roadbed, so that the excess of power required must be largely due to the bad electrical and mechanical contact between the wheels and the rails. The C^2R loss would seem to be high. It would be a rather difficult matter to determine just what is the average resistance between the wheels and the rails, but, as indicated by the flashing, it is considerable. If, for illustration, we take it as one ohm—and in some cases it would be much higher—it would indicate a loss of 3.3 H. P. when the car is taking fifty amperes Even with comparatively clean rails, the increased resistance caused by dust on the rails is considerable.

In all electric switches, which are not even exposed to much dust, it is deemed necessary to have rubbing contacts to insure perfect electrical connection. By wetting the contact, the same purpose would be served. Wetting the rails softens the dirt on the track and the wheels, in place of being lifted in rolling over it, squeeze it to one side; water acting as a lubricant, excessive flange friction is avoided. The same causes also operate to make the car run much smoother and with less noise. Disagreeable flashing at the wheel is entirely done away with. At one time, the writer remembers seeing an electric car in the evening when there was so much dirt on the track that the flashing was blinding. A sudden shower came up and instantly all flashing ceased. Flashing indicates a varying resistance and, consequently, an unsteady current in the motor. It is a well known fact that sudden variations in the current are bad for the insulation on the motor, and tend to break it down. The motor instead of being propelled by a steady flow of current is jerked along, as it were, by a succession of more or less varying currents. Then, again, flashing is bad for both the wheels and the rails. The intense heat of the arc softens and blisters the iron and a succession of a great many flashes must materially increase the wear on the wheels and to a much less extent, of course—on account of the greater surface—the wear on the rails. If one will examine the wheels of a motor car after it has been run some time, the blisters caused by flashing will, I think, be distinctly noticeable. In connection with wetting the rails, the surrounding roadway can be sprinkled, thus laying the dust and preventing it from blowing on to the rails. In this way also

travel is made much pleasanter and the dust is prevented from getting into the motor and axle bearings.

Other advantages in the way of overcoming defective bond wires and an improved ground return have been mentioned by Mr. Wheeler, in an article in the January Street Railway Journal, and need not be enlarged on in this communication. E. D. Priest.

Public and State Treatment of Corporations.

New York, March 3, 1892.

Editors Street Railway Journal:—

Your correspondent, Mr. J. B., in the last issue of the Street Railway Journal, says so many pleasant and complimentary things of my paper on the above topic, that it seems almost ungracious in me to insist that I have the facts with me in the only issue he makes with any of my statements.

Mr. J. B. claims in substance, as I understand him, that private persons and corporations in the state of New York would be taxed equally if all the personal estate of individuals was assessed and taxed as it should be, without any evasion under the statutes. I claim, on the other hand, that the statutes themselves are tyrannical, cruel and unjust to corporations and the owners of corporate property.

Let us take the case of a street railroad for the purpose of making clear this point. If the nominal capital stock of such a supposed corporation is $1,000,000 and this stock sells at par in the market, it is quite evident that the owners of this stock, and all the world as well, are united in their judgment that all the property of the company whatsoever, real and personal, including its franchise, good will and prospects, is worth just $1,000,000 over and above all its debts and liabilities. This $1,000,000, then, is exactly the cash value of everything it owns on earth of every name and nature. Now for the just and equal assessment and taxation: First of all, the assessors have always, heretofore, assessed the company for the purpose of personal taxation alone to the full amount of the market value of the stock, fixing this value at the price the stock sells for in the open market. In this case, of course, it would be exactly $1,000,000. This, then (less the actual market value of the real estate deducted), should end all assessments against the company for any and all taxation whatever if the corporation is to be treated not as individuals are who evade the law, but as individuals should be treated under the statute. Even then it would be grossly unjust to corporate property, for this valuation includes not only all real and personal estate and franchises of the company but its prospects, good will and also the integrity, ability and efficiency of management which, although incorporeal and not properly taxable at all, make up no inconsiderable part of the value of the stock of the corporation. It is true that from this valuation is deducted the assessed valuation of real estate, or say, 75 per cent. of its market value; and so the other 25 per cent. which enters into and gives value to the capital stock, is taxed as personal estate. Not only that, but it is taxed over and over again every year, as will be shown. But the real estate is, as stated, assessed and taxed by itself. The tracks are again assessed and taxed by themselves, although wholly included in the stock assessment.

The capital stock even, including as it must and always does the full value of the real and personal estate, is again assessed and taxed on the basis of the dividend it pays. Again, a heavy state tax is levied, based on gross earnings. The company is still taxed again for the expenses of the railroad commissioners covering all the cost of this department; and, lastly, the cars in many cases are arbitrarily taxed $50 each, as a so-called license fee, and all these taxes are levied and paid annually. No deduction from any of these taxes is allowed on account of indebtedness, either bonded or floating, as Mr. J. B. supposes. He speaks of "swearing off" taxes. They may be sworn at, but not "sworn off;" for no deductions are allowable under the statute, except stock in other companies, which a street railroad company is not likely to have, or property in another state, which it is not permitted to own. Who shall say then—and upon what grounds—that individual property and the corporate property of street railroads are dealt with equitably and alike in the matter of assessment and taxation in the State of New York?

It may be claimed as a last subterfuge that these assessments and taxes so levied on such corporate property are not legal. But they have been tested in the courts and declared legal in all important and oppressive particulars.

An exact inventory of all the personal estate, to the minutest item, of a New York company was made a few years since, duly verified and each article carefully valued at its original cost, and was presented to the Tax Commissioners for assessment as and for the personal estate of the company owning the same. There was no dispute as to any matter of value or of fact, and no question on this score was raised, but the commissioners assessed the personal estate at more than a $1,000,000 above the actual value of the personal estate so verified and presented to them in this case. The matter was then taken to the Supreme Court, and the commissioners' assessment was, upon full agreement, sustained by the court as in accordance with the statutes governing the taxation of corporate property. It is true that after years of labor, argument and protest the Court of Appeals has at last made one decision which promises some relief from this gross injustice, but no court had done so when I began the agitation of this subject, nor indeed until the last year. It gave me great pleasure to read the article of Mr. J. B. on this subject, and I thank him for all his kind and courteous remarks upon my efforts to elucidate this matter, but the truth, sad and discouraging as it is, must be reiterated until it is understood and appreciated, that tyranny consists in permitting one class of persons to become parasites upon another class by an unequal distribution of burdens, and that other humiliating truth that the great and otherwise glorious State of New York has few equals in her rapid march toward this unjust and wicked consummation. G. Hilton Scribner.

St. Louis Notes.

The earnings per day, for 1891, of the street railways of St. Louis, are herewith presented. They are most satisfactory, as the total per day of all lines shows an increase of 19 per cent. over the total for 1890.

	1891	1890	Increase or Decrease.
St. Louis & Suburban	551	594	—43
Bellefontaine	421	324	97
Union Depot	1,160	921	239
Cass Avenue	452	471	—19
Citizens'	1,213	1,168	45
Fourth Street & Arsenal	69	151	—82
Jefferson Avenue	251	233	18
Lindell	1,499	759	740
Missouri	1,854	1,685	169
Mound City	567	360	207
Northern Central	302	301	1
People's	595	621	—26
Southern	584	361	223
St. Louis	1,479	1,042	437
Union	248	301	—53
Total	11,055	9,292	Inc. 1,763

The Citizens' Railway Co. have applied to the City Council for permission to reconstruct the horse car portion of their road, starting from the terminus of the Eastern Avenue cable division and ending at the city limits, and to operate electric cars thereon; also to operate the Grand Avenue branch of the cable division by electricity. An officer of the company states that the Love underground trolley is to be experimented with on the latter line, thus utilizing the present cable conduit. If success-

ful, it will be adopted. The change is to be made from cable power on account of the adoption of electricity by other roads in the vicinity. The traffic on the cable road will thus be greatly diminished. Besides, more trains are needed on the Easton Avenue cable line, and the latter will be augmented by those on the Grand Avenue division, which will reduce the headway of trains on the former division from two minutes to one minute and a half. Passengers will be transferred at Grand and Easton Avenues where the two lines intersect.

A most important item of news is the consolidation of the Cass Avenue & Fair Grounds, the Northern Central, and the Union railways. The new company is to assume the name of the first of the above three. Numerous extensions are to be made, and a change to electricity is one of the provisions of the bill, which has just passed the City Council. Under the name of the Cass Avenue & Fair Grounds Railway, the corporation have been authorized to extend and construct their tracks from Prairie Avenue westwardly on St. Louis Avenue, and at the end of the latter thoroughfare they are allowed to continue the course westward through alleys and blocks, then again, on St. Louis Avenue to Goodfellow Avenue, the terminus. Provided in the bill is authority to construct the necessary switches, turnouts, sidings, poles, wires, etc., to operate by electricity, and to maintain a speed not exceeding fifteen miles an hour west of Prairie Avenue. One power house is to supply the necessary current, the location of which has not yet been decided upon. But one contract has been let, and that to John A. Roebling's Sons Co., of Trenton, N. J., for the wire. Cars have to be running within two years, but will most likely be in operation within one-half that time, for as soon as the bill passes the House of Delegates, the work of reconstruction will be commenced. Captain McCulloch estimates that the city will receive $5,000 the first year and nearly $20,000 the last year of the franchise. He says the consolidated roads must take in $500,000 the first year or the expense of changing to electricity will not be paid. According to the provisions of the bill, the company is to pay the city each year from January 1, 1893, to January 1, 1895, 3 per cent. of the gross earnings; from January 1, 1895, to January 1, 1900, 4 per cent.; 1900 to 1910, 5 per cent.; 1910 to 1920, 6 per cent.; 1920 to 1925, 7 per cent.

The Bellefontaine railway is at present very busy changing to electricity. All the track has been reconstructed with a seventy-eight pound Johnson girder rail, and ninety-two pound curve rail. The company will extend their line out Florissant Avenue to the cemeteries, later on. An extension has just been completed to the Fair Grounds, which also will operate by electricity. It is expected to have the road in operation by April 14. The Thomson-Houston system has been adopted, and the power station will be on the old stable site. As it will not be finished before the middle of May, current for running the cars will be supplied by the Municipal Electric Light & Power Co. The cars are thirty in number, with twenty foot bodies, and are being built by the St Louis Car Co. The management expects to have the cars make forty-eight minutes better time to the round trip than formerly.

On Monday, February 15, the bill passed by the City Council regulating the stoppage of cars for the reception and discharge of passengers, went into force. It provides that all cars must come to a full stop to discharge or receive passengers when they signal at the proper places, namely, far corners and the centres of long blocks designated by notices in the cars. This novel innovation has its good and its bad points. If the law is violated, the railroad companies will not suffer, but the conductors and motorneers, or gripmen, who will be fined not less than $5, nor more than $25.

The new cars of the St. Louis & Suburban Railway have a rather long wheel base, to prevent oscillation, consequent upon the fast running time that is made in the outlying districts. A number of cars belonging to this company are each mounted on Brill's No. 13 independent rigid motor truck, having both spiral and elliptical springs. It is said the truck is very satisfactory, and that the car rides as smoothly as if it were mounted on bogie trucks, all oscillation being done away with. This is the first appearance of the truck in St. Louis. The railway company are at present engaged in building their Forest Park extension along Union Avenue, from the main line to the park. The construction consists of light T rails placed on rough hewn ties, and the ballast is macadam. On account of opposition of property holders, the City Council will not allow the company to build the tracks in the middle of the street, but one on each side.

The Union Depot Railway Co. are adding several new boilers to their already extensive equipment.

The Lindell Railway Co. are revising and repairing the stringer constructed portion of the Washington Avenue division. This company are rapidly combining their cars, and there are at present on the Washington Avenue division four combination cars, each forty-seven and a half feet in length, or seven feet and a half shorter than a standard passenger coach. One of the cars is equipped with two twenty H. P. Westinghouse S. R. G. motors. It recently ran its maiden trip under the supervision of Mr. Guido Pantaleoni, the electrician. The car has been running for some time now, and is said to be giving excellent satisfaction. Another one of these cars is equipped with two twenty H. P. Short S. R. G. motors, which also is very satisfactory. The railroad company, as is evident, want to make a thorough test and adopt the best motor. Most of their cars are equipped with Edison motors.

The Phœnix Iron Co., of Phœnixville, Pennsylvania, have been awarded the contract for supplying the engines and boilers, and the Thomson-Houston company for supplying the electric appliances for the new power house of the Midland Electric Railway on Cook Avenue.

The suburban residents of St. Louis, who live on the line of the Missouri Pacific Railroad are placed at great disadvantage. After they have expended fifteen or twenty cents for their railroad fare they are landed about a mile and a half from the business centre of the city. There are but few who can expend an extra five cents on the electric cars to reach their places of business; and to do away with this great inconvenience, a novel scheme has been proposed. The following explains it: It is said that the Missouri Pacific company have been negotiating with the Union Depot Railway (electric) for right of way over their tracks to the down town districts and return. It is said the railroad company intend to build large suburban coaches and equip them with electric motors. From the suburban towns to the Union Depot locomotives will haul the cars, the latter will then be detached, adjust their trolleys to the wires, and speed along to the business centre as electric cars, stopping at every corner similar to a street car.

The Mission Railroad Co. will soon begin to build a branch line to Forest Park out the Clayton Road. The trailers at present in use will be turned into motor cars and run on the new branch. The power station equipment of the road is sufficient to supply the new branch, together with the Market Street and Laclede Aveuue lines.

The Fourth Street & Arsenal Railway are to adopt electricity and extend their route farther north than the present Morgan Street terminus.

It is rumored that the St.Louis & Suburban, the Lindell, and the Citizens' Railway companies are each endeavoring to gain control of the St. Louis County Railway. As the city is fast growing into the country this is a valuable property. J. B. G.

Charles Hansel, consulting engineer of the Railroad Commission of Illinois, has been commissioned to promote the interests of the Columbian Fair in Europe by urging railway companies and manufacturers to become exhibitors. Mr. Hansel will sail for Europe soon, and expects to spend several months in Great Britain and on the continent. Director General Davis has declared that all applications for space ought to be presented by July 1, 1892.

Franchises Given to Chicago Street Railway Companies.

The City Council of Chicago has finally given the Chicago City Railway Co. the privilege of improving their service by adopting an ordinance giving them the right to lay a single loop track downtown. It has been contended by the company, that it was simply impossible for them to increase the number of cars on their lines during the rush hours, for the reason that the existing loop was already overtaxed. This statement has been recognized as true beyond all question, but it was only within the last few weeks that the aldermen consented to move in the matter.

At the same meeting the Council passed the cross-town ordinances, which give the South Side company the right to operate cars on several streets by electricity. It is provided, however, that no overhead wires are to be used on Thirty-fifth, Forty-seventh, and Fifty-seventh Streets, and these restrictions are made in connection with each ordinance "provided that no trolley overhead wires shall be used, except upon the consent and approval of and conditions imposed by the Mayor and Commissioner of Public Works."

At the same meeting of the Council an ordinance was adopted, which gave to the West Chicago Railroad Co. and the North Chicago Railroad Co., the right to operate their lines by compressed air, gas, electricity, or any motor or motive power which they may see fit to adopt; provided, that such motor or motive power shall be practically noiseless, and, before using, shall be approved by the mayor and commissioner of public works.

The ordinance was vetoed by Mayor Washburne, who said in his message of disapproval:

> I recommend that it be amended as follows:
>
> In the event of electric power being used, the same shall be placed underground, and its method of construction shall first be approved by the Commissioner of Public Works.
>
> My reason for suggesting this amendment is, that it is eminently desirable that overhead wires in the city of Chicago be displaced in all instances as soon as practicable, and that no grants be given for any overhead system of electric or other wires, when any other method can be adopted.
>
> In some instances in outlying territory, under certain restrictions and a time limit, it might be practicable and advisable to permit some overhead system of electric wires for the use of street car travel. This right, however, should be limited in time and surrounded by such penalties as to compel all companies using overhead wires to place the same or other motive power underground, within a comparatively short period of time.
>
> To permit this ordinance to stand as it is now worded, would allow the use of overhead wires through all portions of our city, where the two said railroad companies now conduct their business; and for these reasons I recommend that the amendment hereinbefore mentioned, be passed before this ordinance becomes a law.

The ordinance was amended as suggested, and passed.

At the same meeting the Council adopted what has been known as the "omnibus" ordinance, giving to the West Chicago company the right to lay track on many crosstown streets, and providing that the roads should be operated by animal power, cable, electricity, or some motor approved by the authorities. If electricity was adopted, the conductors are to be underground. The mayor, at a subsequent meeting of the Council, returned the ordinances, suggesting modifications, which were made, after which the measures were again passed.

The Trolley in Philadelphia.

Last month has witnessed repeated in Philadelphia many of the scenes which occurred in Brooklyn before the final permission was given to use the trolley. The immediate cause of this was the application of the Philadelphia Traction Co. for permission to erect poles and overhead wires for a trolley system over certain of the more populated streets. In the course of the investigation before the railroad committee of the City Councils upon the application, a number of experts and others were called upon to testify as to the relative merits of the trolley system. Among those who appeared in behalf of the system were Oscar T. Crosby, George Westinghouse Prof. Louis Duncan, C. J. Field, E. E. Higgins, Messrs. Ostran and Stern of the Johnson and Edison General Electric companies respectively and Mayor Haynes, of Newark. The applicants also showed a large number of letters from mayors and heads of departments, insurance, brokers and others in cities where the trolley system is in operation and who expressed themselves in favor of the system. Among others who appeared in opposition were the Trades League, the Municipal League, Board of Trade, Lumbermen's Exchange, Master Builders' Exchange and several citizens' committees and associations, as well as private individuals. Prof. Wm. D. Marks gave testimony as an expert for the opposition.

The bills came before the Councils on March 22, and were finally passed by a large majority, and sent to the Mayor on March 23.

In speaking of the matter Mayor Stuart said: "I shall not act hastily. I want to read the ordinances carefully, and will take no action until I have done so."

The ordinances have been sent to Director Beitler, who will, as the head of the Electrical Department, make a report to the Mayor before action is taken.

New Rapid Transit Plan for New York.

A new plan for providing rapid transit in New York City has recently been made public. It is designed in opposition to any underground system which the advocates of the new plan assert can never prove popular or satisfactory in the city of New York. The project contemplates the removal of the top of the New York Central tunnel, from the Harlem River to Forty-second Street, and the construction of an elevated four track road over the existing four tracks, at a height above the level of Park Avenue sufficient to leave traffic on that thoroughfare undisturbed; from this point it is proposed to build a viaduct over private property to the City Hall. The advantages of this plan are concisely stated as follows: The new plan assures plenty of air and light. It will cost less than the tunnels. It will not disfigure streets. The minimum of damage will be done to property. The road will be substantial enough to make safe the running of fast trains over it. It will have convenient connection with every railroad entering New York overland, and, by means of the proposed North River bridge, with the roads terminating in New Jersey.

An Interesting Test of Engines.

Some interesting tests to determine the relative economy of high and low speed engines, have recently been carried out at the power station of the East Cleveland Railway Co., by Charles W. Wason. The types of engines used in this station are stated in another portion of the paper.

Amperemeter and voltmeter readings were taken every fifteen seconds, the amount of water used for steam and of coal consumed were accurately measured, and a careful account of the number of motor and tow cars moved, and mileage made by each were carefully kept, and the condition of the weather was noted. The temperature of the water as it left the heaters, was taken every fifteen minutes.

Owing to the constant and rapidly varying load, it was almost impossible to get the mechanical horse power. In taking a card with the indicator, the load will change before the stroke is completed. The average electrical horse power developed in ten hours for the high speed engine was 563; for the low speed 842. The water consumption for the average electric horse power was: High speed, 43.29 cu. ft.; low speed, 37.69 cu. ft. The amount of fuel used for average electrical horse power per hour for high speed, 6.55 lbs., low speed, 6.75 lbs. The number of pounds of coal consumed per car mile: high speed, 6.57 lbs.; low speed, 6.38 lbs. Total number of motor cars was seventy-one in both cases; total number of tow cars eleven during the high speed test, twelve during the low speed test. Average horse power per car required during the high speed test was 686, low speed was 759.

Contracts Awarded.

The Brooklyn City Railroad Co., of Brooklyn, N. Y., being about to equip their lines for electric traction, as we have before noted, have awarded the following contracts: To the Thomson-Houston Electric Co., of Boston, the complete electrical equipment for 250 electric cars, each car to be equipped with two twenty-five H. P. W. P. type of motor. To the Ansonia Brass & Copper Co., of Ansonia, Conn. and the Simplex Electrical Co., of Boston, the contracts for the trolley, return and feed wires. To W. H. Wallace & Co., of New York, contract for poles, which are to be of the tubular type, twenty-seven feet high, in six, five and four inch sections, swaged at the joints and having a ring shrunk on at each joint. The poles are to be provided with four pin cross arms for supporting feed wires, and eyebolt for the guard wire span. The span wires are to be mostly of Norway iron, but as an experiment a portion of the line will be equipped with bronze wire. The rail joints will be bonded in the ordinary manner, and the return wire will consist of heavy tinned copper wire. The contract has been awarded to the Johnson Co. for sixty-six pound girder rails sufficient to equip one mile of track, with which the Johnson standard rail joint will be employed, and the chairs electrically welded to the rail. To the Lewis & Fowler Girder Rail Co., of Brooklyn, N. Y., to equip nine miles with their sixty-five pound box girder rail. The contracts for the power equipment have not yet been let, but it has been decided to belt direct from the flywheel of each engine to two generators, the shafts of the latter being provided with friction clutches.

Providence (R. I.) Notes.

At a recent meeting of the Advance Club of Providence, President Homer M. Daggett, Jr. of the Inter-State Street Railway Co., described the extensive electric railway system which his company are now installing:

The Inter-State Street Railway Co., according to Mr. Daggett, have a charter from the Legislature of the State of Rhode Island, and a license from the State of Massachusetts to do business in the towns of Seekonk, Attleboro and North Attleboro in that state. They have street franchises from Attleboro, Seekonk, North Attleboro, Cumberland, Lincoln, East Providence and the city of Pawtucket, besides an arrangement to run their cars into Providence under certain conditions.

The system covers about forty-two miles of road, divided as follows: Attleboro to Pawtucket eight miles; North Attleboro to Pawtucket eight miles; Manville and Cumberland Hill to Pawtucket ten miles; Bullock's Point to Pawtucket ten miles; Pawtucket to Providence four miles; Pawtucket, local, two miles. Of these routes they have built thirteen and a half miles of track, and expect to have the two routes from Attleboro to Pawtucket and from North Attleboro to Pawtucket in operation by next April, and the routes from Pawtucket to Bullock's Point in operation by May 30. The other lines will be completed as rapidly as possible.

South Side Elevated Road, Chicago.

The Chicago & South Side Rapid Transit Co. who control the Alley L, are now forming plans for the operation of the road. A general description of the company's system was presented in a recent number of the STREET RAILWAY JOURNAL. It is now stated that trains will be run about May 1, if engine builders do not fail to execute their contracts.

The schedule of the service, as now outlined by the engineers, is as follows: From 6 o'clock to 9 o'clock A. M., four car trains will be run every two and a half minutes., from 9 A. M. until 4 P. M. four car trains will be run every five minutes; from 4 P. M. until 8 P. M., four car trains will be run every two and half minutes; from 8 P. M., until 11 P. M., three car trains will be run every ten minutes; from 11 until 12 P. M., three car trains will be run every five minutes; and from 12 P. M. until 6 A. M.; two car trains will be run every thirty minutes. If found necessary, five car trains will be run every two minutes. It is estimated the road will carry 56,000 persons daily, if every passenger is provided a seat, or double that number if loads such as are carried on trains in New York are transported.

Notes on the Short Railway System.

THE Short Electric Railway Co. have closed a contract with the Bangkok Tramway Co. of Bangkok, Siam, which is one of the most successful and valuable street railway properties in Asia. It will be remembered that the general manager of this company, Mr. Aage Westenholz, visited this country some eight months ago, and made a careful study of the different electric railway systems, and that his company upon his recommendation should adopt the Short system is considered highly complimentary to the Short company. The first portion of the equipment will consist of six motor cars, each equipped with twenty H. P. single reduction motor and generating capacity for a somewhat larger number. The track will be strengthened somewhat, and in places relaid with new and heavier rail, and it is the intention to gradually change over the entire roadbed to conform more nearly to American practice. Mr. Westenholz has sent out a private circular letter to stockholders in Siamese and English announcing the change. Mr. Westenholz' statements in regard to the electric work in this country are of great interest, and his conclusions are evidently based on a careful study of the situation.

THE management of the Houston City Railway Co. with a view of giving its patrons the best possible service, says the Houston *News* in a recent issue, have been experimenting with various makes of electric motors, and some time ago contracted with the Short Electric Railway Co. of Cleveland, O., for one of their gearless type. Car 51, equipped with one of these motors, has been in active service on the Glenwood line about a week, and has made many friends by the excellence of its work. In company with A. W. Dutton, representing the St. Louis Engineering Co., agent for the Short railway company, the *News* correspondent took a trip on car 51, and with the trap doors up examined the working of the motor. Very noticeable features were the absence of noise and any sparking on the commutator, and although the car had made some thirteen round trips, approximately seventy-five miles, the motor was perfectly cool.

THE Short Electric Railway Co. closed a contract for electrically equipping three miles of road for the Spokane & Montrose Motor Railway at Spokane, and furnishing three cars equipped with "gearless" motors, which will take the place of the old steam dummies. Spokane will be the first Western city to adopt gearless motors, although contracts for this system are about to be closed in several other coast cities. This contract was negotiated by Chas. H. Baker & Co., the company's Western agents at Seattle.

THE Short Electric Railway Co. announce that they have recently received orders for original equipment or for additional apparatus from the Beatrice Rapid Transit & Power Co., Beatrice, Neb.; the Janesville Street Railway Co., Janesville, Wis.; the Spokane & Montrose Motor Railroad Co., Spokane Falls, Wash.; the Bloomington City Electric Railway Co., Bloomington, Ill.; the East Liverpool & Wellsville Street Railroad Co., East Liverpool, O.; the Braddock Electric Railway Co., Braddock, Pa.; the Georgetown & Tenallytown Railway Co., Washington, D. C.; the West End Street Railway Co., Rockford, Ill.; the Jamestown Street Railway Co., Jamestown, N. Y.; the South Covington & Cincinnati Street Railway Co., Cincinnati, O.; the Lincoln Street Railway Co., Lincoln, Neb.; the Union Passenger Railway Co., Chester, Pa.; the Ft. Wayne Electric Railway Co., Ft. Wayne, Ind.; the Schuylkill Electric Railway Co., Pottsville, Pa.

THE title which it is said will be adopted by the consolidated Thomson-Houston and Edison companies, is the "General Electric Co."

Obituary.

CHARLES J. VAN DEPOELE

Charles J. Van Depoele, the eminent electrician, inventor and pioneer in electric light and electric street railway work, died at his home in Lynn, Mass., March 18, in the forty-sixth year of his age.

Mr. Van Depoele was stricken with his fatal illness in December, and for over three months had hovered between life and death. Pneumonia was the primary cause of death, although a complication of disorders had developed during his long sickness.

The funeral services took place March 21. The pall bearers were W. N. Sheaf, Franklin James, John Riddall, Elmer P Morris, Theo. De Krieff, Henry Plachere, John Heinze and A B. Hoffmann. Among the many beautiful floral tributes was one representing an electric car with trolley, and with the word Van Depoele on the car body.

Mr. Van Depoele was born in Lichtervelde, Belgium, April 27, 1846. His father was an engineer on a small railway, and it was here that young Van Depoele gained his first mechanical ideas, and later learned his first lesson in electricity.

When about fifteen or sixteen years of age his father



THE LATE CHARLES J. VAN DEPOELE.

apprenticed him to a church furniture and fancy wood carver in Paris. He continued in this business until, in 1871, he came to this country and settled in Detroit, Mich., where he started a shop of his own, employing at one time 200 men.

Becoming interested in the electric light and believing in its commercial practicability, he constructed a dynamo, and in 1880, moved to Chicago, and formed the Van Depoele Electric Light Co., with General A. K. Stiles at its head. The following summer he lighted some of the streets in Chicago gratis, and soon after the company made and carried out numerous contracts.

As soon as this company was fairly started he began advocating the running of street railways by electricity, contrary to Mr. Stiles' wishes, who thought nothing would come of it. Van Depoele was undaunted, and in 1883 he obtained Mr. Stiles' consent to put up a short exhibition railway in Chicago. Seeing the success of this, Mr. Stiles became enthusiastic, and from that time on offered no opposition.

In 1884 he constructed a conduit road at the Toronto (Ont.) Exposition, followed in 1885 by the overhead system in the same place. This system was the first using a grooved contact device traveling along an overhead wire and conveying the current to the motor, which in this case was situated on the forward platform of the car. During the next three years he was busy developing the electric railway, taking out many patents, and building several railways in Toronto, Ont., South Bend, Ind., Minneapolis, Minn., and other places. In 1888 the Thomson-Houston company purchased all of his railway patents, and in March he went to Lynn, Mass., and has been connected with the company ever since as electrician and inventor.

Mr. Van Depoele has also done some very important work in the electric mining field, and it has been through him that the electric percussion drill has been brought to its present state of perfection, he having begun his experiments in that field as far back as 1882.

Though much interested in all branches of electricity, it is the electric railway and the reciprocating business that owes most to him. At the time of his death he was developing and improving his apparatus in the railway field.

His home life was happy, and his many friends among his social and business acquaintances, will deplore his loss. He leaves a wife and four children. The loss of a little son, a child of five years, two years ago, was a blow from which he never recovered. He also leaves a mother in Chicago.

A. D. WHITTON.

A. D. Whitton, late chief engineer of the Philadelphia Traction Co., died at his home in Philadelphia, February 23, after an illness of six months. His wife and two children survive him.

Mr. Whitton was born in Aiden, Scotland, in 1856, and came to this country about ten years ago. After remaining in Baltimore about two years he removed to Philadelphia and entered the service of the Traction company, and built the Market Street cable line of that city. Mr. Whitton, as chief engineer, had superintended the building of nearly all the cable lines that have been constructed by the Philadelphia syndicate, including lines in Pittsburgh, the north and west Chicago lines and the Baltimore line. He also made the original designs for the Broadway (New York) line, but owing to failing health he was not able to superintend the construction, and the work was committed to other engineers, who changed the plans and adopted a different type of construction.

Mr. Whitton was prolific in invention, and patented a number of appliances relating to cable traction. He had a capacity for arduous work, and it was thought by his friends that overwork hastened his death.

While many of his designs are employed on the lines controlled by the syndicate, they have not been generally adopted by other engineers. Mr. Whitton was accustomed to work along independent lines, and did not allow himself to be influenced to any great extent by the opinions of other engineers. We count it a pleasure to have known Mr. Whitton, and whenever our duties called us to his office we have found him most cordial and obliging. His family and associates have our warmest sympathy in this hour of their bereavement.

MELTIRE CAMPBELL.

Meltire Campbell, a superintendent of the Broadway & Seventh Avenue Cable Railway of New York, died February 25, of heart failure, at his home, 453 West Thirtieth Street.

H. W. EDES.

We regret to record the death of H. W. Edes, superintendent of the Houston, West Street & Pavonia Ferry Railway Co., of New York, who died on March 4 Mr. Edes was in the service of the company nineteen years, acting in the capacity of conductor, receiver, bookkeeper and superintendent. He was highly esteemed by the other officials of the company for his faithful and conscientious discharge of every duty. His age was thirty-eight years.

We are informed by a member of J. & W. Seligman, bankers, of New York City, that a recent attempt was made by them to purchase the street railway lines in Cleveland, O., in behalf of Eastern capitalists. The total amount offered was between $6,000,000 and $7,000,000, but the sale fell through.

Underground Electric Lines for Vienna.

In the City of Vienna, Austria, which has recently become considerably enlarged by the absorption of several important suburbs, it is proposed to install an extensive rapid transit system for intramural communication. According to the statements already published in the local papers, an underground system, similar to the City & South London electric subway in London, will probably be adopted. A twin iron tunnel will be constructed, and the cars will be drawn by electric locomotives, the current being supplied from an existing central station or one to be especially erected.

The passenger stations are to be made easily and conveniently accessible for the public by stairs, or at greater depths by elevators, and it has been ascertained that the necessary space for the officials and the public, as well as for access to the stairs and the elevators can be accommodated on the ground floor of the adjacent buildings.

Single Motors for Cars.*

BY E. A. SPERRY.

I have been deeply interested in the consideration of car equipment where a single motor has been employed. It has seemed to me from the earliest that a single motor was by all means the best; that it was by far better to employ a single motor where possible, and dispense with the complications involved in using two. There is certainly no trouble in obtaining power enough in one, but inasmuch as it has been suggested by some one that the car equipments had been designed in some instances by the so-called electricians rather than by the mechanical engineer, the mechanical difficulties encountered in transmitting the power after it has been generated, and distributing it to the traction wheels of the car, have stood in the way of employing one motor rather than two. Not only have I believed in the employment of a single motor for car equipment, but I have undertaken to put my ideas into practical form. For instance, I have employed a single motor for two wheels upon a car, four wheels, six wheels and eight wheels; and these not on models but upon full grown, full sized car equipments. Some eight wheel car equipments which I have been engaged upon have weighed as high as twelve tons, and have been employed on very heavy grades. These equipments have required different powers of motors. For instance, on an equipment of this class—that is, single motor car equipments—I have installed motors as high as 125 H. P., in those cases running eight wheels. This principle in operation has been very satisfactory—very much so indeed. These equipments have been used on tracks with heavy grades and in severe service in the way of railway crossings and numerous frogs, and in the heavier motors have been used on extremely sharp curves—that is, curves of low radius; and where employed as locomotives they have been attached to very heavy trains and have succeeded in doing the work for which they were assigned; in most instances they have been enabled to do a great deal more work than it was at first supposed they were capable.

I am a firm believer in the single source of power and a system of distribution for that power to the various wheels of the car.

The points I will consider in connection with this matter may be stated briefly as follows: A single motor for car equipment is the better, or the best form, from the fact that it is simpler, less expensive, it has a lighter weight, has a higher efficiency, and it has higher efficiency of transmission after the power is generated; it is more economical of current in other ways, as we will see; more economical of repairs; it can be made to give us more traction, and a single motor permits of more elaborate construction to adapt the motor and gearing to the requirements of service.

As to the first point, that it is simpler. One motor is simpler than two, having one armature, which is the bane of a great many electrical railroads employing but one set of commutator-brushes; and where the motor is geared to the tractive elements of the combination by a single-reduction gearing, there are less journals, less parts, and taken from every standpoint the equipment is simpler.

The point of its being less expensive is one which needs no elaboration. It will readily be understood that for a given potential a larger motor has less windings upon it and is of quite a little less weight for a given capacity. The windings, for instance, in a fifty H. P. motor need only be about half what it is in a twenty H. P. motor, and we all know that the element of time, especially where expert workmen are employed in the construction of any device, is the feature that very largely controls in the computation of the total cost of the articles, and where fewer convolutions and parts are required for the same power, of course considerable can be saved in the equipment.

That the equipment is lighter in weight I have had ample opportunity to observe from the fact that I have seen equipments operated side by side, and have investigated as to the weight of single reduction and double reduction equipment, where one motor and where two are employed, and know that the saving where single motor equipment was employed is between 1,800 and 2,200 lbs.

This factor is one of importance, inasmuch as it has to deal with the wear and tear upon the roadbed and the total amount of power required by the equipment, especially the total amount of dead weight to be pulled about for a certain carrying capacity in live load. For instance, take an extreme case like the Pike's Peak Railroad. The total capacity of that equipment in live load is somewhere between three and four tons weight—that is, the paying load is between three or four tons for hauling thirty-seven tons. In electric car service, especially where the roads are comparatively level, the paying weight can be greatly increased as compared with the total weight of equipment. This can be accomplished to the greatest extent where a single light motor may be employed to develop the traction. It may be stated that in the distribution of this weight (snppose we consider a single motor for car equipment as compared with two motors, each hung upon the axle), where two motors are employed, it is usually customary to hang them directly upon the axle, and the consequence is that in some instances it springs the axle. I came across an instance of this kind recently, and there are numerons instances of the sort. I enquired the size of the axle. I said: "Your axle must be extremely small if the weight of the motor is sufficient to spring it." The means of its measurement not being at hand, we, however, found a wheel that had come off of the axle, and measured the bore, and it was a standard three and a quarter inch steel axle that had been sprung by the hammering action of the motor mounted upon it. The axles are much more readily crystallized when carrying this weight, and, as is well known, the roadbed suffers materially, which is a question of great importance, the one that is being talked of and investigated very extensively at the present moment. It is a question that has seemed to dawn on the street railway people all over the country almost within the last six months, and extreme measures are now being employed to obviate it. They are trying to overcome this bad effect in a number of ways, some of which seem to promise good results.

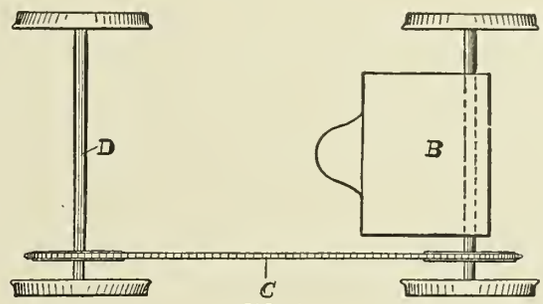


FIG. 1.

Now, there are two methods in which a single motor may be employed. Let us consider B the motor in Fig. 1, in this case mounted directly upon the axle, its end being supported in any of the usual ways, elastic or otherwise. In that case the power from a single motor may be transmitted by gearing or by a sprocket chain C to the other axle, letting the dotted line indicate the sprocket chain. That method was one of the first used by Mr. Van Depoele—the sad news of whose decease has just reached us, and we are all affected with the same feeling of sorrow that so prominent an engineer has passed away. Mr. Van Depoele placed the motor on the front platform of the car and then transmitted the power back through countershafting, first using gearing and then transmitting to one axle by a chain. In numerous instances in Ohio chains were used between two axles, so as to transmit the power to all the axles, thus getting the benefit of all the adhesion. This idea of using a sprocket chain has never proven successful, from the fact that wherever in engineering a sprocket chain is used it requires that the centres shall be adjustable. The distance between the axles in all cases snould be capable of adjustment. Of course, it is possible in some instances to use a sprocket chain with an idler, but in that instance it must be a "face wheel" in almost every case. But in the case here our wheels are small as compared to the distance; the idler brings the chains too near together, and the greatest adjustment possible is very small, and has never been found available. The idea of making both, or one of the axles adjustable with reference to the other, was thought at first not to be good engineering. The proof of this, of course, would be in equipping a car in this manner and watch the operation I have done this and can report, after some months of use, that there seems to be no trouble at all in allowing one axle of a truck to be adjustable. The main difficulty encountered at first was the fact that sometimes one end would be adjusted further than the other. I found that a very simple expedient to remedy that was to provide a small scale attached to the stationary

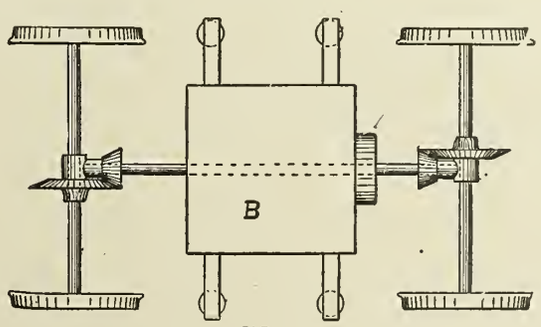


FIG 2.

*Abstract of paper read before the Chicago Electric Club, March 21, 1892.

part of the truck, with a little pointer fastened to the movable pedestal box, and whenever it was adjusted, the pointer would move along the scale, indicating whether the two sides were alike, so that the two axles would not be at an angle.

The other system may be diagrammatically illustrated as in Fig. 2. Suppose B to be a motor, a bevel pinion shaft connected therewith, and a bevel gear to be attached to each axle as shown. The bevel gear on one axle should be in the opposite position to that on the other, so that all the wheels will move in the same direction. It has been thought by some that the use of bevel gearing is objectionable. It has been thought that a bevel gear will not run on pitch lines. A bevel gear I have found by actual tests to be more delicate than a spur gear.

Now to the economy of current. There is one other factor in the absorption of current by two motors per car equipment than the one referring to its direct absorption for the power given. One of the best contemporary authorities on this matter writes as follows: "It is found in practice, that if electric motors, as ordinarily constructed

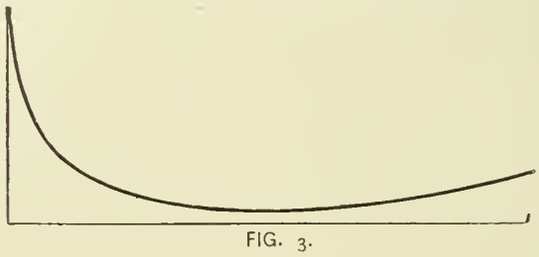


FIG. 3.

and connected in circuit are bolted to the same shaft, or are otherwise applied to the same work so that they must revolve together, the results are unsatisfactory, because of the fact that the load will be unequally or disproportionately divided. This is occasioned by the fact that it is very difficult, in fact almost impossible, to construct electric motors so that they will, with the same rate of rotation, and when supplied with current of the same potential, have precisely the same counter electromotive force. Therefore if two motors are connected, as ordinarily, to the same supplying mains, and operated so that they must revolve together, the motor whose armature produces the lowest counter electro-motive force, will take a larger current than the other motor. The effect of this increased flow of current is to greatly exaggerate or enhance the differences existing between the motors, because the magnetic field of the motor is disturbed by the increased flow, and its counter electro-motive force is thereby still further reduced. This motor, requiring a higher speed to produce a counter electro-motive force, equal to that of the second motor, takes the bulk of the work, and tends to drive the second motor as a generator, and the load is unequally divided between the different motors. It is practically impossible to make motors, running under the conditions mentioned, self controlled by adjustments affecting only their own circuits."

It is a fact in practice, and it has been one of great interest to me, that upon several occasions a street railway superintendent has actually removed one of the motors from a double motor equipment, and has reduced the destruction of armatures, in the neighborhood of 70 per cent.

The next point is economy in repairs, which needs but a passing comment. There are certainly less parts to wear, and if we can, as in a single large motor, run the motor at lower speed, the repairs will certainly be less in number and less in quantity. But when taken in connection

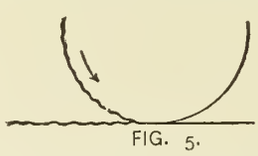


FIG. 5.

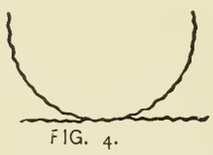


FIG. 4.

with the fact that when a single motor is used for car equipment, it is possible to mount that motor in an entirely different manner, and in a manner that is calculated to meet the special requirements of the case, as compared with that where two motors are in operation, it is possible to still further reduce the wear and tear. In the case of single motor per equipment, the motor may be elastically supported, and may be removed entirely from the sledge hammer concussion of the axle. The insulation, which is a large component of every motor, and which consists of cotton thread, something which cannot by any possibility stand the sledge hammer concussion, in this manner may be protected from the concussion and jar which is constantly going on in the axle.

The point which I wish especially to bring out, and I will try to be very brief in reference to it, is that where we have a single motor we are enabled to get a great deal more traction. The office of the motor on the car truck is for traction, it is placed there for the sole purpose of pulling the car about; and this result is accomplished through the adhesion of the wheels on the rails.

Now the friction not only varies with the pressure, irrespective of the surfaces, but also with the velocity; at zero velocity friction is very high. As the friction of quiescence disappears, the curve of friction doubtless comes down, and so along almost parallel, and at high speed it is supposed by some to rise as shown in Fig. 3. Now if this is not so I think it would be very difficult to explain one phenomenon which in Chicago we have excellent opportunity to observe.

It is a fact that the friction brake used in all the South Side cable lines is operated by what is known as the momentum brake system, the invention of Tom L. Johnson of Cleveland. Here a double friction phenomenon exists, one controlling the other. On one of the axles is a loose friction disk which is held up by a lever under the control of a gripman, against the rotating disk, fastened solidly upon the axle, and to the first disk is fastened the brake chain, which applies the other brake shoes to the periphery of the wheels. Now in this case we have the reverse of the old way of trying the experiment, by taking the resistance of the friction of quiescence and having it come down, as motion is given. It is often said that it is a poor rule that does not work both ways. In this brake system if the friction did go up it would be very apparent, much more so than in the ordinary application of brakes. Now what is the fact? When the brake is applied the velocity is very great as compared with the loose stationary disk, therefore we should expect to find the friction low, and we know that the initial reduction of the velocity of the car is not great. But as the train is brought to a standstill the curve of velocity drops off more and more quickly, and at last drops off very suddenly, and if one is standing hanging on the strap, as is usually the case, you feel your body, if you notice carefully, sway further and further, until at last when rest is attained by the car you give a sudden lurch ahead, showing that the resistance undoubtedly comes up, as we should expect it to do if our curve is correct.

When we speak of journal friction, the value of frictional quality is low as compared with adhesion, or the frictional phenomenon connected with adhesion. In the matter of adhesion on an ordinary sixteen foot street car, we have about 13,000 lbs. per square inch applied; whereas in an ordinary journal we have only from 900 to 1,600 lbs. per square inch, which is the highest journal friction in practice. But where we have such a severe application, where only a minute part of the surface is available, and where the wheel would tend to dig itself into or abrade the rail, where the velocity is different, the phenomenon which we know as adhesion takes place, we are enabled to know one point on that curve. For instance, we know that friction between chilled cast iron and ordinary soft steel rails is as high as 24 per cent., even after a slight motion is obtained. Furthermore, that by the application of silicates or sharp sand, it can be raised as high as 42 per cent., even after slipping has set in. The idea of adhesion is undoubtedly one of molecular gear. Suppose a wheel surface to be magnified very greatly. In this case we find that the surface is always more or less rough, and when we reduce it to a molecular surface, it must certainly be rough, as rudely shown in Fig. 4. In this case we have what may be termed a molecular gear, or gear and rack, and as they roll it might be said that the two mesh; this is known as the friction quiescence; we obtain the enormous pull that we observed in the high point of the curve. Now, then, why does the curve come down so rapidly? It seems to me that it may be readily explained by saying that the moment a slip takes place, and we can see by the curve that is the critical moment, these gear teeth are stripped off, and we have what approximates a surface left. We can almost illustrate it by an irregular line, moving the straight surface to the rear when the gear teeth have been stripped. See Fig. 5.

In my judgment this all goes to show that we must arrange our truck and our car equipment so that the first or initial slip will be prevented. It is a fact that has been observed that when a train is running double header, just as soon as the drivers of one locomotive commence to slip on a heavy grade the drivers on the other will immediately commence to slip, although it has no mechanical connection with it whatever. The tractive power, which was very high, and which was exerting itself upon the load tremendously, just as soon as the slip occurs, is reduced and all the load is thrown upon the other drivers, which are not equal to increased duty required. In the case of an eight wheeler the advantage exists in the fact that they are all coupled together and all must rotate in unison. When one driver, tends to slip, it is held back to its place by its rigid attachment to all the other seven that do not happen to tend to slip at the same instant. At the next instant it perhaps finds itself in rigid, direct contact, has its gear teeth in mesh and does not offer to slip, and may tend to hold back some other driver from slipping at that instant, and in that case the sum total of their tractive effects is held up high on the curve. They are held to the rail at the point of adhesion so that their tractive power is very much greater than it is where they are allowed to slip, in which case the tractive power comes down to merely a fraction of its possible value to a point generally denominated *friction*.

Single motor per car equipment admits of constructions rendering available the high tractive power secured by coupling the drivers.

I found further that gearing from such connections is far superior to side rod connections from the fact that lost motion in joints of the reciprocating parts tends to *start* the slip, bringing about a great reduction in tractive capacity.

Street Railway News.

Extensions and Improvements.

Ann Arbor, Mich.—The City Council have unanimously passed a franchise allowing the motor line between Ann Arbor and Ypsilanti to enter the city on the middle of Packard Street, thus overcoming the objections of the Supreme Court, mentioned in our last issue.

Atlanta, Ga.—The people of Marietta are now making an effort o raise sufficient money to induce the management of the Chattahoochee road to extend it to that place.

Baltimore, Md.—The Traction Co. have petitioned for the right to lay a second track upon a number of streets, including Saratoga and Cary, and a single track on Saratoga, Cary and Calhoun Streets.

THE North Avenue Electric Railway Co. have petitioned for the right to extend their tracks on Lexington, Eden, McElderry and Bond Streets.

The First Branch City Council have granted the right to use electricity to the Central, or Crosstown Railway.

Boston, Mass.—The West End Street Railway Co. have petitioned for leave to construct tracks on Beverly Street, Warren Bridge, Warren Avenue, City Square, Park Street and Warren Street, and also on Main Street in the Charlestown District from City Square to the Somerville line.

Bradford, Mass.—The selectmen have unanimously granted the Haverhill & Groveland Street Railroad a location to the North Andover line, with the power to operate it by electricity. The Merrimac Valley road also has a location in North Andover to the Bradford line, thus making a continuous line from Methuen to West Newbury.

Brooklyn, N. Y.—The Atlantic Avenue Railroad Co. have purchased a plot of ground on the Gowanus canal for a power station. The site runs from the canal to Third Avenue and is bounded on one side by a small private lateral canal running to within 100 ft. of Third Avenue. The site, including half of Second Street, which is closed, is 635 ft. 9 ins. × 230 ft. in dimensions. There is at present a brick factory building upon it which will be utilized. Concerning the purchase, Mr. Richardson said: "There is hardly a site in the city better adapted for our purpose. We shall put up our power station directly on Gowanus canal. This will be most convenient in taking coal, as it can be directly transferred from the canal boats into the bunks. The details of the power station are not completed, and I cannot tell how much that will cost. It will start in with a capacity of 1,500 H. P. This will be increased, if necessary, to 6,000 H. P."

The Brooklyn City Railroad Co. are making preparations for the extension of their Meeker Avenue line to New Calvary and intend to have the cars running by Decoration Day.

Buffalo, N. Y.—The extension of the electric system of the Buffalo Street Railway Co. out Main Street will be begun as soon as the frost is out of the ground. The Elmwood line will, probably, be equipped soon afterwards.

Canandaigua, N. Y.—The town authorities have been asked for overhead rights by the street railway company.

Canton, O.—The construction of a line on Dueber Avenue has been suggested.

Chicago, Ill.—The South Chicago City Railway Co., under a charter obtained in 1891, will extend their tracks from Ninety-second Street, north on Commercial Avenue and also north on Buffalo Avenue to Seventy-ninth Street, where the two lines converge, and thence north to the southeast entrance on Jackson Park, so that they can deliver passengers at the Forestry Building and Lake Shore for the World's Fair. The above line will be double tracked and also that south of Ninety-second Street, to 106 Street and both sides of the Calumet River, with seventy-five pound girder rail, making altogether about twenty-two miles of single track or eleven miles of street. The motive power will probably be steam, after designs which render the motors noiseless and smokeless. It is expected that this extension will be in operation by July of this year.

Cleveland, O.—The Collamer branch of the East Cleveland Street Railway Co. will be extended to Collinswood.

The West Side Street Railway Co. may erect their power house on Gordon Avenue The work of putting in electricity as motive power will be commenced as soon as the frost is out of the ground. Eight miles of track will have to be relaid, chiefly on Lorain and Detroit Streets, but it is expected that everything will be in readiness to run motor cars by September.

The extension of the East Cleveland Railroad to the village of Collinwood will be built this spring.

Clinton, Mass.—The Clinton selectmen have granted a conditional franchise to the Clinton Street Railway Co. The route, as approved by the franchise, extends over North Main, Water, Union, Chestnut, and other streets. The franchise states that a majority of directors of the road shall be inhabitants of Clinton, and that the corporation shall run its cars as often as the board of selectmen shall determine from time to time. A corporation bond of $5,000 must be given the board before any move is made toward building.

Concord, N. H.—It is understood that the owners of the Concord electric road are already contemplating the extension of their line southward to Garvin's Falls, in case the power there is developed according to the proposed plans.

Denver, Colo.—The City Cable Co. have obtained a permit to grade Curtis, Eleventh and South Eleventh Streets. Work is to be commenced at once and will be pushed with all possible rapidity so that the road may be opened for traffic this summer.

Dubuque, Ia.—J. A. Rhomberg last month bought Mrs. J. J. Linehan's half interest in the Dubuque Street Railway Co., for $142,000. This interest was transferred to a syndicate of leading citizens. The company was reorganized and the directory was enlarged by the addition of several names. A contract for eighteen car equipments has been given to the Detroit Electric Works and the installation of the overhead system will be pushed rapidly forward.

Duluth, Minn.—The street railway company propose to build a line down Garfield Avenue to connect with the Superior Street line. The Douglass County Street Railway Co., of West Superior, will build on the Wisconsin side. It is said a bridge will be thrown across the river at this point, connecting Duluth and West Superior by an electric street railway.

Elizabeth, N. J.—The New Jersey Traction Co. have applied to the City Council for power to extend their line from Jefferson Avenue, through North Avenue to Newark Avenue and along this thoroughfare to the boundary line of Clinton Township in Essex Country.

Eureka Springs, Ark.—The Eureka Springs Electric Light & Street Railway Co., have decided to equip their line with electric power.

Evansville, Ind.—The Evansville Street Railway Co. have been reorganized, and improvements will be made looking, it is said, to the investment of $500,000. Electricity will be substituted for mule power. The officers are: Pres., John J. Shiphard; Vice-Pres., George H. Stockwell; Treas., Thomas S. Krutz; Sec., H. D. Moran. The engineers are Barry & McTighe of New York,

Fall River, Mass.—The Globe Street Railway is to be entirely reconstructed, and the trolley system put in, and by July 1 the road will be in full running order. Three miles of track will be built, a new power house will be erected, and fifty new cars will be put on the road, and the service will be doubled.

Ft. Wayne, Ind.—The City Council has adopted an ordinance granting the street railway company the privilege of using electricity as a motive power. It is provided that work shall begin within four months, and shall be completed within a year.

Grand Island, Neb.—The Grand Island Street Railway Co. are considering the adoption of electric power. O. B. Thomson, secretary, in behalf of the company recently made visits to different electric lines to investigate the merits of the different systems.

Hampton, Va.—About one and one-quarter miles of street railway, to be operated by horses, will be constructed by the East Hampton Development Co.

Harrisburg, Pa.—The Passenger Street Railway Co. have asked permission to extend on certain streets.

Holbrook, Mass.—A meeting of citizens last month voted in favor of granting a franchise to build an electric road from the Brockton line to the Braintree line, through Franklin Street, to the directors of the Brockton Street Railway Co. The company will give bonds to build the road by or before January 1, 1893. The selectmen are in favor of the road, and the franchise will probably be granted.

Houston, Tex.—The Houston City Street Railway Co. have petitioned for privilege to extend their lines over several streets.

Indianapolis, Ind.—By the terms of a recent order made by the county commissioners the Broad Ripple Rapid Transit Co. were given the right of way over Central Avenue, and Washington Boulevard or Alabama Street was left for the Citizens' company. The conditions of the franchise are that on or before March the Broad Ripple company shall exhibit a contract for the building of the road, and shall deposit a certified check for $10,000, guaranteeing the faithful performance of the work. The line must be completed to Broad Ripple by September 1, 1892. The contract binds the Broad Ripple company to allow the Citizens' company to run cars over the tracks on Central Avenue from the city limits to Thirtieth Street. Ex-president Shaffer, of the Citizens' company, will be resident manager, and will be backed by New York capitalists, of whom R. L. Belknap is said to be at the head.

Jefferson, Ind.—It is extremely probable that the street cars will be operated by electricity in the near future.

Kalamazoo, Mich.—The Kalamazoo City & County Street Railway Co. propose extending their line to the asylum.

Kansas City, Mo.—The Kansas City Cable Co. will soon have a new cable for the Troost Avenue line. The rope is being manufactured by the Hazard Manufacturing Co., of Wilkesbarre, Pa., and will be 33,550 ft. long, one and a quarter inches in diameter and weigh 91,697 lbs. This rope will be put in on the Troost line in April, about the same time that the one recently imported from England will be laid in the main line of the road.

It is said that the plans already mentioned for effecting the transformation of the elevated road or interstate rapid transit railway into an electric line have already been prepared and accepted. Also that the contract for the electrical equipment has been let, and that actual work will be begun as soon as possible. The Jarvis-Conklin Mortgage Trust Co. are interested.

Kennebec, Me.—There is on foot a plan to build an electric railroad from this village to Madison.

Kokomo, Ind.—The machinery at the power station of the street railway company will be largely added to shortly.

Lafayette, Ind.—The line of the Lafayette Street Railway Co. has been relaid with fifty-six pound T rail. More cars will be added soon, and several extensions of line will probably be made. The road is reported to be doing a very good business, and the outlook is favorable.

Lancaster, Pa.—The Lancaster City Street Railway Co. have been granted the right by the City Council to extend over certain streets, conditioned upon paying annually to the city fifty cents on every pole which may be erected, and $5 for every car which they may operate.

The Common Council have also granted the West End Railway Co. the privilege of laying tracks on Marietta Avenue, from College Avenue to the city limits.

Leavenworth, Kan.—Warren F. Putnam, president of the National Granite bank of Exeter, N. H., and principal owner of Leavenworth's horse street railroad, was in Leavenworth last month and stated it as his intention to convert the line into an electric road.

Lebanon, Pa.—An ordinance has been recently passed by the Common Council authorizing the Lebanon & Annville Street Railway Co. to extend their road upon certain streets of the city.

Leominister, Mass.—The legislative committee has reported aeorably the bill authorizing the consolidation of the Leominister and Fitchburg street railway companies. The construction of the line to Fitchburg will probably begin now very soon.

Lexington, Ky.—The Passenger & Belt Line Railway contemplate adding one motor car and one and one-half miles of track this year. The company built last year two and three-quarters miles of track.

Lima, O.—Since the purchase of the Lima Street Railway by Amos E. Townsend, Pittsburgh, Wm. M. Brown, Newcastle, Pa., W. W. Hazzard, of Cleveland, O., and W. R. Kimball, of Cincinnati, O., $75,000 to $100,000 will be expended in the reconstruction and re-equipping with the Thomson-Houston system in place of the VanDepoele apparatus. The new company also will increase the number of cars from ten to fifteen.

Logansport, Ind.—A two mile extension will be built this spring. Four cars are now run, but double that number will be operated when the extension is complete.

Lincoln, Neb.—Vice-President Upham of the Lincoln Street Railway Co., has just closed a contract for 200 electric motors, with the Westinghouse Electric & Manufacturing Co. for the sum of $218,000.

Louisville, Ky.—At the annual meeting of the stockholders of the Louisville Railway Co., held a few weeks ago, a large sum was appropriated for the purpose of further extending the electric lines. It was left to the discretion of the Board of Directors what lines should be equipped.

Lowell, Mass.—Workmen of the Lowell & Suburban Street Railway Co. will soon begin to erect poles on Central and Gorham Streets and string wires for electric cars. If the petition is granted by the Dracut selectmen, double tracks will be laid at once to Lakeview. After the Lakeview route is completed it is intended to have electric cars pass through Merrimack, Central and Gorham Streets.

THE selectmen of Chelmsford have given to the Lowell & Suburban Street Railroad Co. authority to extend double tracks to the centre and north villages of that town, and similar permission has been granted by the selectmen of Dracut, the extension to be made in connection with the equipment of the road with electric power on all their tracks in Lowell.

Lynn, Mass.—The Lynn & Boston Street Railroad Co. have petitioned the selectmen of Saugus for permission to run electric cars in that town over existing lines of track, and for leave to equip the lines with electric power, to erect poles for the same, etc.

Macon, Ga.—Messrs. Mitchell & Harris, the owners of the Metropolitan Street Railroad, state that it is to be completed at once. It is also said that a bond has been given to complete the road within ninety days.

Manchester, N. H.—At a special meeting of street railway directors, held last month, it was voted that a committee consisting of Messrs. Williams, Bartlett and Stevens be authorized to procure surveys and estimates of costs extension of the road and to investigate as to the best system of motive power.

Manchester, Va.—The Richmond & Manchester Railway Co. have contracted for the construction of an electric street railway up Hull Street. This will give two lines to Forest Hill Park. Work will be commenced soon.

Milwaukee, Wis.—In response to a call from a committee of the Merchants' Association and certain property owners in North Greenfield, Henry C. Payne has agreed to extend his line from the Soldiers' Home to the State Fair grounds, providing the citizens would erect a separate power house at the end of the present track.

Montreal, P. Q.—W. S. Walker, F. B. McNamee, Wm. Mann, W. J. Withall and F. Thom, shareholders in the Mount Royal Park Incline Co., have petitioned for the privilege of constructing a railway to connect the present mountain elevator with the city street railway system. Also to construct another line eastwards to the corner of Papineau Avenue and Craig by way of Duluth Avenue, Amherst Street, Rachel and Papineau Road to Craig Street. These roads to be double tracked and electric power to be used. Should this application be granted, the intention is to construct the road at an early date.

ROBERT COWANS and R. A. Mainwaring have also petitioned for a route in the municipality of St. Louis du Mile End on Park Avenue and other streets for an electric surface road, also that they may have the privilege of running over the car tracks of the Montreal Street Railway Co. on Bleury from St. Catherine to Craig.

Natick, Mass.—The Natick Electric Street Railway Co. have asked permission to lay tracks, erect poles, wires, etc., on Mill Street, from Pond to West Central, at this point connecting with the location already granted.

Niagara Falls, N.Y.—The Niagara Falls & Suspension Bridge Street Railway Co. will equip their road with electric motors, and will expend $150,000 in improvements.

Neenah, Wis.—C. C. Garland, of Minneapolis, has purchased the plant, franchise and good will of the Neenah & Menasha Street Railway, and will change the same to an electric line. The consideration is said to be about $30,000.

New Orleans, La.—C. V. Haile and W. U. Rosenthal, the committee of the Carrolton Railroad Co., appointed to visit other cities to inspect the different electric systems, have returned from an extensive investigating tour, and state that they are fully satisfied with the rusults attained by electric power.

Newark, N. J.—The Newark Passenger Railway Co. will begin in a short time to equip the Broad Street line with electricity. The company have received a petition from Eighth ward citizens, asking for the early equipment of the Mount Prospect Avenue line, and another from the West End people, asking that something be done on the Bergen Street line. Cars will run by electricity over the present Bloomfield route to Broad Street.

THE Traction company have made application to the Street and Water Board for permission to construct and operate a double track railroad in Frelinghuysen Avenue from Miller Street to the line of Clinton township. The petition was signed by President Thomas C. Barr. This is believed to be the proposed direct electric route to Elizabeth.

Newark, O.—An ordinance has been asked by the Newark City Railway Co., to construct and operate an electric railroad from and along other streets to the corporation limits.

Newburgh, N. Y.—The conversion of the street railway into an electric road is probable. The power to run dynamos will be furnished by utilizing the falls in the Rondout Creek at Eddyville, two and a half miles distant.

Newburyport, Mass.—The Newburyport & Amesbury Electric Railroad Co. are contemplating improving their plant. They will put new cars on the High Street branch. The power at the electric station will also be increased by the addition of a new engine and boiler.

Oakland, Cal.—A number of important street railway improvements are projected or being carried out here, as follows: The Consolidated Piedmont Cable Co. have begun work on several miles of cable extensions. The managers of the Berkeley electric road have begun several miles of crosstown road, and are completing their cemetery extension. The Pacific Improvement Co. are ready to construct their electric road to Berkeley out Telegraph Avenue. The Sessions-Vandercook Electric Road to East Oakland, and the electric road to Haywards are approaching completion, and Theodore Meetz has promised electrical connection with Alameda.

IT has been decided to commence work at once on the Fourteenth street road of the Piedmont Cable Co.

THE Oakland Consolidated Electric Railway Co. will soon begin the construction of a branch line from Thirteenth and Franklin Streets to East Oakland.

Omaha, Neb.—The Dundee Land Co. propose to equip their street car line to Dundee Place with electric cars, and have petitioned for a franchise. The present horse car line to Dundee was built under an ordinance passed several years ago to the Metropolitan Cable Railway Co.

Philadelphia, Pa.—The seven ordinances presented by the Philadelphia Traction Co. to the railroad committee of City Councils, cover nearly all of the territory occupied by the Traction company east of the Schuylkill river. Market, Chestnut and Walnut Streets are not included. The plan is to bring passengers from the northeast, northwest, southwest and West Philadelphia to the centre of the city by electricity. The West Philadelphia franchise has already been secured, but, as it will not allow the cars to come east of the river, passengers will be transferred to cable cars.

IT is reported that the Philadelphia Traction Co. will introduce the trolley system on the Darby branch.

Pittsburgh, Pa.—It has been officially stated that the Duquesne Traction Co. will extend their line farther out in the suburbs of the East End.

Providence, R. I.—The petition of the Union Railroad Co. to lay additional rails and string wires in East Providence, which has been before the Council of that town since last November, has been granted, on condition that any other company, in the discretion of the Council, will have the privilege of using the rails and wires.

Quincy, Mass.—The Quincy & Boston Street Railway Co. have petitioned for right to extend their tracks to North Weymouth, North and South Braintree, East Milton, etc.

St. Louis, Mo.—The Hamilton street railroad syndicate have begun the work of converting their line on South Seventh Street into an electric line.

Salt Lake City, Utah.—The Salt Lake City Railway Co. will soon extend a line north as far as the Hot Springs. It is proposed to extend the First South Street line west to Ninth West, thence north to Ninth North, then one block west to Mitchell, thence north through the Kinney & Gourlay addition to Kinney's North Salt Lake plat, lately filed. This will make the extension two miles long, and then it is only a mile or so to go to the Hot Springs, to which point the road will build at a later date.

San Francisco, Cal.—The Geary Street, Park & Ocean Railroad Co. are making active preparations for beginning the work of extending the cable to Golden Gate Park. Contracts have already been let for the construction of the road, and the iron, rock and cement to be used is being hauled along the line of the proposed extension. Work will be commenced at both ends of the line, as it is the intention to reconstruct the roadbed of the cable line now in operation and to narrow the gauge to conform with that of the Market Street system.

THE Sutter Street Cable Railway Co. propose to extend the Polk Street cable line to Fort Mason, and the Pacific Avenue branch from Devisadero to Central Avenue. The estimated cost is about $250,000.

Savannah, Ga.—A contract has been made with L. H. McIntire to equip the city and suburban railway with an electric system. Thomson-Houston motors will be used. Sixteen cars will be operated.

Application has been made by Captain Johnston of the coast line road, to equip the line with an electric system.

Seattle, Wash.—It is understood that Fred. E. Sander contemplates extending the Grant Street electric railway gradually along the Duwamish and White river valleys until it reaches Tacoma. A fifty-six pound rail set in a chair is being used.

Spokane, Wash.—The steam motor road is to be converted into an electric railway.

Steelton, Pa.—The Citizens' Electric Passenger Railway Co. are considering the project of constructing a road from Harrisburg to Oberlin.

Superior, Wis.—The directors of the Douglas County Street Railway Co. have voted $200,000, to be used in improvements by the company at once. A new brick car house will probably be erected this spring.

Terre Haute, Ind.—The street railway line will probably be soon extended to Brazil.

Toledo, O.—The Consolidated road will soon begin the construction of a belt line, which will take in Monroe Street, Auburn, Central and Collingwood Avenues, Adams and Summit Streets. This will do away with the horse cars on the Adams and Monroe Street lines and almost complete the electric railway service in Toledo.

Troy, N. Y.—The electric line between Troy and Albia will be completed and in operation in the latter part of June, or the first part of July.

Washington, Pa.—If the company receive proper encouragement from property owners, the Electric Street Railway Co. will extend their line eastward on the National Pike.

Waterville, Me.—The work necessary to convert the street railway into an electric road, will be commenced at once.

Woburn, Mass.—The East Middlesex Street Railway Co. will equip electrically the Woburn section of their systems. The Woburn Electric Light Co. have contracted with officials of the East Middlesex and North Woburn Street Railway companies to furnish necessary power to operate the systems. The power will be ready as soon as the street railway people can make use of it. In case there is no opposition, the cars of the East Middlesex line will be run by electricity early in the summer.

New Roads.

Akron, O.—By the first of June, it is now confidentially announced, Akron will be connected with Cuyahoga Falls and Silver Lake by an electric railway. The promoters of the project are W. J. Price, of Chicago; J. A. Long, of Akron, and E. L. Babcock and T. T. Walsh, of Cuyahoga Falls.

Allegheny, Pa.—The Millvale, Etna & Sharpsburgh Street Railway Co., capital $300,000, was chartered last month. The president is J. N. Davidson, and the directors are John H. Dalzell, Joshua Rhodes, George B. Hill and G. W. Henderson. The line will be in harmony with the Manchester system. It will be a single track, twelve miles long, and it will connect Allegheny with Millvale, Etna and Sharpsburgh.

Americus, Ga.—W. E. Staley, J. H. Starbuck and W. K. Wheatley, of Americus, state that Americus' street car system will soon be in active operation.

Anna, Ill.—The Anna, Jonesboro & Asylum Electric Street Railway Co. have been incorporated with a capital stock of $75,000. The incorporators are John H. Spann, John W. Hess, John H. Mitchell and Alexander J. Nisbet.

Annapolis, Md.—Robert Baldwin, John S. Lusk, William R. Cole, and Harry W. Rusk have filed a certificate of incorporation of the Baltimore, Canton & Point Breeze Railway Co. The capital stock is $10,000.

Bartow, Fla.—The Bartow & Plant City Railway Co., have filed articles of incorporation. The capital stock is $220,000. The road will be about twenty-two miles in length. The officers are: J. H. Tatum, president; B. B. Tatum, secretary and treasurer.

Beaver Falls, Pa.—At a recent meeting of the People's Electric Street Railway Co., a committee was appointed to select ground for and ascertain the cost of a power plant, as well as to get estimates on cost of constructing the road from Beaver to Conway. It was decided to begin operations April 1.

The Beaver & Vanport Street Railway Co., capital $15,000, was chartered lately. The length of this road will be two miles, and it will extend from the east side of Buffalo Street, in the Borough of Beaver, to and through the village of Vanport. President, A. O. Meyers; secretary, M. B. Sloan; treasurer, Wm. Wallace.

Belleville, Ill.—Articles of incorporation have been filed of the Belleville & St. Louis Electric Railway Co. The object is to construct an electric railway from Belleville to a point on the Mississippi river in East St. Louis. The principal business office is to be at East St. Louis, the capital stock $200,000, and the first board of directors are George W. Atterbury and John D. Filley, of St. Louis, Mo.; John J. McLean, of Hillsboro, Ill., and others.

Bethlehem, Pa.—A charter has been granted for the South Bethlehem & Saucan Street Railway.

Bryan, Tex.—Guy M. Bryan, Jr., Fred. S. Robbins and S. P. Bryan have procured a charter for an electric railway to be built from Velasco to Bryan Heights, two miles distance.

Buffalo, N. Y.—Articles of incorporation of the Buffalo & Lancaster Electric Railway Co., to build a street railway between Buffalo and Lancaster have been filed in the office of Secretary of State Rice by William J. Volkner, of Buffalo. The capital stock is $200,000, and the directors include George M. Browne, George Bingham, Daniel O'Grady, George A. Davis and John H. Slack. Tracks will be laid covering a distance of twenty miles.

Another company called the Buffalo, Bellevue & Lancaster Railway Co., have also been organized. The capital stock is $90,000, and the directors for the first year are Henry W. Box, James A. Roberts, John C. Conway, John L. Williams, Hardin H. Littell, John N. Scatcherd, Daniel O'Day, all of Buffalo. The road will probably be operated in connection with either the Broadway, Clinton or William Street cars, and will be seven miles long.

The New York Central Railroad Co. have purchased land between Buffalo and Lancaster for repair shops and will found the town of Depew. An electric railway will probably then be built connecting with Buffalo.

Centreville, Ia.—The mining towns of Centreville, Mystic and Forbush are to be connected by an electric car line. An Eastern syndicate have interested themselves in the project, and the citizens of this place, to encourage the scheme, have raised sufficient funds to secure a survey and plan of the proposed route.

Chicago, Ill.—The Northern & Western Elevated Railroad Co. have been incorporated at Chicago to construct an elevated railroad in Chicago from the intersection of Halsted and Thirty-ninth Streets to the intersection of Irving Boulevard and Milwaukee Avenue; capital stock, $10,000,000; incorporators, Leander D. Condee, John A. Rose and Oscar S. Bass.

The Chicago & Edison Park Electric & Street Railway Co., capital stock, $500,000 have been incorporated to build and operate street railways embraced in the vicinity of the towns of Lake, Calumet, Hyde Park, South, North and West Chicago, Lake View, Evanston, Norwood, Maine, Cicero, Jefferson, etc.; N. H. Hanchette, 173 LaSalle Street, Chicago, Ill. is one of the promoters of the enterprise.

The Park Elevated Railway Co. has been incorporated; capital stock, $50,000; incorporators, Henry W. Magee, John T. Condon and Samuel H. McLaughlin.

The Lakeside Dummy Railroad Co. have been incorporated with capital stock of $1,000,000 by Eugene H. Dupee, Lockwood Honore and Arthur A. Bliss.

The West Side Elevated Railroad Co. have been incorporated with a capital of $15,000,000. The company propose to build an elevated road on the West Side. The stockholders include many of those interested in the elevated road on the South Side. The scheme, as proposed, includes a trunk line with two branches. The form of construction agreed upon is identical with that of the South Side company, which was shown in February number of the Street Railway Journal.

Clinton, Mass.—The Clinton Street Railway Co. last month received their long expected franchise from the board of selectmen.

Columbus, O.—M. H. Neil president, and G. W. Meeker secretary of the Columbus & Westerville Railway Co. have asked for a franchise between this city and Westerville.

The Leonard Avenue Street Railway Co. have been organized to operate a street railway by electric, gas, steam, horse or other motive power. Among those interested in the project is Thomas Leonard, of Columbus.

Papers have been prepared for the incorporation of the Columbus & Grand View circuit of the electric street railway system of the city. The purpose is to run one line from Fifth and Grand View Avenues down Third Avenue to Neil and connect there with the Consolidated line. Another branch of the circuit will start from the same point, come down Grand View Avenue and across the projected bridge over the Scioto and thence along Central Avenue to Broad Street and connect with the West Side road there.

Concord, N. H.—There is a rumor that a syndicate of capitalists of large means have under consideration a scheme for establishing an independent electric railroad from Concord to Boston. The project includes the taking of the local railway plants in this city, Manchester, Nashua and Lowell, and the building of such links as will make the contemplated through line. It is further stated that the efforts now being made to secure the construction of an electric line from Lowell to Nashua is a part of the programme.

Dennison, O.—There is talk about a street railway between Dennison and Uhrichsville, connecting the Pan Handle station at Dennison with the Union station of the P., C., C. & St. L. and C. L. & W. railways at West Uhrichsville. Pittsburgh parties are working the matter up, and if a franchise is granted the road will undoubtedly be built this summer.

Detroit, Mich.—It is proposed to give a bonus of $25,000 to the owners of what is known as the North Detroit Street Railway Co. to build a line this year. The company has no corporate existence. The franchise known under its name is owned by William Livingstone, Jr., George H. Russel and Thomas H. Baskerville. It is a franchise for a street railway to run from the junction of Woodward Avenue and Pallister Avenue to North Detroit.

East St. Louis Ill.—The Columbian Underground Electric Traction Co. of East St. Louis have been incorporated with a capital of $1,000,000. The incorporators are D. J. Murname, George L. Van Beek and Stephen Von Puhl.

Ellicott City, Md.—A new road to connect with the Baltimore Traction Co.'s system is projected.

Fond du Lac, Minn.—The Fond du Lac Electric Co. have been organized with a capital stock of $100,000 to operate an electric railway. Coleman Sutherland & Hines of Fond du Lac are interested in the enterprise.

Gloversville, N.Y.—The Cayadutta Electric Railroad Co. were incorporated last month, with a capital of $120,000 to build a street road from Gloversville to Fonda, twelve miles. The directors are Thomas C. Frenyear and C. R. Huntley, Buffalo; A. N. Broadhead, Jamestown; Everett Smith and Charles M. Gibson, Schenectady; G. Levor, A. J. Zimmer and James S. Burr, Gloversville; C. E. Arnold, Albany; Harwood Dudley, Johnstown and J. Ledlie Hees, Fonda, each of whom subscribes for ten shares of the capital stock. The officers for the first year are: President, Everett Smith; first vice-president, C. H. Huntley; second vice-president, A. J. Zimmer; treasurer, J. Ledlie Hees; secretary, Thomas C. Frenyear.

Grand Forks, N. Dak.—C. F. Erroll, of St. Paul, is largely interested in the Grand Forks Electric Railway Co., who propose the installation of a road here. The conditions of the ordinance passed by the Council require the acceptance of its conditions within ninety days, construction to commence ninety days thereafter and one mile to be completed six months later.

Grand Rapids, Mich.—Percy T. Cook has presented to the Council a petition asking for a franchise for a new street railway. The contemplated line commences at the corner of Hall and South Ionia Streets and reaches the centre of the city. Mr. Cook agrees to pay to the city treasurer in each year one and a half per cent. of the gross receipts from said road in lieu of all taxes, assessments and license fees and also to transfer a certain proportion of the earnings over ten per cent.

Harrisonburg, Va.—The Harrisonburg & Bridgewater Electric Railway Co. have been organized; the incorporators are Rivers Talum, E. A. Saunder, W. J. Johnson of Richmond.

Huntington, W. Va.—An electric railway between this place and Ashland, Ky., is proposed. Among those interested are: T. N. Fordyce, of Detroit, Mich., J. H. Sentz, of Spring Hill, W. Va., and T. E. Stout, of Huntington.

Hyde Park, Mass.—The Norfolk & Suffolk Street Railway Co. in which Hon. Moody Merrill, C. G. Chick and J. E. Cotter are interested will probably begin roadbed construction soon.

Jonesboro, Ind.—Work on the Jonesboro & Marion Street Railway will begin as soon as the state of the weather will permit, and by the employment of a large number of men, the company expect to have the cars in operation by July next. Frank E. Snow and William E. Avery, of Detroit, Mich., are the principal owners of the proposed road.

Kenosha, Wis.—John W. Munson has been granted a franchise to build an electric street railway in the city of Kenosha. Work will be commenced as soon as he can secure the consent of the property owners on streets where the road will run.

Keokuk, Ia.—John S. Wise and J. H. Herrick, both of the Edison General Electric Co. of New York, James H. Anderson, James C. Davis and Asaph Buck are the incorporators of a new road called the Keokuk Electric Street Railway. Twenty years is the life of the corporation, and the capital stock is $200,000.

Kingsley, Pa.—The meeting of prominent citizens was lately held to take steps for the building of an electric road from this place to Harford. Mr. Horace Sweet was chairman and Messrs. L. W. Moore and W. B. Guile were appointed a committee to make inquiries.

Kingston, N. Y.—The early building of the proposed electric railroad here is said to be almost assured. The Thomson-Houston Electric Co. will probably furnish the motors, and the Manhattan Trust Co. will furnish the capital. It is also said that the franchise of the Kingston City Horse Railroad Co. will be purchased for $175,000.

Lansdale, Pa.—The originators of the proposed electric road from Lansdale to Harleysville are said to be Lyman Rosenberger and Manassa Clemens. Henry S. Kriebel of North Wales is also an earnest supporter of the enterprise.

Leavenworth, Kan.—A Leavenworth company has been chartered, for the purpose of building and operating an electric street railway between the city and Fort Leavenworth. The estimated length of the line is fifteen miles, and the capital stock $300,000. The directors are Geo. A. Baker, J. C. Lysle, Geo. Burrows, Laurens Hawn, and William Dill, of Leavenworth; W. F. Putnam, Exeter, N. H.; W. A. Patten, Kingston, N. H.

Lenape, Pa.—J. Clempson Sharpless is interested in a proposed electric line here, and has had a survey made for a line from Lenape to Unionville.

Lewiston, Pa.—Among the probabilities spoken of is an electric railroad from this place to Logan.

Lima, O.—W. L. Parmenter, Wilbur Fisk, Thos. Duffield, Theo. D. Robb and F. Langan have applied to the city asking permission to construct two street railway routes, one on North Main Street, the other from the intersection of Tanner and Wayne Streets, to the depot of Pittsburgh, Fort Wayne & Chicago Railroad.

Los Angeles, Cal.—An electric railroad to connect the Julian County and Warner's ranch with Los Angeles is being agitated. The road, if built, will probably have a branch from Santa Ysabel to Warner's to connect with the Temecula route.

Marion, Ind.—Papers have been drawn up for the incorporation of the Marion Electric Railway, Light & Power Co. with a capital stock of $100,000. The incorporators are Dan Babst, Jr., C. H. Norris, W. E. Scofield, E. Huber and D. A. Frank.

Marseilles, Ill.—The Marseilles Electric Street Railway Co. have been organized with $12,000 capital stock. Incorporators are Frank Montgomery, Richard Hughes, and A. J. Gum.

Marquette, Mich.—The Negaunee & Ishpeming Electric Street Railway will be extended to Marquette.

McKeesport, Pa.—An electric street railway is to be built parallel with the Baltimore & Ohio railroad from Boston to Elrods, thence to Christy Park and McKeesport, a distance of about three miles. The line is assured, as several capitalists from this section and others from Pittsburgh, are interested.

Memphis, Tenn.—The Raleigh Railroad Co. and the Citizens' Street Railway Co. both wish to lay tracks on Front Street from West Court Street north.

Millbury, Mass.—The selectmen have received two petitions for an electric railroad from Worcester to Millbury. The first one is from the Consolidated Street Railroad, of Worcester; the other is from H. W. Aiken, Esq., Samuel Winslow, L. L. Whitney, C. D. Morse and others, in behalf of the Worcester & Millbury Electric Railway Co.

Montclair, N. J.—The Montclair & East Orange Street Railway Co. have been incorporated. The road will be two miles long. The capital stock is $25,000. The incorporators are Morris Leeking of East Orange, Thomas Nevins, Josiah O. Ward of Orange; Augustus C. Studer, William Jacobus of Montclair, and Francis M. Eppley of East Orange.

New Albany, Ind,—The Glenview Park Railroad Co. were organized March 4, with a capital of $50,000. The officers are: Jonathan Peters, president; John Crane, vice-president; R. W. Morris, treasurer; E. B. Stosenburg, secretary. The road is to run through State Street to Glenview Park, and will be two miles long and operated by electricity. It will be completed by July 1.

New Britain, Conn.—There is a movement on foot here to organize a stock company for the purpose of running an electric railroad to Bristol.

New York, N. Y.—A bill has been introduced in the assembly permitting the use of Fifth Avenue below Forty-second Street for a street railroad.

AN electric street railroad to connect Harlem with City Island has been projected. It is proposed to build a bridge across the mouth of Pelham Bay from Belden Point, City Island, to Locust Point, Messrs. Duryee, Belden and Piepgrass, wealthy residents along the proposed line, are, it is said, pushing the matter.

Newburyport, Mass.—A petition is being circulated asking the legislature for a charter to establish a street railroad from the terminus of the Newburyport & Amesbury Railroad to Haverhill & Groveland Street Railroad.

Niagara Falls, N. Y.—Work on the electric road on the Canadian side will be begun as soon as frost is out of the ground. It is said that the Canadian Pacific Railway is backing the enterprise.

Niagara Falls, Ont.—A bill has been presented to the Ontario Legislature to incorporate the Niagara Falls Park & Queenston Electric Railway & Steamboat Co. The company consists of E. B. Osler, Herbert Carlyle Hammond, both of Toronto; William Hendrie Hamilton and Richard Bladworth Angus of Montreal. The proposed route is through Niagara, Queenston, Queen Victoria Park, Chippewa and Fort Erie. The capital stock of the company is $1,000,000.

J. M. Brinker, of Buffalo, is one of the incorporators of the Niagara Falls & Queenston Railway Co. who propose building a steam or electric railway to Queenston. A bridge franchise across the river is included in the scheme.

Niles, O.—The Mineral Ridge & Niles Electric Street Railway Co., with a capital stock of $50,000,000, have been incorporated by C. F. Whitney, W. W. Rosensteel, Edward Blunt E. J. Ohl and W. T. Williams, of Warren, O., and George Reeves and J. S. Benedict of Niles.

Norfolk, Va.—The City Council have two petitions for street railway franchises before them. One is from the People's Railway Co., and is signed by W. A. Young, M. Glennan, Walter Sharp, P. L. Poindexter, L. D. Smith and Charles Sharp; the other is from the Rapid Transit & Improvement Co., and is signed by F. L. Grandy, their president.

Oxford, Pa.—A citizens' meeting was lately held to further the proposed electric railroad from Oxford via Russellville and Cochranville to Parkersburgh, a distance of fourteen miles. Encouraging addresses were also made by S. R. Dickey, president of the National Bank of Oxford, Dr. J. Willis Houston, Chester Martindale and others. A resolution was adopted pledging the movement hearty support.

Pekin, Ill.—The Pekin Street Railway Co. have been incorporated with a capital stock of $10,000; incorporators, Adolph Fehrman, Otto Koch and Freiderich Schnellbacher.

Philadelphia, Pa.—Last month a new company was incorporated under the title of the Philadelphia Rapid Transit Co., Philadelphia; capital, $300,000. Directors, Edward E. Denniston, Alfred Parrish, John P. Ilsley, Edmund A. Hopkins, William S. Harding, Philadelphia.

Pittsburgh, Pa.—It is said that the Mt. Washington electric road will be built before summer.

Pottsville, Pa.—The time allowed the Schuylkill Electric Railway Co. for installing their road has been extended to March 4, 1893.

Another new electric railway has been chartered here, entitled the Pottsville & Minersville Electric Railway Co. The capital is $100,000, and the projectors are ex-Congressman Charles N. Brumm, John F. Finney, D. D. Phillips and others connected with the Shenandoah, Ashland & Mahanoy City road. The road will be built by a circuitous route between here and Minersville. It will take in the greater part of Mahantongo Street, going down to Railroad.

Reading, Pa.—A charter has been granted to the Reading & Temple Electric Railway Co.; capital, $30.000. The directors include John A. Rigg, Matthias Moyer, F. S. Livingood and W. K. Leaman, all of Reading. The line will be five miles in length, through a number of suburban villages to the north of the city.

At a meeting of the Berks & Dauphin Turnpike Co. at Myerstown, it was decided to apply for a charter for the reconstruction of an electric railway from Reading to Lebanon. A committee on subscriptions consists of George W. Donges, Capt. J. H. Bassler and Joseph Coover.

Redlands, Cal.—The petition of I. N. Hoag and others, for a street railway franchise, mentioned in our last issue, has been granted. The franchise provides that the road shall be put in operation within eighteen months.

Roanoke, Va.—A charter has been granted to the Crystal Street Railway Co.

Rockland, Me.—Shaw & Ferguson, of Boston, have been awarded the contract for building the electric road. The Thomson-Houston company will furnish the motors, the Westinghouse company the generator and the Briggs Car Co. of Amesbury, Mass., the car equipment.

St. Louis, Mo.—It is reported that the St. Louis & Kirkwood Electric Railway Co. have secured connection with the Market street line of cars for their proposed electric line from St. Louis to Kirkwood by way of Sutton, Shrewsbury Park and Webster Groves, and that the construction of the tracks will be commenced early in the spring.

The proposition to construct and operate an electric railway from the limits of the city of St. Louis to Ballwin by way of Clayton and Manchester, is being favorably considered by the people of the county. It is proposed to construct the road over the fields so that a high rate of speed can be had.

Sacramento, Cal.—An electric road from Oak Park to a point near the County Hospital and thence to Florin is under consideration.

San Francisco, Cal.—The San Francisco & West Shore Railroad Co. have been formed to build a road from San Francisco to Half Moon Bay, a distance of thirty miles. Lewis F. Dunand of San Francisco is interested in the project.

Saratoga, N. Y.—Thomas Murray, of New York, has been awarded the contract to build the line of the Saratoga Union Electric Railway. The road must be completed by June 1. The cars to be used will be the Pullman double deckers for lake travel and other kinds for track travel. The company expect to make a schedule time of ten minutes from Saratoga to the lake.

Sioux City, Ia. —The Sioux City & Leeds Electric Street Railway Co., capital stock $200,000, have been formed to construct, maintain and operate street or other railways, in or adjacent to Sioux City, operated by horse, electric or steam power. A. M. Coffman, W. E. Higman, W. M. Stevens, C. C. Peirce, Maris Peirce, E. W. Skerry, of Sioux City, and A. W. Gates Fairbanks, of Boston, Mass., are the promoters.

Spokane, Wash.—Contracts have been let by Francis H. Cook, for the remodeling of the motor line road. The work of reconstruction will soon be commenced by Charles H. Baker & Co., of Seattle, representing the Short Electric Railway Co.. and the work will be completed by May 13. The gauge of the road is three feet and six inches.

Taftville, Conn.—The Fonemah Co., intend, it is said, to build an electric railroad from Baltic to Norwich, running through Occum, Limerick and Granville.

Tazewell, Va.—A charter has been granted to the Tazewell Street Railway Co.

Valparaiso, Ind.—Edmo Charles Getty, of New York, on behalf of the Valparaiso City Railway Co. has presented a petition to the Council asking for a street railway franchise.

Velasco, Tex.—The Velasco & Surf Side Railway Co. have been incorporated with a capital stock of $250,000, by W. D. Lee, G. W. Angle, and Frank Caldwell. The company propose to build an electric road from Velasco to Surf Side.

Washington, D. C.—The House recently passed the bill to incorporate the District of Columbia Suburban Railway Co. The incorporators of this company are Gen. Eppa Hunton, Charles E. Creecy, John T. Mitchell, and others. This road is to commence at the dividing line between the District of Columbia, to the State of Maryland on the Bladensburg Road, extending along Maryland Avenue and 15th Street, N. E., thence northward in the direction of Brookland to a point northeast of the Soldiers' Home. The bill stipulates that the line from Bladensburg to Pennsylvania Avenue east, shall be completed within three years. Capital stock $400,000. The motive power is to be either cable, electric or other mechanical power, except steam.

A bill has been introduced in the Senate to incorporate the Union Passenger Railroad Co. with the following incorporators: John G. Slater, Thomas B. Singleton, Morris Keim, and others. This road is to commence at 19th Street, in the southeast. The motive power will be either cable or electricity. The company will have a capital stock of from $300,000 to $500,000.

Waukegan, Ill.—The Waukegan & North Shore Rapid Transit Co. have elected the following officers: President, Dunlap Smith of Chicago; vice-president, A. L. Hendee of Waukegan; secretary, Homer Cook of Waukegan; treasurer, C. E. Simmons of Chicago. The company propose to build and operate seven miles of electric road in Waukegan.

West Superior, Minn.—J. Hagen, R. A. Haste and L. F. Johnson have formed a company with a capital stock of $250,000, to operate a street railway in West Superior.

Winona, Minn.—The Winona City Railway Co., with a capital stock of $100,000, have been incorporated.

Personal.

Mr. William Hazelton, 3d, of Philadelphia, made us a call during March. Mr. Hazelton represents the Short Electric Railway Co., in Philadelphia.

Mr. Henry Alexander, the treasurer of Alexander, Barney & Chapin, has tendered his resignation and will sever his connection with the company April 1.

Mr. William Roseborough has been appointed superintendent of the Rochester Electric Railway. Mr. Roseborough has been connected with the company for twenty-three years.

Mr. H. W. Shurtz, of the Northwestern Electrical Engineering Co., of Portland, Ore., came East last month to be married. While in New York City he called frequently at our office.

Prof. Elihu Thomson recently addressed the Boston Society of Civil Engineers at their annual banquet. He predicted that in time all steam locomotives would be displaced by electric motors.

Mr. William Baxter, Jr., of the Baxter Electric Motor Co., of Baltimore, Md., called at our office recently and mentioned that his company were enjoying their full share of patronage and doing a large business.

Mr. C. S. Clark, manager of the West Side electric road at Kansas City, Mo., has resigned his position to accept the management of the street railway at Augusta, Ga. He will be succeeded by Mr. W. H. McClelland.

Mr. D. B. Dean, formerly of the Electric Merchandise Co., and well known in street railway circles, has made an engagement with the McGuire Manufacturing Co., and will represent them in New York City. Mr. Dean has our best wishes in his new sphere.

Mr. C. E. Wilson, well known from his connection with the Knapp Electrical Works, has just made arrangements to represent the Electric Merchandise Co., Chicago. Mr. Wilson's long experience and large acquaintance will make him a valuable addition to the staff of the company.

Mr. Edward J. Robinson, general manager of the Laclede Car Co., St. Louis, has been spending some days in New York. He reports business in good condition. The cars for the Third Avenue (N. Y.) road have been approved, and some of them will be ready for early summer delivery.

Mr. J. W. Dickerson, formerly editor of the *Western Electrician*, has accepted the position of associate editor of the Street Railway Journal and manager of our Western office. Early in April our Western office will be removed to rooms 535 and 537 "The Rookery," where Mr. Dickerson will be glad to welcome all callers.

Mr. P. N. Hyden, a representative of the Pullman Palace Car Co. recently returned from Sidney, Australia, where he has been for several months superintending the erection, and finishing a train of Palace cars, which were shipped last year (knocked down) by the Pullman Co. through Henry W. Peabody & Co., shipping agents of this to the Government of New South Wales. On leaving Mr. Hyden received complimentary letters from the Railroad Commissioners of the government highly commending his work.

New Publications.

Calendar of the Lunkenheimer Brass Manufacturing Co., Cincinnati, O. This calendar has on its face a representation of the Handy Gate Valve, and as a novelty will be preserved by those who receive it.

Electric Heating is the title of a handsome pamphlet just issued by the Electric Merchandise Co. of Chicago, the selling agents for the Burton electric heaters. The system is thoroughly described, its merits for street railway service are fully presented, testimonials are published from those who have made severe tests of the heaters, and articles which have appeared in electrical journals are reproduced.

Eddy Motor Installations. This publication presents views and brief descriptions of some of the most interesting plants installed by the Eddy Electric Manufacturing Co., of Windsor, Conn. Two complete equipments supplied to the Globe Tobacco Works, of Detroit, and the Globe Printing Co. are very thoroughly illustrated. Manufacturers contemplating the use of electric power will find this a very interesting and instructive publication.

The Vogel Cable System, issued by the Vogel Cable Construction Co. of New York. This pamphlet contains a description and illustrations of the shallow cable system of the Vogel company, including their novel types of grips for single and double rope systems. Views are also given of the construction used at Butte, Mont., where a road built on the Vogel system and with grades of 18 per cent., has been in successful operation for over two years.

Seeger & Guernsey's Cyclopædia of the Manufactures and Products of the United States. Published by the Seeger & Guernsey Co., 7 Bowling Green, New York. Price, $10. This complete and exhaustive cyclopædia is arranged alphabetically according to products and manufactures, and will be found most useful to buyers and purchasing agents of all corporations, as well as to individual buyers on an extensive scale. The volume contains 1,360 pages, is carefully printed and substantially bound. In addition to the regular directory the volume also contains an index to separate articles, commencing with "Abacuses "and ending with "Zymosimeters," and a compact cipher code.

The Milliken Patent Poles. This pamphlet, issued by Milliken Bros., of New York and Chicago, is a third edition, the two former editions having been exhausted by the large demand made upon the manufacturers for copies. The different types of Milliken poles for street railway and electric lighting service are illustrated and described, and several pages are devoted to views of actual construction. In addition, some valuable information is given of the best methods of setting poles, theory of the Milliken pole construction, etc. ; while a report of the recent test made under the direction of Prof. R. H. Thurston, of Cornell University on the Strength of Iron and Steel Poles for Street Railway Work is also included. An idea of some of the iron work construction performed by Milliken Bros. can be gained from the last two illustrations in the book, which show views of the Buffalo (N. Y.) power house roof and the Long Island Railroad passenger station, both during erection.

The Annual Report for the Year 1892 of the Railroad Commissioners for the State of Massachusetts, published by the Commission. This report, which constitutes the twenty-third of the annual reports issued by this commission, covers 336 pages and presents much interesting matter. In the department relating to street railways, we note some interesting statistics in regard to accidents. The total number of accidents occurring on the West End Street Railway for the year ending September 30, 1891, was 204, of which 122 were due to horse cars, and eighty-two to electric cars. Of these fourteen were fatal, divided ten and four respectively, between horse and electric, and 190 not fatal, divided 112 and seventy-eight respectively. The accidents by horse cars averaged one to every 105,528 miles run, and by electrics, one to every 55,953 miles run. The accidents average one in every 985,656 carried. In the part of the report devoted to financial matters, we see that of the fifty-stx street railways, thirty-four declared and paid no dividends. The average rate of dividend on the total amount of capital stock was 5.63 per cent., and the net earnings amounted to 5.7 per cent. on the aggregate of capital stock and gross debt. Passengers were carried to the number of 176,090,189, being an increase of more than 11,000,000 over the number of passengers for the preceding year. The number of passengers carried on street railways in the state exceeded the number carried by the steam railways by more than 68,000,000. The average amount received for the conveyance of each passenger was 5.06 cents. The average cost of carrying each passenger, 4.05 cents.

An Electric Patent Suit.

A suit deserving of more than passing notice has been commenced in the United States Courts for the northern district of New York directed against the Troy & Lansingburg electric road and its officers asking for an injunction and accounting for past infringements of patents 345,845 and 424,298 granted to John C. Henry. These patents were applied for in January and October 1885 and the latter was issued in July 1886, the former, however, not until March 1890, its issue being witheld by the Patent Office on account of interfering patents applied for by Van Depoele and others at a later day. The courts are now sifting the rights of inventors in this art and it is quite probable they will find many infringements. With a liberal interpretation the following claims selected from the Henry patents may be construed to completely cover the trolley system exclusive of the machinery. In patent 424,298, claim 1 is for the use of trolley wires suspended over the track by insulators, and claims 6 and 8 for trolley wires in combination with an under running trolley held against the wire by spring pressure. In patent 345,845 claim 5 is for the combinationof insulated feed wires connected at intervals to the suspended trolley wire. claim 10 for all forms of insulators having passageways for the trolley through them and claim 15 for curve construction where the trolley wires are held in position by guy wires.

A Lecture on Belts.

At the meeting of the Polytechnic section of the American Institute of New York on Thursday, evening, March 17, Mr. Chas. A. Schieren read a paper on the "Art of Tanning Leather and Making Belting." He showed in the lecture the various processes through which a hide passes in the tannery, which were all beautifully illustrated by lantern slides. The various departments through which the hide passes in the tannery, the machinery used for manipulating the leather as well as the grinding and leaching of the bark, were illustrated and thrown on a large canvas by lantern slides. This made the lecture doubly interesting because the audience could get a clearer idea of the manipulation of leather in the tannery.

In the making of belting Mr. Schieren showed a hide of leather from which were taken four pieces of equal length and width ; they had been submitted to a test by a powerful testing machine of the Fairbanks Scale Co. of New York. These pieces were all eighteen inches long and two inches wide, and were numbered. No. 3, being cut from the lower part of the centre, broke at 2,490 lbs. strain, which would give the piece a transverse strength of 14,940 lbs. per square foot. No. 4, cut from the upper part of the centre of the hide, broke at 2,000 lbs. No. 5, cut from the lower part of the shoulder piece, broke at 1,390 lbs. No. 6, cut from the upper part of the shoulder, broke at 1,130 lbs.

The lecturer explained that very many belts were sold and offered in the market which were made from one piece of centre on one side, and a piece of shoulder on the other side. He clearly proved that such belts were defective, because of the shoulder being so much more liable to stretch, and not being able to withstand the strain of a centre piece by at least forty-three per cent., it would be a serious mistake to put the two pieces together for transmission of power, on account of the unequal tension. A belt would be superior if two shoulders were used, or two centre pieces separately. He claimed that a belt made from two centres could withstand a transverse strain of nearly 26,940 lbs. to the square foot, whereas, a belt made from shoulders would hardly stand 15,120 lbs. strain, and such belts would not be reliable, especially on dynamos, or swift running machinery, in fact, for almost any drive where a belt is subjected to severe strain.

Equipment Notes.

Schleicher, Schumm & Co., of Philadelphia, Pa., engineers and builders of the Otto gas engine, have opened an office in Boston, at 93 Pearl Street.

The Ellis Car Co. of Amesbury, Mass., are building a large number of cars for Johnstown, Tenn. This same company have recently delivered two sample cars to the Milwaukee Railway Co., one open and one closed.

The Lewis & Fowler Manufacturing Co. of Brooklyn, N. Y., are, as usual, supplying cars and other appliances demanded for the opening of new roads and the extension of old lines consequent upon the arrival of spring.

The Tramway Rail Co. of Pittsburgh, Pa., report a large call for the many appliances which they manufacture, especially the Samson bridge chair, mentioned in our last issue. A large order for this appliance has recently been received from Peoria, Ill.

Charles H. Davis, consulting engineer at 120 Broadway, New York and 308 Walnut Street, Philadelphia has issued a small folder entitled "Facts and Figures Interesting to Street Railway Men," and giving in convenient form interesting facts and tables.

The Newburyport Car Manufacturing Co. of Newburyport, Mass., number among the orders recently taken for cars some for Brockton, Mass., Allentown, Pa, and Rochester, N. Y. All of these will be equipped with the Reliable Manufucturing Co's. improved ratchet handle brake.

G. F. Whitney, of Boston, Mass., manufacturer of soaps for cleaning paint, cars, etc., reports a large business among street railway companies as well as other consumers. Mr. Whitney makes a specialty of soaps of this class, and tells us that his business is constantly extending.

The Stearns Manufacturing Co., of Erie, Pa., on the first of May, will establish a branch office in Chicago, which will be under the management of their Mr. A. F. Griswold, who has been with the firm for a great many years. Their office will be located in the Rookery Building, No. 1120.

The Lamokin Car Works of Chester, Pa., have, as usual, a large number of orders on their books, and their cars seem to meet the verdict of popular favor. Among recent shipments made by them are cars to Washington, D. C., Derby, Conn., Williamsport, Pa., Altoona, Pa. and Manchester, Va.

The Pennsylvania Iron Works Co., of Philadelphia, Pa., have received the contracts for the construction of two cable power stations for the West Chicago Street Railway Co. One of these is to be erected at the corner of Blue Island Avenue and Twelfth Street, and the other at the corner of Van Buren and Jefferson Streets.

The Goubert Manufacturing Co. of New York, find a great demand for their heaters, which is keeping them very busy at their New York headquarters, 32 Cortlandt Street. Mr. W. W. Nugent, a consulting and contracting engineer of prominence, has been appointed sole agent for this heater, vertical and horizontal, in Chicago, his office being located at 823 Home Insurance Building, that city.

The Eddy Electric Manufacturing Co. of Windsor, Conn., will begin work on the addition to their factory as soon as the weather makes it practicable. The new building will be equipped with the most modern machinery, and will make it possible for the company to treble their output. The addition will give the company facilities for increasing the number of railway generators for which they have lately received several orders.

The Southwark Foundry & Machine Co., of Philadelphia, sole makers of the Porter-Allen high speed, automatic engines, have many calls for this engine in electric stations. The Porter-Allen engine is made simple, condensing and compound, and has achieved for itself an enviable reputation in the line of work for which it is adapted. The company also manufacture reversing engines, blowing engines, centrifugal pumps, boilers, tanks, etc.

The Campbell & Zell Co., of Baltimore, Md., have issued a circular letter stating that they have secured the entire plant known as the Ramsey Engineering Works, located at Locust Point, Baltimore. With these increased facilities, operating in conjunction with their Enterprise Iron Works, at Canton, they state that they are enabled to meet the demand for the Zell improved water tube safety boiler and other apparatus which they manufacture.

The Charles Scott Spring Co., of Philadelphia, Pa., manufacture a high class line of crucible steel springs for cable, electric, and horse cars. Their single elliptical springs, when used in connection with spirals, are claimed to provide the easiest running for high speed electric or cable service. The Charles Scott Spring Co. also manufacture and are ready to deliver on order, spirals of any required size or capacity, as well as graduated springs to fit any truck or box.

Milliken Bros., 55 Liberty Street, New York. manufacturers of Milliken patent poles for electric street railways and electric light work. have recently issued a handsome catalogue of their patent poles, third edition, which is mentioned more particularly in another column. Owing to the great demand for these poles in all portions of the world, this well known firm have made arrangements with parties in England, France and other parts of Europe, to manufacture these goods.

George Cradock & Co., of Wakefield, Eng., write us that they have secured the contract for the cable to be used on the line of the London Tramways Co.,at Brixton,London. This rope will be 30,000 ft. long, and 3.518 ins. in circumference, and will weigh about thirty tons when completed. It will be delivered about the end of April, and will be made on Lang's lay. This company on March 22 installed a cable on the Tenth Avenue and 125th Street line of the Third Avenue Railway Co., New York.

F. P. Little & Co., of Buffalo, N. Y., report that they have just closed a contract with the Western Transit Co., for lighting their city elevators A. and B. This contract includes a 7×12 Rice engine, manufactured by The John T. Noye Manufacturing Co. ; one E. I., cylindrical type, Thomson-Houston dynamo, and necessary wiring and equipment for 300 sixteen C. P. incandescent lights and four arc lights, to be run from the same circuit. They are also to erect a 10×25×13 ft. brick building in which to put the plant.

The Johnson Co., of Johnstown, Pa., have decided to establish an agency for North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas and Tennessee, in Atlanta, Ga., which will be in charge of their Southern agent, Mr. Wm. W. Kingston, whose office will be in the new Equitable Building after its completion, about May 1, next. Until that time he may be addressed at Room No. 10, Y. M. C. A. Building, Atlanta, Ga. This action on the part of the Johnson Co. will be heartily appreciated by their customers in the South.

The Ball Engine Co., of Erie, Pa., write us that they are furnishing a number of street railways at the present time with their well known engines. Among these roads are the Wilmington Street Railway Co., Wilmington, N. C. ; Rome Street Railway Co., Rome, Ga. ; Hoboken Rapid Transit Co., Hoboken, N. J. ; Schuylkill Electric Railway Co., Pottsville, Pa. ; Niagara Street Railway Co., Niagara Falls, N. Y. ; Sandusky Street Railway Co., Sandusky, O. They are also furnishing the Erie Electric Motor Co. with a 450 H. P. tandem, compound engine.

The Pond Engineering Co. have recently closed a contract with John A. Barham, president of the Janesville (Wis.) Street Railway Co. for the complete steam plant, necessary to operate his road by electricity. The plant includes a 14×13 Armington & Sims Engine, with foundation box; 66×16 steel boiler with stack and the usual fittings, a No. 3 Blake boiler and feed pump and a No. 5 Hoppes exhaust heater. The Pond company's contract also included delivery and erection of this machinery in Janesville, with foundations, brick work, pipe connections,etc., all ready for service.

The United States Steam & Street Railway Advertising Co., Carleton & Kissam proprietors, still continue extending their immense plant, having lately closed a lease with the Columbus Consolidated Street Railroad Co., of Columbus, O., for the advertising privilege in all their cars. The company formerly ran the advertising themselves, but concluded that it was more profitable for them to make a long lease with Carleton & Kissam, whose method of conducting the street car advertising business, has met the approval of many of the most prominent street railway presidents in the United States.

The Trenton Iron Co., in addition to the large business which they are doing in the street railway field, have many calls for their wire ropes in other industries. In addition to one line which they recently built for the Holy Moses mine,they have received contracts from the Amethyst Mining Co. for a cable having a length of 8,250 ft., and a capacity of 200 tons per day ; another line of 5,150 ft. for the Smuggler Union Mining Co. in Ouray. Colo., with a capacity of 200 tons per day, and another line for one of the Haggin mines in Guanacevi, Mexico, having a capacity of 100 tons per day, and a length of 5,960 ft.

Thomas H. Fearey, New York State agent for the railway Department of the Thomson-Houston Electric Co., has a pleasant office on the sixth floor of the Kirk Building, Syracuse, N. Y., where correspondence about electric railway business in New York State should be addressed. He has recently closed contracts to equip the Union Electric Railway, Saratoga Springs; the Niagara Falls & Suspension Bridge Railway, and the Buffalo, Bellevue & Lancaster Railway, all to be completed by June 1. Besides the above, orders have been received for additional equipment from the Buffalo Railway Co.; the Rochester Electric Railway; the Troy & Lansingburg Railway, and the Elmira & Horseheads railway.

The Corliss Steam Engine Co. of Providence, R. I., established by Geo. H. Corliss, inventor of the Corliss engine, have supplied many engines to street railway companies. Their high reputation as engine builders is well known, and they seem to make every effort to please their customers and maintain the reputation which they have always had for fair dealing and high classes of goods. Their works have been fully equipped, at great cost, with heavy special tools for the manufacture of their engines. This company are also manufacturers of the Corliss patent vertical tubular water leg boiler, especially adapted for compound and triple expansion engines requiring super-heated steam and at a very high pressure.

The Price Railway Appliance Co., of Philadelphia, write us that their type of rail construction is meeting with much favor wherever it is introduced. At a stated meeting of the Board of Directors of the People's Passenger Railway Co., of Philadelphia, Pa., held November 2, 1891, the following resolution was adopted: "*Resolved*, that the Board of Directors of the People's Passenger Railway Co., for the information of the Price Railway Appliance Co., and that of any other railway company interested in the matter of a perfect track, desire to say, that this company has now in use a track on Eighth Street, from Walnut to Market Street, laid with the Price railway construction No. 5, and that the same is entirely satisfactory to them, and merits their commendation."

The Reliance Electric Manufacturing Co., of Waterford, Ont., who are building the Rae apparatus in Canada, have secured the contract for the equipment of the Toronto & Mimico Electric Railway. This road will start from the terminus of the Toronto City Railway Co.'s lines on Queen Street and extend to the village of Mimico and eventually to Long Branch, a total distance of about seven miles. The road runs along the lake shore for the entire distance. The Reliance company have the contract for the entire equipment exclusive of track. The power station will contain one Armington & Sims engine of the compound condensing type, 125 H. P., and the Rae station electrical apparatus consisting of one eighty-five K. W. generator and necessary appliances. The motors for this road are of Mr. Rae's latest design of single reduction motors, which are at present built only in Canada.

The American Engineering Co. of New York, whose multiple distributing system is in operation on the line of the Coney Island & Brooklyn Electric Railway, and was described in the last issue of the STREET RAILWAY JOURNAL, tell us that their car is still operating very successfully. The line has been visited by a large number of prominent street railway managers, and the president of the railway company, Gen. H. W. Slocum, has expressed himself as much pleased with the results shown. The validity of the patents owned by this company has been attacked in one or two quarters, but the company assure us that all charges of any kind reflecting upon their patents, are utterly false and without foundation. They state that they absolutely own and control all patents used in the construction and operation of the multiple distributing system as installed by them, and that they guarantee every feature of it against legal proceedings.

The Reliable Manufacturing Co., of Boston, Mass., have shipped to the Thomson-Houston Electric Co., of San Francisco, Cal., sixty of the Reliable sand boxes to be used on the San Francisco & San Mateo Street Railway Co., of San Francisco, a new electric road about completed. They have also shipped forty boxes to the Lamokin Car Works, of Chester, Penn., to be applied to large new cars just built for two new street railway companies ; also during the last month the Reliable sand box and Collett ratchet brake handles have been shipped to the Augusta, Hallowell & Gardiner Railway Co., Augusta, Me. ; Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Co., New York ; Federal Street & Pleasant Valley Railway Co., Pittsburgh, Penn. ; Natick & Cochituate Street Railway Co., Natick, Mass. ; Pennock Battery Electric Light & Improvement Co., Peoria, Ill. and others.

The Engineering Equipment Co., of New York, have recently received an order from the Buffalo Street Railway Co., consolidated lines, for three twenty-four inch Underwood cotton leather belts for their power station. These are in addition to the four cotton leather belts of the same make and size now running at this station. These and other Underwood belts running in Buffalo were inspected and found to be doing exceedingly well. The Iroquois and Broezel Hotels are equipped with them and guests of these houses who were attending the Convention were shown the practical working value of Underwood belting. This company write us that suit has been brought by the Builders' Insulating Tube Co., of Lynn, Mass., and the Indurated Fibre Industries Co. against the Interior Conduit & Insulation Co., for infringements of patents that cover the making of pipes, or paper tubing to carry electric wires.

The Robinson Electric Truck & Supply Co., of Boston, have received orders from the Brooklyn City Railroad Co., for forty Robinson radial trucks for the first forty electric cars which are to be put in operation in Brooklyn. These are open cars, thirty-five feet long, and of the regular Robinson type, having twelve benches and seating sixty passengers each. Twenty of the car bodies are being built by the Lewis & Fowler Manufacturing Co. of Brooklyn, and twenty by J. M. Jones' Sons of West Troy, N Y. These cars are to run on the Fort Hamilton division. All the electric cars in Providence, R. I., are equipped with the Robinson radial truck, and have been giving such excellent satisfaction that the Union Railroad Co., on whose lines they are running, has placed a further order with the Robinson company for a full equipment of radial trucks for their open cars, to be used on the Providence lines during the summer. These are only samples of the orders recently received for Robinson radial trucks.

The New Process Raw Hide Co., of Syracuse, N. Y., send us the copy of a letter recently received by them from C. E. Barnes, superintendent of the Plymouth & Kingston Street Railway Co., of Plymouth, Mass., a large user of their gears. In this letter Mr. Barnes says: "Seven months ago I purchased of you some of your gears for trial. I did not have an idea that they would do the work that was represented they would do. I told your representative that they should have a fair trial. In order to satisfy myself and be sure there was no mistake, I took the gears from one of my cars and replaced them by putting on one end of the car gun metal, on the other end your gears.

I have worn two sets of the gun metal off and your gears are in use at this time. They have had seven months' wear, and I think we have about as hard a road as you will find, as we have a large number of heavy grades, and, what is more, there are heavy curves in the grade. I can only say that the gears have gone far beyond my expectations.

W. R. Fleming & Co., of 174 Fulton Street, New York, during the past few months have been equipping a number of steam boats with their "Ideal" self-oiling, automatic cut-off engines, which have met with great success in New York and elsewhere. These engines have been found satisfactory in steamboat service, as can be shown by the long list of boats now being equipped with them. The first boats supplied were the steamships "Yumuri" and "Maverick" of the Ward's line, which, proving to be perfectly satisfactory, have been followed by the Pacific Mail Steamship Co.'s boats, "Havana," "Armeria," "Newport," "Para" and "Rio Janeiro," besides a new vessel not yet completed at Chester, Pa., and another at San Francisco, for which the engines have just been shipped. The Pennsylvania Railroad Co. have the "Ideal" engines on their new ferryboats "New Brunswick," "Cincinnati" and "Chicago." The Spanish steamship line have the same engines on their steamers "Savannah" and "Ciudad Coudal" running between New York and Cuba, these being directly coupled to multipolar dynamos.

The Burton Electric Co. of Richmond, Va., for whom the Electric Merchandise Co. are selling agents, are experiencing a continual increase in their business. During the past winter this factory has been taxed to the utmost to meet the demands of electric railways, many roads having adopted the Burton electric heater. Such great and immediate results were not expected by the company. In fact the demands in this line have seriously hindered the completion of types for house and office heating, as well as such articles as flatirons, soldering-irons, laundry rolls, etc. We understand that these latter pieces have been put into serviceable shape and that the company will soon be ready to fill the numerous orders that they are continually receiving. The Burton company are certainly working along right lines, as shown by the efficiency of their street car heater. In certain cases, too, they have prepared heaters for special uses, and these have been found highly satisfactory, which is additional proof of the same fact. A neat and instructive pamphlet, giving full information regarding the heater, has been published by the selling agents, which should be obtained by people interested in electrical heating.

The Berlin Iron Bridge Co. of East Berlin, Conn., are running their works full time and are very much crowded with orders. Among other contracts which they have on hand is an iron building 80 × 254 ft. for the True Blue Marble Co. at West Rutland, Vt.; an iron building 52 × 170 ft. for the Chester Pipe & Tube Co. South Chester. Pa.; a boiler shop 68 × 201 ft. and a machine shop 72 × 184 ft. for the Dry Dock Engine Co at Detroit, Mich; a boiler shop 115 × 370 ft. for the Wm. Cramp & Sons Ship & Engine Building Co. at Philadelphia, Pa.; all the iron work, including the beams, girders, roofs, etc., for a new building which the National Fire Insurance Co. are building at Hartford, Conn.; an iron boiler house for the Montgomery Furnace at Pt. Kennedy, Pa.; a new casting shop 69 × 167 ft. for the American Tube Works at Somerville, Mass., and also a large roof for the new residence of Joseph D. Potts at Wyebrook, Pa. In bridge work they are building several bridges for the New York, New Haven & Harford Railroad Co., besides a large number of highway bridges in different parts of the country. They have just completed a large iron building for the Delaware Iron Co. at Newcastle, Del., and also a large iron building for the Boston & Montana Consolidated Silver & Copper Mining Co. at Great Falls, Montana. While a great many companies are complaining of slack business, yet the Berlin company seem to have plenty to do, and are employing their full force full time.

The Meneely Bearing Co., of West Troy, N. Y., manufacturers of patented tubular journal bearings, are meeting with great success in the sale of their roller bearings for street railway cars. They have sent us a copy of a letter recently received by them from Mr. John W. McNamara, general manager of the Albany Railway Co., upon which their bearings have been used for nearly two years. Mr. McNamara states that forty-two cars on his road are altogether equipped with these bearings, and that an average of twenty-four cars are in use, upon grades ranging from 3 to 8 per cent. In this connection he states in his letter to the Meneely Bearing Co. that the coal consumption for these twenty-four cars is only 16 per cent. greater than that of a neighboring road operating only twelve cars on a comparatively level line. The Meneely Bearing Co. have also secured a contract to equip all the motor cars of a new railway line to be opened in Troy this spring (the Troy City Railway), and have also received a second order from the Troy & Lansingburg Railway Co. to equip nine motor cars now being built for their line. This bearing is composed of steel tubes grouped closely, though not in contact with each other, about and in alignment with the journal. These tubes are arranged longitudinally in three series, the centre series being of double length and the outside ones being opposite each other while the centre is set in advance. The thrust of the axle is received upon a steel ball set in a groove formed in the cylinder head, and a corresponding recess is formed at the end of the journal. The Meneely Bearing Co. have recently issued a descriptive pamphlet in regard to their device, which gives full particulars and forms very interesting reading.

The Wightman Electric Manufacturing Co., of Scranton, Pa., as our readers well know, have been prominent advocates of high speed for electric cars, on heavy grades, especially where such speed was permitted by the municipial authorities. The time saved by running up grades and on levels, they think, more than repays for the increased consumption of coal or the increase in power consumed. Acting upon this theory the Wightman motor is designed, capable of accomplishing high speeds, while having a high efficiency at all speeds. A letter recently received by them from J. H. Vander Veer, superintendent of the People's Street Railway Co., of Scranton, Pa., which we give below, seems to substantiate this theory. Mr. Vander Veer says: "I have recently made an experiment in street railway practice, in which I think you will be interested. I have fixed up a car, equipped with two of your twenty H. P. motors, in a very attractive manner, and for the last month or so I have been running this car as an extra, on one of my lines running to Dunmore, making trips between the regular cars and running only half way to Dunmore. This car has now become a very popular one with the residents whom it reaches, and I can account for it only by the fact that it makes very rapid time. The up trip, a distance of about a mile and a quarter, averages a grade of 7 or 8 per cent., and I find that with this car we are enabled to go up the steepest points of the grade at a speed very nearly twenty miles an hour. I find, therefore, that the mileage that I can get out of this car is a long way in advance of the mileage made by the other cars; and as I do not have to pay any more for conductors and motormen for this car, it has proved very profitable. As this car runs in between the regular cars, it has to make very rapid time, and frequently the trip has been made in less than five minutes, although there are several curves and switches on the line. I at first thought that such a speed would be dangerous to maintain constantly, but we have not had an accident so far, and I find that it pays much better to run the cars up hill fast, than it does to make all the speed on the down grades. The repairs on your motors, I would say, have been so slight as to be insignificant. This car has your automatic brake connection, and I find that the motorman can run with a great deal more confidence than if the car did not have this arrangement, as he feels that in case of an accident to the brakes and a derailment of the trolley, he would still have a means of stopping his car quickly. It is a curious fact that when our schedule was so arranged that we could make three trips an hour, the receipts of this car were almost double what they are now when making only two trips. This seems to indicate that attractive cars operated at a high speed are requisite to the maximum success of any street railway, and the more there are the better."

R. D. Nuttall Co., of Allegheny, Pa., write us that their business continues to be very good and that thay have many orders from street railway companies on their books. They are now adding some improved gear cutting machinery which they expect will increase their facilities about one-fourth. They are buying the latest improved and expect great results from this machinery, both in the way of accurate work and cheap production. The steel trolley pole which they brought out last October is giving general satisfaction all over the country, and they have sold 3,000 since first bringing them out. Some of the largest street railway apparatus mauufacturing concerns have adopted this trolley pole and the reports on it from all parts of the country are very favorable indeed. This pole is made of the best grade of homogeneous steel, drawn to a taper, and when bent can be straightened without injury to the material composing the pole. Their "rawhide" pinion trade has greatly increased in the past few months, as they have made some vast improvements in the production of these articles. They submit all their rawhide to a pressure of 100 tons in the block before the pinion is made. The flanges are then placed on the pinion and riveted up under a pressure of forty tons. This they think makes a pinion superior to anything now on the market, as the compression strengthens the material almost fifty per cent. They have reports from these pinions from different parts of the country claiming that they are standing up equal to any metal pinion ever used. They have been experimenting a great deal with different grades of iron for gear wheels in the last few months and have added greatly to the strength and durability of their gears. They are also producing a gear now of cast iron that will stand almost equal to steel as far as tensile strength is concerned. They have also added to their factory a department for the manufacture of armatures ready for wiring and commutators of all classes. They are also prepared to re-fill commutators and repair them at reasonable rates. They have also added to their factory a department for rewinding armatures, field spools, etc. This department was forced on them by a great many of their customers, as the latter have had to send armatures to the manufacturers in the East to have this work done. The trade in this line, they say, is increasing daily. They expect this coming summer to reorganize and recapitalize their company and build larger works in the suburbs of the city where they can get room to place their factory all on one floor. They then intend to add greatly to their output and take up different lines, which heretofore they have not been able to handle. They are also making large amounts of bearings for street railway motors of different kinds, and have adopted the best grades of phosphor bronze for this work, and find their bearings are giving general satisfaction wherever used. Their patent composition spring trolley has been in great demand the last month. During the early part of the winter they did not have so many orders for this trolley, but in the last several weeks they have received orders for 145 trolleys complete. They are making these trolleys much better in every respect than the first ones brought out. This trolley was formerly sold with a wood pole for $20. By the addition of a steel trolley pole department to their factory they have been enabled to furnish this trolley complete with steel pole, made throughout of the best material, for $20, with wood pole complete for $18.

WESTERN NOTES.

Walker & Barrett, of Chicago, civil engineers and contractors, have opened an office in the Western Bank Note Building, and will equip street railways on the Judson system.

The St. Louis Car Co. have just put on the market a new electric truck. It is of the extended spring hase type, with many improvements over the various trucks of this kind offered in the past to street railway companies.

The Hoppes Manufacturing Co., of Springfield, O., have issued a handsome advertisement, consisting of a single sheet wall hanger printed in three colors, and showing their live steam feed water purifier and feed water heater.

The Sioux City Engine Works, of Sioux City, Ia., outgrew their capital long since, but in spite of all obstacles the sales were doubled in 1891, and at the beginning of the present year the company had a large number of contracts upon their books, a large and valuable stock of material on hand and excellent business prospects for the future. The business is now to be reorganized.

The Central Electric Co., of Chicago, report activity in their pin and bracket department, their factory at Columbia City being in full operation, and the goods being sent far and near in car load lots. The pin and bracket made by this firm is of approved quality, and has a steady demand. Since this company took the agency for the Interior Conduit & Insulation Co., they have been overwhelmed with orders, the largest buildings in Chicago, St. Louis and Kansas City erected or now in course of construction being equipped with this device. The business in this department of the Central Electric Co., bids fair to be one of their prominent features, and they can be congratulated upon the success already achieved in this department.

The Brownell Car Co., of St. Louis, send us word of many orders which they have recently received for street cars, and mention that their Accelerator type of car seems to be meeting with much favor. They received during January a letter from Charles T. Yerkes, of Chicago, speaking in highest terms of the Accelerator type of car, as mentioned in our last issue, and have since received an order from the road of which Mr. Yerkes is president, for thirty Accelerator cars, giving a practical demonstration of Mr. Yerkes' appreciation of the merits of the car. The Brownell Car Co., have also received an order from the Milwaukee Street Railway Co., for a sample Accelerator car. They are building fifty cars for the Baltimore Traction Co., which they state will be models of beauty and excellence. A number of cars of the Accelerator type built by this company will soon be in operation in Chicago, thirty having been ordered by the North Side Street Railway Co. of that city. One of these cars has also been sent to Milwaukee for trial.

The Detroit Electrical Works have received from the Athens (Ga.) Railway Co. a very flattering testimonial in regard to the operation of their system on the lines of the latter company. General Manager Voss, of the Athens company says: "We have had very little trouble or expense with the bevel gear; in fact, there is no trouble with it when the friction collars are kept well adjusted, which is very simply and easily done. Our cars make less noise and run smoother than those of any other system that I have ever inspected. I have been in the street railway business for some twelve years, and last year, before we began to make any change in our line here, I made a tour of inspection of the different systems." They have closed, among their many other orders, one with the Dubuque Street Railway Co., for six motor cars. These will replace the storage cars which have been in use on that line. They have also closed contracts with the Patrick Land Co., of Omaha, Neb , for four thirty H. P. equipments, as well as all the line construction, in fact, making a complete installation. Mr. H. A. Kinney, formerly of the Omaha Consolidated Electric Co., is now connected with this company.

The Laclede Car Co., of St. Louis, have their various departments full of material for the Third Avenue (N. Y.) cable cars. The joinery shop presented a busy scene recently. Sixty car ventilators were being erected for the above cars, and in the mill material was being cut into an almost endless number of shapes, to be sent to the erecting shop, for entering into the erection of eighty cars. The 200 closed cars for this company are to be built first, because the road will not be in operation before the beginning of next winter, and the open cars will not be needed until the summer of 1893. Among the orders the company have on their books and are now completing, a number of sixteen foot cars for the Colerain Avenue, East End and Browne Street electric railways of Cincinnati, which make eight orders the works have received from that city lately, several twenty-two foot cars for Duluth, Minn., and cars of various sizes for Covington, Ky., Twin City, Mo., Waxahatchie, Tex., Watertown, Wis., and the Perry Manufacturing Co., Ltd., also the first car for the Pendleton, Mount Lookout, & East Walnut Hills Railway Co., a new line to start up in Cincinnati. The works have been equipped with electric lights recently, and a night force will be put on.

The Electric Merchandise Co., of Chicago, are in luck—no, not luck exactly—for their success is deserved and is the result of continual push and hustle. A notable feature of several contracts recently secured by parent companies is that the overhead equipment of the Electric Merchandise Co. has been specified as a necessary factor in the building of the roads. It is observable, too, that in electric railway circles this company are both well and favorably known. Even the East, with its many electrical concerns—sufficient it would seem to supply the needs of local traction companies—has felt the activity of this particular house. The Merchandise company have one advantage in forcing attention, and that is, the concentration of their energies upon a single branch of the electrical business. They are universally known as the "exclusive electric railway supply house." Perhaps, their latest Eastern conquest was at Saratoga, where their fixtures will be used upon the new electric road, but they send us reports of equal success elsewhere. From all accounts their Western business is booming, frequent shipment to the coast, Colorado, Montana, Iowa and nearer points so testifying. The much-talked-of consolidation of the parent companies does not seem to affect the policy of this company. Their evident intention is to do business, and matters look as if they would.

The Pond Engineering Co., owing to increase of business, have found it necessary to remove their Chicago office from 427–429. the Rookery, where they have been located for three years past, to room 8 of the same building. This room is located on the ground floor, and extends from the rotunda to the Rookery court. The front part of the room will be used exclusively for office purposes and the rear for drafting, shipping, etc. Room 8 is one of the best offices in the well known Rookery Office Building, and the Pond company are fitting it up in an elegant manner with a view to the best accommodation and convenience of themselves and patrons. It has also been found necessary to make a change in the Dallas, Tex., office of the Pond Engineering Co., which has just been moved to much more desirable quarters in the Scollard Building, room 211. These changes will, no doubt, be of interest to many friends of the company who will be welcomed with pleasure at the new locations. This company have received an order from the Janesville Street Railway Co. for a complete steam plant necessary to operate the road by electricity. The plant includes an Armington & Sims engine, with a foundation box ; a boiler, with stack and the usual fittings ; a Blake boiler feed pump, and a Hoppes exhaust heater. The Pond company's contract also includes delivery and erection of this machinery in Janesville, with foundations, brickwork, pipe connections, etc., all ready for service.

Electric Railway Equipment in Dubuque.

President J. A. Rhomberg, of the Dubuque, Ia., Street Railway Co., has made important contracts during the last month, in behalf of his road in connection with the change from storage battery traction, to that of the overhead wire. The motors for this road will be furnished by the Detroit Electrical Works, and there will be six equipments. The motor cars will be sixteen feet long, and will be built by the J. G. Brill Co., of Philadelphia. Ten trail cars have been ordered from the St. Louis Car Co.

At the power station there will be two additional generators of the Edison type of fifty kilo-watts each. Some additions will also be made to the power equipment.

An Important Consolidation.

An important consolidation of manufacturers of electrical insulations has been recently effected between The Johns-Pratt Co., of Hartford, Conn., and the Gould & Watson Co., of Boston, Mass. The Johns-Pratt Co. are the manufacturers of the well known insulating material, vulcabeston, now used by all the large electrical manufacturers. The Gould & Watson Co. are identified with the manufacture of moulded mica, well known in the field of electric railway insulation.

These two interests are now combined and the business will be conducted by the Johns-Pratt Co. The product of the consolidated companies will cover every requirement for electrical insulation. Mr. C. Tennant Lee, the inventor of moulded mica, will be consulting chemist of the company, and the H. W. Johns Manufacturing Co., 87 Maiden Lane, New York, with branches at Chicago, Philadelphia, Boston, Atlanta and London, will continue to be the selling agents, as formerly.

A New Car Manufacturing Co.

The Randall Street & Electric Car Manufacturing Co. have recently been organized for the purpose of manufacturing street and electric cars and other railway appliances in Boston. The general manager is I. H. Randall, who for thirty years was with the Metropolitan & West End Street Railway Co. as master car builder.

The present location is at 1,131 Tremont Street, Boston, and the company are capitalized at $150,000 under the laws of the State of Maine. The demand for cars throughout the country for the past few years has been greatly increased by the adoption of electric power, and the manufacture of electric cars and railway appliances constitutes a most important part of the business.

The company expect to have their new catalogue ready for distribution in a short time, and this pamphlet will embrace cuts and general descriptions of articles manufactured by them.

A Trade Paper Changes Hands.

The Baltimore *Manufacturers' Record*, which is one of the most profitable newspaper properties in the South, has recently been sold by its founder, Richard H. Edmonds, and his brother Wm. H. Edmonds, to a company of journalists of wide experience and reputation. The purchasers are Thomas P. Grasty, Edward H. Sanborn, and Walter H. Page, who have also associated with them as part owners, F. S. Presbrey and Albert Fox. Mr. Grasty has for more than three years been the general Southern correspondent of the *Record*, and is widely known as an authority on Southern industrial topics. Mr. Sanborn, who has recently been connected with the Census Bureau, is an expert in iron and steel, has had wide experience in trade journalism, and has been an extensive contributor to industrial and technical papers. Mr. Page is editor of rhe *Forum*, is a Southern man and is interested in many Southern enterprises. Mr. Fox has been on the staff of the New York *Evening Telegram*, and Mr. Presbrey was recently the editor and manager of *Public Opinion*, Washington. The new editors have organized a Manufacturers' Record Publishing Co., with paid up capital of $200,000.

We extend to the new managers of the paper our wishes for the success they deserve.

Annual Meeting of the Short Electric Railway Co.

The annual meeting of the stockholders of the Short Electric Railway Co., and the usual directors' meeting following, were held at the office of the company in Cleveland, O., March 16. The following directors were elected: Sidney H. Short, Myron T. Herrick, J. Potter, John S. Bartlett, James Parmelee, Eugene Griffin, and William B. Bolton. The directors met and elected the following officers for the ensuing year: J. Potter, president; S. H. Short, vice-president and chief electrician; Charles B. Lothrop, secretary and treasurer; E. E. Higgins, general manager; William B. Bolton, general counsel. Mr. S. H. Short, who has been, from the organization of the company its president and chief electrician, was renominated for the presidency, but declined to accept the position. He stated that, owing to the growth of the company, its duties had now become so onerous as to seriously interfere with his technical work and inventions, to which he desired to give his undivided attention. He therefore asked relief from his general business cares.

A New Electric Truck Company.

The Taylor Electric Truck Co., of Troy, N. Y., have just been organized for the manufacture of the Taylor improved electric truck. The company is composed of Mr. Lewis E. Gurley and son, the well known manufacturers of civil engineers' and surveyors' instruments.

The inventor of the truck which this company will manufacture Mr. John Taylor, has devoted much time and study to the perfection of electric trucks. His early inventions have met with flattering success, such railway companies as the Troy & Lansingburgh Street Railway Co., preferring them to all others, and he has recently made and patented several new improvements which have been submitted to practical tests, and which have proved their efficiency in embodying simplicity and durability with easy riding.

The company intend to use only the best materials, and with the personal supervision of Mr. Taylor they hope to suit their customers.

They start with some flattering encouragements, and trust that any railway company desiring trucks will give them a chance to exhibit the good points of the Taylor improved.

The Siemens & Halske Company, of Chicago.

Siemens & Halske, of Berlin, the most important electrical manufacturers in Europe, have for a long time realized that the United States is a most promising field for the sale of electrical apparatus. For some time they have had under consideration a plan for establishing a branch in this country, and arrangements have just been perfected. Recently the Siemens & Halske Electric Co. were organized in Chicago, with a capital stock of $500,000. The officers are: O. W. Meysenburg, president; A. W. Wright, secretary; Arnold von Siemens, George William von Siemens, O. W. Meysenburg, A. W. Wright and Alexander von Babo, directors. Mr. Meysenburg and Mr. Wright are known the country over as contractors and cable railway engineers. They are also heavily interested in the Wells & French company, which manufacture cars. Alexander von Babo is a German, residing in New York, and is the American representative of the parent company in a number of other interests. G. H. Benjamin, of New York, will have charge of all matters relating to patents and patent litigation. George and Arnold von Siemens are the active members of the firm of Siemens & Halske, as Dr. Werner von Siemens has retired from active business, and Herr Halske is dead, his interest having been purchased by the Siemens family.

The new company will probably begin active operations within three months. The plant will be located at the shops of the Wells & French Co., on Blue Island Avenue. Dr. Berliner will be the chief electrical engineer of the company. He is at present in Berlin, but will locate in Chicago within a short time. Plans for the building are being prepared and drawings and patterns for the apparatus and special tools will soon reach the city.

Siemens & Halske claim to have the only practical conduit electric railway, and the American company expect to do considerable work in the railway field. It was while examining the road built on this system in Buda-Pesth, Austro-Hungary, that Messrs. Wright and Meysenburg first came in contact with the house with which they are now connected. Wright & Meysenburg have been negotiating for some time with C. T. Yerkes for the construction of a similar electric line with underground conduit in West Twelfth Street, but the matter still hangs fire, although at one time Mr. Yerkes was on the point of consummating the bargain. The Siemens & Halske Co., however, do not confine themselves to the conduit system, but propose to enter into active competition for the installation of overhead roads.

It has frequently been stated that the conduit system, as constructed at Buda-Pesth, could not be installed successfully in America, as the conditions were so entirely different. This statement, Mr. Wright said to a representative of the STREET RAILWAY JOURNAL, was entirely erroneous. The streets of Buda-Pesth were no cleaner, and were not better drained than those of Chicago; and, if the system were successful in the one city, there was no reason why it should not be successful in the other.

The founders of the branch company expect that they will be formidable competitors of companies now engaged in installing railway apparatus, as the corporation will be backed by the parent concern with its capital of $40,000,000.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, FEBRUARY 23, 1892, TO MARCH 22, 1892, INCLUSIVE.

FEBRUARY 23.

Automatic Disconnector, Andrew L. Johnson, Richmond, Va. 469,253
Brake for Electric Cars, Edward S. Amrock, Waltham, Mass. 469,383
Brake Handle, Robert L. Fosburgh and John F. Milligan, St. Louis, Mo. 469,401
Cable Grip, Theodor Otto, Schkeuditz, Germany 469,318
Conduit for Cable or Electric Tramways, George S. Morison, Chicago, Ill., and Charles Vogel, San Anselmo, Cal. 469,262
Car Brake, Michael H. Molloy, Milwaukee, Wis 469,423
Commutator-Cleaning Device, William J. Phelps, Elmwood, Ill. 468,319
Electric Railway, William S. Smith, Berkeley, Cal. 469,280
Elevated Railway Track, Myron J. Ferren, Stoneham, Mass. 469,371
Method of Utilizing Stationary Cables on Cable Railways, James P. Harper, Kansas City, Mo. 469,330
Overhead Conductor for Electric Railways, Edward M. Bentley, New York 469,353
Pilot for Street Cars, John W. Abrahams, Allegheny, Pa. 469,291
Power Transmitting Device, John Walker, Cleveland, O. 469,491
Pulley, William F. Buswell, San Francisco, Cal. 469,512
Railway Rail Chair, William H. Mattson, Philadelphia, Pa. 469,485
Railroad Tie Plate, Charles H. Dunham, Chicago, Ill. 469,386
Railway Tunnel Construction, Jesse W. Reno, New York 469,453
Street Railway or Tramway, James M. Price, Philadelphia, Pa. 469,392
Trolley for Overhead Railways, Nelson E. Austin, Danbury, Conn. 469,460
Winding Drum for Cable Railways, John Walker, Cleveland, O. 469,338

MARCH 8.

Cable Railway and Grip therefor, Cornelius Bollinger, Harrisburg, Pa. 470,280
Cable Railway Switch, Knud Rasmussen, Denver, Colo. 470,306
Car Wheel and Brake, John A. La Croix, Chicago, Ill. 470,202
Change Receiver, Jacob Ortlieb, Winfield, and Caleb E. Garey, New York. 470,592
Electric Locomotive, Elmer A. Sperry, Chicago, Ill. 470,516
Electric Locomotive, Sidney P. Hollingsworth, Washington, D. C. 470,627
Electric Railway, Elihu Thompson, Lynn, Mass. 470,221
Fare Register, Louis C. De Sloovere, Salem, Mass. 470,373
Insulator for Overhead Electric Railways, Henry D. Winton, Wellesley, Mass. 470,356
Insulator for Trolley Wires, William S. Andrews, New York, and Henry P. Hall, Brooklyn, N. Y. 470,417
Railroad Rail Joint, Charles U. Agner, Morantown, and William D. Armstrong, Carlyle, Kans. 470,459
Railway Construction, Richard W. King, Wichita, Kan. 470,641
Safety Cut-Out, Max Kerstein, Boston, Mass. 470,382
Vehicle, Homer L. Boyle, Grand Rapids, Mich. 470,175
Ventilator for Cars, etc., William Braidwood, Mount Vernon, N. Y. 470,540

MARCH 15.

Automatic Car Brake, William T. Rickman, Fern Bank, Ala. 471,022
Car Replacer, Nelson S. Scott, Taylor, Tex. 471,027
Car Starter, William Grunow, Jr., New York 470,753
Car Track, Charles F. Heath, Jersey City, N. J. 470,935
Car Truck, Edgar Peckham, Kingston, N. Y. 471,061
Car Truck, Edgar Peckham, Kingston, N. Y. 471,062
Contact Device for Electric Railways, Francis O. Blackwell, Boston, Mass. 470,657
Device for Heating Cars, Hugo Newman, New York 471,016
Driving Mechanism for Cars, Thomas A. Edison, Llewellyn Park, N. J. 470,927
Electric Railway Motor, Francis O. Blackwell, New York 470,817
Electric Railway, Edward M. Bentley, Boston, Mass. 470,654
Electric Wire Support, Francis O. Blackwell, New York 470,844
Elevated Railway Plant, St. John V. Day, Terre Haute, Ind., and Charles D. Moody, Webster Groves, Mo. 470,992
Fare Box, John W. Haigh and George Exley, Worcester, Mass. 470,933
Motor for Electric Cars, Francis O. Blackwell, Boston, Mass. 470,656

MARCH 22.

Axle Box for Street Cars, Norman C. Bassett, Lynn, Mass. 471,089
Car Brake, John Taylor, Troy, N. Y. 471,444
Cable Take Up, William B. Upton, Kansas City, Mo. 471,446
Charging Table for Electric Railways, Edward P. Usher, Grafton, Mass. 471,447
Conduit for Electric Railways, Francis O. Blackwell, Boston, Mass. 471,375
Elevated Railroad, Elbert D. Wilson, Birmingham, Ala. 471,452
Electric Railway Signal, Edgar C. Wiley, Bristol, Tenn. 471,230
Street Car Heating Apparatus, James F. McElroy, Albany, N. Y. 471,316
Trolley Pole Catcher, Montraville M. Wood, Chicago, Ill. 471,206
Trolley Wire Support, Elmer A. Sperry, Chicago, Ill. 471,151

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

THE Wainwright Manufacturing Co. of Massachusetts, of Boston, have recently closed contracts for 16,000 H. P. of their well known heaters, for the Lynn & Boston Electric Railway, the New York Electric Railway, and the Albany Street Railway Co. This is said to be the largest order that has ever been placed for feed water heaters, and is an important testimonial for the type manufactured by the Wainwright company.

QUOTATIONS OF STREET RAILWAY STOCKS.

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 7 Exchange Place, Members of Boston Stock Exchange. Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	87	87¼
West End Com'n	50	$7,150,000	J. & J.	5	1890–1891	76½	77

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Mar. 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co	100	$270,000	New.	...	Oct., 1887	90	95
Union R. R. Co., Prov.	100	2,000,000	Q.—J.	2	1862–1863	190	192
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co	100	$360,000	J. & J.	4	.....	200	225
Holyoke Street R. R.	100	150,000	J. & J.	4	.....	190	200
Northampton Street R. R.	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	3	.....	.....	65
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co	100	800,000	Quart.	1½	1867	128	130
Crescent City R. Co	100	1,150,000	"	1¼	.866	90½	91
Canal & Claiborne R. R. Co.	40	240,000	.....	..	1888	23½	26
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	132½	133¼
Orleans R. R. Co	50	185,000	"	2	1868	73½	75
St. Charles Street R. R. Co	50	600,000	"	3	1866	92	94

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	102¼	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93–'99	.....	.....
do do new	1886	40,000	M & N	6	1896	.....	.....
N. O. City R. R. Co	1879	495,200	J & D	6	1903	119	122
N. O. & Carrollton R. R. Co.	1882	300,000	F & A	6	'92–'06	113½	.....
St. Charles Street R. R. Co.	1881	165,000	J & D	6	'89–'01	.....	.....

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	140	.....
State Street Horse R. R. Co.	25	23,000	J. & J.	3	.....	100	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	20	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co.	1874	20,000	J. & J.	7	Jan., 1894	105	.....
New Haven & W. Haven R. R. Co	1859	50.000	J. & J.	5	July, 1899	100	.....
Bridgeport Horse R. R. Co.	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B.	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued)	.....	100,000	M. & N.	5	May, 1910	.....	.....

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co	50	1,250,000	Q.—J.	1½	.....	107	108
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	185	.....
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	175	.....
Coney Island & Brooklyn R. R. Co	100	500,000	.....	...	.....	125	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.	.....	140,500	M. & N.	7	May. 1894	101	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	106
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	101	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	107	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	103	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	108	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Aug.	1½	1890	112	115
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	10	12

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort.	1865	40,000	J. & J.	5	1905	103	.....
" " " 2d Mort.	1873	20,000	M. & N.	7	1893	102	.....
" " " 3d Mort.	1875	28,500	J. & J.	7	1895	105	.....
" " " 4th Mort.	1880	11,500	M. & S.	6	1905	105	.....
" " " 5th Mort.	1888	50,000	M. & S.	5	1913	105	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103	104
" " " Debenture.	1891	200,000	M. & N.	6	1901	111½	114
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	105	.....
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	80	.....

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾	.....	25	27
Broadway & Seventh Avenue.	100	2,100,000	Q.—J.	2	.....	205	205
Brooklyn City	10	2,000,000	Q.—F.	2	.....	165	170
Brooklyn Crosstown	100	500,000	A. & O.	4	.....	.....	.....
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	104	1 8
Christopher & Tenth	100	650,000	F. & A.	1¾	.....	115	116
Central Crosstown	100	600,000	Q.—F.	1¾	.....	125	130
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	125	135
42d & Grand St. Ferry	100	748,000	Q.—F.	3	.....	230	240
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	37	40
Eighth Avenue	100	1,600,000	Q.—J.	2	.....	105	110
Houston, W. St. & Pav. Ferry. Leased to B'way & 7 ave	100	1,000,000	Q—F.	2	.....	160	.....
Second Avenue	100	1,862,000	J. & J.	5	.....	95	100
Sixth Avenue	100	1,500,000	M. & S.	3	.....	130	150
Third Avenue	100	2,000,000	M. & N.	4	.....	290	305
23d St	100	600,000	Q.—F.	2½	.....	240	230
Ninth Avenue	100	800,000	.....	3	.....	90	95

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry	.....	700,000	J. & J.	7	July, 1900	110	.....
B'way & 7th Ave., 1st mort.	.....	1,500,000	J. & D.	5	June, 1904	105	107
2d mort	.....	500,000	J. & J.	5	July, 1914	105	106
Broadway Surface Guaranteed	.....	1,500.000	J. & J.	6	July, 1924	106	107
Additional	.....	1,000,000	J. & J.	5	July, 1905	93	95
Brooklyn City	.....	200.000	J. & J.	5	Jan., 1902	105½	107½
Brooklyn Crosstown	.....	200,000	.....	5	1902	107	109
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	114	116
Christopher & Tenth	.....	250,000	A. & O.	7	Oct., 1888	112	1 4
Central Crosstown	.....	250,000	M. & N.	6	Nov., 1922	118	120
Dry Dock, E. B'way & Battery. 1st mort	.....	840,000	J. & D.	7	June, 1893	104	106
Scrip	.....	1,200,000	F. & A.	6	Aug. 1914	98	100
42d & Grand St. Ferry	.....	236,000	A. & O.	7	April, 1893	110	112
42d St. Manhat. & St. Nich. Av 1st mort	.....	1,200,000	M & S.	6	Sept., 1910	112	114
2d mort	.....	1,200,000	J. & J.	6	1915	38	39
Eighth Ave., Scrip	.....	1,000,000	F. & A.	6	Aug., 1914	105	110
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	109	111
Second Avenue	.....	1,600,000	M. & N.	5	Nov., 1909	102	103
Third Avenue	.....	5,000,000	J. & J.	5	Jan., 1937	110	115
23d St	.....	250,000	M. & N.	7	May, 1893	108	110

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	50	$600,000	M. & N.	4	May, '91.	184	190

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref.	100	$1,000,000	A. & O.	5	Jan. 1891	77	78
Louisville St. Ry. Co., com.	100	5,000,000	.....	...	Jan. 1891	21	22

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	93½	94½
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	112½	.....
Central Passenger Ry. Co.	1888	400,000	M. & N.	6	1908	112½	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	324	325
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	91	92
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	177	178
West Division City	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	130	130½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	98¼	98½
Chicago Passenger	1883	400,000	F. & A.	6	1903	108	109
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,640,000	M. & N.	4½	1927	95½	96
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100	100½
West Division Railway	.....	3,790,000	J. & J.	5	.....	101	101½
" " " Ext.	.....	250,000	J. & D.	6	.....	101	101½
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101¼	101½
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	.....	98

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co	50	1,500,000	.....	..	.....	.....	28½
Citizens' Traction R. R. Co	50	3,000,000	J. & J.	3	.....	63	63½
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	.....	28
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	55	60
Federal St. & Pleasant Valley	50	1,300,000	J. & J.	3	.....	25	.....
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	39¾	.....
West End R. R. Co.	50	200,000	J. & J.	...	.....	70	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	51
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	5	20
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	40	.....
Pittsburgh Incline Co.	100	150,000	.....	...	.....	115	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O	5	1927	107	108
Pitts. & Birmingham Traction Co.	1889	1,500,000	M. & N.	5	1929	.....	101½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	....	105
Pleasant Valley Ry.	1891	300,000	J. & J.	5	1919	.....	.....
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	102	109¼
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	.....	100
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Pleasant Valley R. R. Co.	1873	75,000	J. & J.	6	1903	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.	1883	125,000	.....	6	1903	102½	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.. ..	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH Broker, 440 California Street, San Francisco, Cal., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.	100	1,000,000	Monthly	5	.....	116	117½
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	97	105
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	50	70
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	34½	37
Omnibus Cable Co.	100	2,000,000	Monthly	4	.....	59	61
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	31

Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	.....	107
Market Street R. R.	.....	3,000,000	J. & J.	6	913	121¼	122½
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	115¼	116¾
Powell Street R. R.	.....	700,000	M. & S.	6	1912	.....	115
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	111	114¾
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	94	97½
Cal. St. Cable R. R.	.....	.....	.....	...	.....	103	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Mar. 18.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.	100	$324,000	Q.—J.	3	1864	102	103
Cass Ave. & Fair Grounds.	50	300,000	.....	...	1876	44½	45½
Citizens'	100	1,500,000	A. & O.	1¼	1887	100	105
Jefferson Avenue.	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	56	60
Missouri	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central	100	200,000	.....	...	1884	100	105
People's	50	1,000,000	M. & S.	6	1889	40	45
St. Louis	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal	50	150,000	Jan.	.50	1872	15	25
Union	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban	100	2,500,000	.....	...	1891	48	50

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine.	1880	$500,000	F. & A.	6	1900	102	102½
Cass Avenue.	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable.	1887	1,500,000	J. & J.	6	1907	107	108
Lindell	1890	1,500,000	J. & J.	5	1895–1910	99	100
Mound City	1890	525,000	A. & O.	6	1900–1910	105	106
Missouri Cable.	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort.	1882	125,000	J. & D.	6	1902	102	105
" 2d mort.	1886	75,000	M. & N.	7	1902	104	105
People's Cable.	1889	800,000	J. & J.	6	1889–1914	97½	100
Northern Central.	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable.	1890	1,500,000	M. & N.	5	1900–1910	97½	98
Union.	1885	150,000	M. & N.	6	1895–1915	102	103
Union Depot.	1890	1,600,000	A. & O.	6	1900–1910	105	106

PHILADELPHIA STOCKS AND BONDS.—Corrected by ROBERT GLENDINNING & Co., 143 So. Fourth st. (Bullitt Building), Philadelphia, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'	50	$500,000	Q.—J.	4	1858	255	.....
Continental	50	1,000,000	J.—J.	6	1873	120	122
Frankford & Southwark.	50	1,250,000	Q.—J.	6	1854	204	205
Germantown	50	1,500,000	Q.—J.	...	1858	100	101
Green & Coates.	50	500,000	Q.—J.	3	1868	117	118
Hestonville.	50	2,050,000	.....	..	1859	36	36¾
Lombard & South.	25	500,000	A.—O.	8	1861	55	58
People's Common	25	1,500,000	M.—S.	2½	1873	49	50
" Preferred	25	750,000	M.—S.	2½	.....	49	.....
Philadelphia City	50	1,000,000	J.—J.	7½	1859	150	151
Philadelphia & Gray's Ferry.	50	617,500	J.—J.	3½	1858	66	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	83	85
" " (40 pd.)						73	75
Ridge Avenue.	50	750,000	Q.—J.	5	1872	200	205
Second & Third	50	1,060,200	Q.—J.	4½	1853	159	160
Thirteenth & Fifteenth.	50	1,000,000	J.—J.	9	1858	195	.....
Union	50	1,250,000	J.—J.	9½	1864	177	180
West Philadelphia.	50	750,000	J.—J.	10	1857	185	185½
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	114	.....
Baltimore Traction	25	5,000,000	.....	...	1889	23	24
Buffalo (N. Y.) Railway.	100	6,000,000	.....	...	.....	34	36
Newark (N. J.) Passenger.	100	6,000,000	.....	...	.....	29	30

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	109	110
" " Imp.	1892	1,250,000	M.—S.	6	1901	102½	.....
Germantown, 1st mort.	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort.	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	**Date of Issue**	**Am't Out-stand-ing.**	**Inter'st Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & CO., Bankers and Brokers, 26 West Third Street, Cincinnati, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	110½	111
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	110¼	111
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	118	120
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	66	67½
" " " Pref.	100	100,000	.....	6	.....	99½	101
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	102	.....
" "	.....	50,000	J. & J.	7	July, 1894	104	.....
" "	.....	50,000	J. & J.	7	July, 1895	.....	110
" "	.....	50,000	J. & J.	7	July, 1896	108	112
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	103½	.....
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	.....
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	112	.....
" " "	.....	300,000	J. & J.	6	Jan. 1914	107	107½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	100	103
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & CO. Bankers, 9 South Street, Baltimore, Md., Mar. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	70	75
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Highlandtown & Point Breeze Ry. Co.	50	189,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	23⅜	23¾
North Balto. Pass. Ry.	25	.....	.....	...	.....	45	.....
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " cons. mort.	.....	1,500,000	.....	5	.....	93	100
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	109½	110
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	110⅜	111

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	273	280
Metropolitan R. R.	50	750,000	Q. J.	...	1864	107	115
Columbia R. R.	50	400,000	Q. M.	...	1870	63	66
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	40	44½
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	32	37
Georgetown & Tenallytown	50	200,000	.....	...	.....	46	55
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	102	.....
do. do. convert.	'83-'91	2,000,000	J. & J.	6	1899-1929	150	160
Eckington & Soldiers' Home.	.....	100,000	J. & D.	6	1896-1911	97	99
Capitol & North O St. R. R.	1891	250,000	J. & J.	5	1921	108¾	115
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	118¼	128

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & CO., 139 So. Fourth St. (Bullitt Building), Philadelphia, March 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	31	35
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	35	37
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	.....	25
Newark (N. J.) Pass. Ry	100	6,000,000	.....	...	1890	29	30
BONDS.	**Date of Issue**	**Amount Out standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid**	**Ask'd**
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	90	95
Buffalo (N.Y.) Ry.	1891	5,000 000	F & A	5	1931	94	97½
Paterson (N. J.) Ry.	1891	850 000	J & D	6	1931	.....	100
Newark (N. J.) Pass. Ry	1890	6,000,000	J & J	5	1930	91	92

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	176	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	79	81
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

Financial.

THE Lake Side Electric Railway Co., of Peoria, Ill., have certified to a reduction of capital stock to $8,000.

$ $ $

THE Buffalo (N. Y.) Crosstown Railroad Co. have filed an application for permission to increase their capital from $500,000 to $1,500,000.

$ $ $

THE West Side company, of Chicago, Ill., have issued $1,000,000 in six per cent. debenture bonds, for the purpose of cabling Blue Island Avenue.

$ $ $

THE Stockholders of the Eureka Springs (Ark,) Electric Light & Street Railway Co., at a meeting held March 12, voted to bond the road for $25,000 and install an electric system.

$ $ $

JUDGE MILLER last month ordered the sale of the Central City and Macon & Suburban railways of Macon, Ga., under foreclosure proceedings. The sale was to occur on March 31, and to be for cash.

$ $ $

THE Superior Court has handed down a decree in the foreclosure case of the International Trust Co., of Boston, against the Keokuk (Ia.) Electric Street Railway & Power Co., ordering a sale of the property.

$ $ $

THE stockholders of the Haywards (Cal.) Electric Railway Co. have voted to issue $250,000 of first mortgage bonds, payable in thirty years from March 1, 1892, with interest at six per cent. per annum, payable semi-annually.

$ $ $

THE Cottage City (Mass.) Street Railway Co. have requested permission of the State Railroad Commissioners to increase their capital stock from $15,000 to $25,000, and to issue bonds. The increase will be used to take up the floating debt and the bonds, and to extend the road to Vineyard Haven, a distance of three miles.

$ $ $

AT a meeting of the Second Avenue Electric Street Railway Co., of Pittsburgh, Pa., last month, it was decided to increase the capital stock from $300,000 to $500,000. It was stated that $100,000 of the new stock would be sold at once in order to provide for the floating debt, for the loss caused by the burning of the car stables and for the equipment of the Greenfield Avenue branch, which runs from Second Avenue to Schenley Park. The other $100,000 will be held in reserve for further extensions.

$ $ $

AT a recent meeting of the stockholders of the Citizens' Passenger Railway Co. of Philadelphia, Pa., a formal assent was given to the lease of the road to the Frankford & Southwark Passenger Railway Co. The lease was to take effect on April 1, and the terms are annual payments; for 1892, $115,000; 1893, $120,000; 1894 and 1895, $125,000; 1896 and 1897, $130,000; 1898 and thereafter, $140,000.

THE capital of the Citizens' road is $500,000, par value $50. On January 1, 1891, the amount of capital paid in was $192,500. The dividends since 1885 have ranged from $11 to $17 a share. In 1891 a dividend of $8 a share was declared, but a new car house was paid for out of the earnings.

THE Rochester (N. Y.) Railway Co. last month offered for sale through the German American Bank of Rochester $200,000 of 6 per. cent. gold debenture bonds, payable in 1911, with an option to the company of retiring the same on or after March 1, 1901, coupons payable in March and September. During the twelve months ending January 31, 1892, the gross receipts of the company were reported to have been $673,443.09; operating expenses, $386,909.64; interest on bonded debt and taxes, $191,606.48, leaving an income applicable to dividend of $58,926.97. The steady increase in the business of the company is evidenced by the fact that the gross earnings for January and February of the present year are $20,000 greater than for the corresponding months of 1891.

$ $ $

RECEIVER J. F. CRANK of the Los Angeles (Cal.) cable railway, has petitioned Judge Wade for an order permitting him to pay $12,540, the interest due on the first mortgage bonds of the company, which fell due on Sept. 15, 1891. The receiver shows that the surplus earned by the road for the quarter ending December, 31, 1891, is $15,638.79, a gain of $3,148.14 over the corresponding quarter of the preceding year, and showing also a surplus of $60,440.98 for 1891, as against $10,-923.17 for the preceding year, a gain of $49,517.81. Gain in income over 1890, $26,813.23; decrease in expenses 1891, $22,704.58; The average income per diem was as follows: 1889, $703.35; 1890, $908.81; 1891, $982.29. Increase in 1890 over 1889, $205.48; increase in 1891 over 1890, $73.48.

$ $ $

A LEASE from the Essex Passenger Railway Co., of Newark (N. J.) to the New Jersey Traction Co. was recorded in the County Register's office last month. The lease is for 999 years, and covers all the lines, rolling stock, equipment and franchises, etc., of the Essex Passenger Railway system in Newark and its vicinity. The Traction company is to pay rent beginning with $45,000 in 1892, then $60,000 in 1893 and then increasing $30,000 each year to $240,000 in 1899 and subsequent years. The Manhattan Trust Co., of New York, is the agent of the Essex Passenger Railway Co. in the receipt of the rents. The Traction company assumes all existing contracts and obligations and pays the interest on the bonds which are secured by a mortgage to the Solicitors' Loan & Trust Co. for $6,000,000. The officers of the company are as follows: President, T. C. Barr; vice-president, J. I. Waterbury; treasurer, E. C. Clay, and T. H. Wentworth, Jr., secretary pro tem. The executive committee consists of T. C. Barr, J. I. Waterbury, A. Q. Keasbey, S. S. Battin, Eugene Griffin and T. H. Wentworth, Jr. Mr. Waterbury, who is president of the Manhattan Trust Co. of New York, is mentioned in the certificate of incorporation as subscribing for 2,500 of the 5,000 shares issued.

Annual Meeting of The Brush Co.,

The annual meeting of the Brush Electric Co., was held at the office of the company, Cleveland, O., March 15. The following directors for the ensuing year were elected: S. A. Barton, Boston, Mass; J. S. Bartlett, Boston, Mass., Myron T. Herrick. Cleveland, O.; J. Potter, Cleveland; C. A. Coffin, Boston; William B. Bolton, Cleveland, and S. M. Hamill, Cleveland.

The Lake Shore Route.

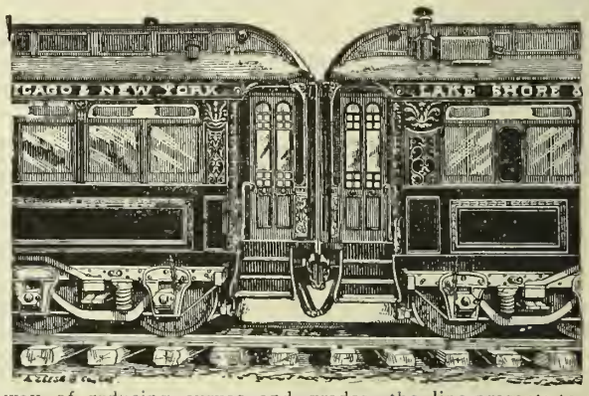
To any person who is contemplating a trip between Buffalo and Chicago, or any two points reached by the extensive railway system of the Lake Shore & Michigan Southern Railway, popularly known as the Lake Shore, we unhesitatingly recommend a trip over the beautiful and picturesque route covered by this railway. To the foreign tourist, a ride on the palatial cars on the Lake Shore means an introduction to comfort and luxuries which will be a surprise and revelation to him. To the American passenger, whether he is accustomed to traveling or not, it will mean a journey with all the usual disagreeable characteristics of traveling eliminated.



This road can truly be called a characteristic, high class American railway, travelers recognizing it as such on account of its well kept tracks, its excellent equipment, its perfect service, and the other requisites necessary to pleasant, comfortable and successful journeys. The main line is 450 miles in length between the cities of Chicago and Buffalo, with branch lines to Oil City and Pittsburgh, Pa., Fort Wayne, Ind., Detroit, Grand Rapids, Lansing, Jackson, Ypsilanti and Kalamazoo, Mich., and other cities. The main line passes through the important cities of Erie, Pa., Ashtabula, Cleveland, Toledo, O., and La Porte, Ind.

This route is the one selected by the United States government to carry the famous fast mail, showing that its reliability and promptness, as well as the high speed maintained by its trains, are recognized among officials at Washington. Three trains daily are devoted almost exclusively to this branch of business. This distinction has led the management of the company to adopt a mail pouch as the trade mark of the route.

The roadbed is probably unsurpassed by that of any line in the country, and with the improvements made during the last two years in



the way of reducing curves and grades, the line presents to-day a thoroughly constructed double track road, practically without grade or curve.

The cars on this line present every improvement which can add to the comfort and safety of the passengers. The vestibule sleepers are of the Wagner type, and the drawing room, buffet, smoking and library cars and standard day coaches are most luxurious in their appointments, and lack nothing which could add to their desirability.

On February 1, 1892, the Lake Shore line began operating its own dining cars. A glance over the menu shows that this department is maintained to as high a standard as the other branches of the service. The table affords the best the markets provide, and is equal in quality and quantity to that of the leading hotels in any large city.



No doubt a large portion of the pleasure experienced in traveling by this route can be attributed to the excellent service of the employes. The cars are in charge of experienced officers and attendants, and it seems to be their purpose to contribute in any way in their power to the comfort of the passengers.

Excellent terminal facilities exist at each end of the route. The magnificent passenger station on Van Buren Street in Chicago occupies a central portion in the city, and is convenient to all hotels, banks, Post Office and street railway lines.

The management of the company, always alert and on the outlook for the latest improvements, have shown themselves willing to adopt, regardless of cost, anything which would have place on a strictly first-class railway line. They expect to be fully equipped next year to carry the large additional traffic incident to the Columbian Exposition at Chicago and have par excellence a line to be selected by visitors to that exhibition.

The management of the Lake Shore is to be complimented on its already efficient service, and also for the uniform and correct manner in which all its numerous trains are handled, its famous fast mail trains, due to its smooth and perfect roadway, and to the prompt and reliable manner in which it takes care of its large and increasing train service.

WE PURCHASE

Total Issues of Street Railway Bonds.

CORRESPONDENCE INVITED.

N. W. HARRIS & CO.,

BANKERS,

163 Dearborn Street Chicago,
15 Wall St., New York. 70 State St., Boston.

COMPARATIVE TESTS OF THE BABCOCK & WILCOX AND HEINE SAFETY BOILERS,

At the Plant of the Rochester Railway Co., Rochester, N. Y.

REPORT BY CHARLES E. EMERY TO THE BABCOCK & WILCOX BOILER CO.

915 Bennett Building, New York, March 12, 1892.

The Babcock & Wilcox Co., 30 Cortlandt Street, New York.

Gentlemen:—In response to your request to represent your company as an expert in connection with tests to be made of a Babcock & Wilcox boiler, and of boilers constructed by the Heine Safety Boiler Co., of St. Louis, all in place in the power house of the Rochester Railway Co., at Rochester, N. Y., I hereby report that I arrived in Rochester on the 15th of February, 1892, and examined the plant, but no complete arrangements could be made for the test for several days, on account of the non-arrival of the expert appointed by the Heine company, Mr. J. J. de Kinder, of Philadelphia, Pa. On the 19th Prof. M. E. Cooley, director of the Department of Mechanical Engineering of the Michigan University, at Ann Arbor, Mich., arrived in place of Mr. de Kinder. During that and the succeeding day, an agreement in writing was formulated and signed relative to competitive capacity trials of the two types of boilers.

On February 21, the Babcock & Wilcox boiler was tested, and on February 23 a corresponding test was made of the Heine boilers.

The relative performance of the two types of boiler are shown in the accompanying table, certified by Professor Cooley and myself.

GENERAL RESULTS.

The general results are that the Babcock & Wilcox Boiler exceeded the performance of the Heine Boilers 22.18 *per cent. in capacity, and* 19.5 *per cent. in economy.*

The results for capacity may be obtained by comparing the relative maximum power shown by the different boilers, on the basis stated in line 28 or line 29.

The economy of the two boilers when worked at the rates of evaporation stated, is shown in line 23, where the actual evaporation is reduced to the same pressure and temperature; from which it will be seen that the Babcock & Wilcox boiler evaporated 19½ per cent. more water per pound of coal than the Heine.

BOILERS TESTED.

There are in position in the boiler room of the power house of the Rochester Railway Co. four Heine boilers, rated at 200 H. P. each, and one Babcock & Wilcox boiler of the 12-high type, rated at 416 H P. Drawings with brief descriptions of these boilers are given in the appendix. The steam generated is supplied to high speed engines to operate dynamos furnishing electric current to operate the electric railroad lines of the railway company. Reports had reached your office that the Babcock & Wilcox boiler was not operating satisfactorily, it being claimed that the railroad could be operated with four Heine boilers, but not with two Heine boilers and the Babcock & Wilcox boiler. This led to a request on your part that the boilers be tested competitively, which was in general terms assented to by the Heine company, and consent was given by the Rochester Railway Co.

PRELIMINARY PREPARATIONS.

Your representative on reaching the ground reported that the connection of the Babcock & Wilcox boiler with the stack was indirect, having a very short offset just before entering the latter, with curves of very short radius. While this fact formed no reason why the boiler should not give a fair percentage of increase over its rated power, you decided that as a competitive test was to be made, it should be on conditions designed to test the comparative merits of the boilers and not of abnormal conditions accidentally existing at this particular place. As time was pressing, the flue around the rear of the boiler was cut off and a straight connection made from the side of the boiler to the chimney. The rear flame plates were at the same time extended downward a few inches further to correspond with the customary practice, which for some reason had not been carried out in this case. The boiler was then put in service to permit two of the Heine boilers to be cleaned preparatory to the test. The engineer of the station cut out one Heine boiler and reported to the president of the railroad company that he would not take the responsibility of taking off two Heine boilers, thus squarely reiterating his former claims that he could keep up steam with four Heine boilers rated at 800 H. P., but could not with two Heine boilers in connection with 416 H. P. of Babcock & Wilcox boilers. I arranged, however, to have the change made, and for safety detailed the firemen you had furnished for the test to fire the Babcock & Wilcox boiler for the time being. I soon saw that the fireman of the Heine company was firing the two Heine boilers which were to be kept in use, so for purposes of comparison I weighed the water evaporated by the Babcock & Wilcox boiler. Under these circumstances it proved necessary to force the 416 H. P. Babcock & Wilcox boiler up to 807 H. P. under actual conditions, in order to prevent the steam pressure from falling, although the total quantity of steam required could not have been more than 1,000 boiler H. P. It was then proposed to weigh the water to the Heine boilers. The fireman on those boilers had been firing high in front and probably leaving holes in the fire at the rear. The proposition caused him to level his fires, when the steam pressure rose rapidly and it became necessary to shut the ash pit doors on all the boilers. This incident settled the question that had been raised in the fire room as to the relative steaming capacities of the two kinds of boilers, and it was not broached again. It seems proper to add here that if so-called tests of competing boilers, based on manœuvres of the kind here observed, are reported to boiler companies without a full statement of the facts, the information, however, satisfactory at the outset cannot form a reliable basis for guarantees of performance to be proved by actual tests under impartial management. After the arrival of Professor Cooley on February 19, the details for conducting competitive tests to ascertain the maximum capacity of the two boilers, and in connection therewith the economical results shown when operated at such capacity, were agreed to and were reduced to writing and signed on the 20th. As Professor Cooley had had no opportunity to investigate matters, and Vice-President Foster of the Heine company appeared to take the lead in making the arrangements, I arranged that Mr. Foster should sign the agreement in connection with Professor Cooley, and also requested Mr. Wells, who was present as a business representative of your company, to sign the same in connection with myself. The following is a copy of the agreement:

"Mutual agreement preliminary to test of Babcock & Wilcox and Heine boilers in power station of Rochester Street Railroad Co.

"Rochester, N. Y., February 20, 1892.

"The test to be exclusively in charge of the experts, Dr. Chas. E. Emery and Prof. M. E. Cooley, and during the progress thereof all persons in the fire room to be subject to the orders of such experts.

"The boilers to be tested to be preliminarily operated with a bright fire until properly heated up—the water level in boiler noted, when boiler and feed pump are operating under average conditions; the pump is then to be stopped and fires promptly hauled. A new fire to be immediately started with weighed kindling and coal on bare grates, and the beginning of the test to be noted at the time such fire is started. The duration of the test to be ten hours, as nearly as possible. At the finish the water is to be brought to the same level as when fires were hauled at the beginning, and while the boiler is still steaming and pumps running regularly, the pump is to be stopped, the test closed and fires immediately hauled. The firemen of the Babcock & Wilcox boiler to cease firing not more than nine hours and forty minutes from the beginning of the test, and those of the Heine boiler not more than nine hours and fifty minutes from the beginning of the test, except that such firemen may, with the consent of the experts, fire small quantities of coal to maintain fires during the portions of the test not completed, it being the intent to maintain the fires at the highest temperature which will permit their being hauled promptly at the expiration of the test limit.

"The unconsumed coal and coke hauled from the furnaces at the close of the test to be picked out by hand, weighed dry and deducted from the total amount of coal fired, in making up the statement of results for the final report hereinafter provided for. The steam pressure to be the same, as nearly as possible, at start and finish. The coal as delivered in building to be divided as used and alternate barrows delivered to the boiler first tested, and intermediate barrows to a pile which is to be used in testing the other boiler. One shovelful for each barrowful weighed to be thrown into a pile, and average samples from this pile to be tested for moisture, the proportion of which shall be deducted from the total coal as fired and the balance called "dry coal." The coal delivered to the boiler undergoing test to be weighed and dumped on the floor in charges.

"The water to be weighed and dumped into a receiving tank and brought to the same level at the beginning and end of the test, also at the end of each hour, which is to be done with weighed water for each observation except the first.

"The ordinary observations to be noted at least three (3) times an hour, and more frequently if so arranged.

"A representative of each party to be assigned to record coincidently each class of data, and any disagreement to be immediately referred to the experts.

"The experts to report in duplicate the equivalent weight of dry coal consumed and the equivalent weight of water evaporated into dry steam under actual conditions; also from seventy pounds pressure and 100° F, also from seventy pounds pressure and 212° F., and also from and at 212° F. for the period of the test of approximately ten hours above provided for. And will also report in duplicate the approximate quantity of water evaporated into dry steam in each boiler during each hour and certify duplicate logs showing in detail all the facts above referred to and other customary data.

(Signed.) Chas. F. Foster,
Representing Heine Safety Boiler Co.

(Signed.) E. H. Wells,
Representing the Babcock & Wilcox Co.

(Signed.) Chas. E. Emery,
Expert appointed by the Babcock & Wilcox Co.

(Signed.) M. E. Cooley,
Expert appointed by the Heine Safety Boiler Co."

RECORDS.

During the tests the agreement was strictly adhered to, except in a few minor particulars, which were modified by consent as the first trial progressed. For instance: It being late when the first test was finished, it was agreed not to attempt to weigh back the coal and coke in the fires hauled out during either trial, but to consider the whole as refuse.

It will be observed that provision is made in the agreement for duplicate records of each class of data by representatives of each of the competing parties. Messrs. Foster and Wells were assigned to record in ink in separate books the records of the water evaporated and the coal consumed; Messrs. Nelson and Rowell to actually measure the water; Messrs. McCormick and Wolfenden to actually weigh the coal, and Messrs. Bateman and Hoxie to take the calorimeter and general log readings, leaving Professor Cooley and myself free to assist either party, and attend to the general conduct of the test. The person first named in each case was a representative of the Heine company, and the person second named in each case was a representative of the Babcock & Wilcox Co. Mr. Silbermann, of the Heine company, was detailed to take charge of the laborers in handling the coal, etc., Mr. George Thomas, of the Babcock & Wilcox Co. being also present. A machinist was detailed to attend to the pump. The firemen employed by the Babcock & Wilcox Co., by name Michael Flavin and John Kernan, were loaned for the purpose by Mr. Pierson, manager of the Boston Electric Railways. Mr. Neeley was the principal fireman of the Heine boilers, though two of the station firemen assisted him.

APPARATUS.

The apparatus for measuring the feed water consisted of two large hogsheads, each set on a platform scale. The two scales and hogs-

heads were mounted on cross pieces over a large lower tank provided with a water gauge. The hogsheads were designated tanks 1 and 2. The man operating each tank would permit the same to fill by opening a valve, then close the valve, balance the scale and write the gross weight on a blackboard in plain view; he would then let the water run out into the lower tank, call out when it was empty, shut outlet valve, again balance the scale, and write the final weight or tare opposite the initial weight above referred to. The recorders, seated at a table between the coal scales and water tanks, would record the several initial and final weights of the upper tanks, and the time each tank was emptied, and in connection with the latter observe and record the height of the water in the gauge on the lower tank, and the height of water in the boiler gauge. The difference of time between emptying the tanks was noted in a special column to avoid all possibility of error by the omission of one tank. This was also prevented by the blackboard system, as the record remained there for a considerable period, and could be copied at intervals, after which the two observers compared notes. The coal as weighed was also continuously recorded on a blackboard, the initial or gross weight and the final or tare weight being set down in separate columns. These were also copied in ink by the observers at the recording table, and carefully compared before the figures on the board were erased.

The first charge of coal weighed out was approximately two tons and afterwards successive charges of eleven barrow loads, or approximately one ton, were furnished the firemen as often as required. A timber was laid on the fire room floor parallel with the boilers, and as one charge was being burned another charge was placed back of the timber and thrown over by the laborers when the first one was exhausted.

Nothing of special interest occurred in connection with starting the fires on either boiler. The wood was brought close at hand while the boilers were running regularly, and when everything was ready the water level in boilers was noted, feed pump stopped and preliminary fires quickly hauled and wet down, when the furnaces were immediately wooded and there was sufficient heat in the brick work to start the wood at the rear as it was put in the furnace. The time for the experiment was called in each case when the greater part of the wood was in each furnace and in a general blaze. The time from giving the order to haul fires to the time the wood was well ignited, as previously stated, was for each boiler almost exactly seven minutes, so no advantage was obtained in this way.

TEST OF BABCOCK & WILCOX BOILERS.

The test of the Babcock & Wilcox boiler was started at 11:26 A. M. on February 21, and continued until 9:27½ P. M. No special incidents occurred during the trial of that boiler, except that the gland worked off the stuffing box of one of the feed pump rods, requiring that the pump be stopped for a few minutes, but the water level was soon regained. A small allowance was agreed to for the weighed water that escaped. After fires were well started the coal was fired on the system of coking in front and then pushing back the surplus. In due time the firemen fired heavily over the front of all the fires in rapid succession, the men shoveling right and left handed into the same opening. The fires were most of the time eighteen inches to two feet thick and absolutely white hot in every part, so as to pain the eyes when looking at them, much the same as when looking at the sun. The feature of the firing was the frequent use of a heavy slice bar to break up the coal from the bottom and make the mass porous, so that the great thickness did not represent solid coal. The firemen only removed three or four clinkers during the entire run of ten hours, and at the end there was no difficulty in cleaning the bars and side walls thoroughly, the few clinkers in the fire being in detached masses of moderate size.

TEST OF HEINE BOILERS.

The test of the Heine boilers was started at 10 : 36 A. M., February 23, and continued until 8 : 36 P. M. that evening.

The firing was done more frequently and with much smaller charges than for the other boiler, and it was apparently intended to carry the fires very much lighter. As there were, however, three men shoveling coal, the fires became probably a foot thick during the first half of the test, but were reduced a little afterward. After the fires under this boiler were fairly started, the uptakes of each of the two boilers and the flue leading to chimney were observed to be quite hot, and small openings revealed the fact that they were full of flame. This fire was attributed to various causes, such as the firing of soot in the chimney, to the direct passage of flame through the flues, and to the ignition of gas generated in the furnaces. The latter appears to have been the correct solution, as the flames stopped after a while and recurred only at intervals, being less frequent when the men carried fires somewhat lighter than at the beginning of the test. During the first hour it appeared for a time as if the test would have to be discontinued, as the flues were so hot that the felt was fired on the steam pipes running over the flues and the lower chords of the wooden roof girders became charred. It became necessary to turn on water through a hose to avoid danger to the building, which was repeated several times during the test. At the close of the test of the Heine boiler there was evidently much more coal in the furnaces than during the test of the Babcock & Wilcox boiler, and there were also many more clinkers, quite a fair proportion of the grate surface being covered by them where the firemen were unable to dislodge them during the trial. The clinkers also adhered in large masses to the side and bridge walls. This clinker being very heavy, the difference in the amount of refuse shown in the table does not represent the additional amount of combustible in the fires at the time they were hauled. It is fair to say that the representatives of the Heine boiler claimed that their dampers were thrown out of shape by the intense heat during the first part of the test, and that the draught thereafter was not as great as desired. These claims could not be verified while I was at Rochester, but there was no apparent difficulty in burning all the coal on the grates that was desired. The limitation appeared to be that when more than a certain quantity was fired the quantity of gas carried through to the uptake became so great that when lighted by any cause it created the difficulty previously mentioned, of overheating the flues, which necessitated the use of the fire hose on the adjoining woodwork.

FURNACES.

It should be stated that the particular furnaces used were selected by the railroad company and were not of the kind preferred by either competing boiler company. They were, however, exactly alike for each type of boiler and therefore, gave neither the advantage.

At the conclusion of each test, the different observers compared their records and signed them in duplicate. The general results of the tests are shown in the table herewith presented, signed in duplicate by Professor Cooley and myself. Copies of the general records, which were similarly certified in duplicate, are also furnished.

The tabulated report was, at the suggestion of Mr. Foster, and for convenience, made out on one of the Heine blanks, so some of the minor features need a little explanation.

RATING.

As is well known, the value of a horse power used in rating the Babcock & Wilcox boilers is that fixed by a committee of the American Society of Mechanical Engineers, and which was used previously by the writer in reports of the boiler trials at the Centennial Exhibition, such value being thirty pounds of water evaporated into dry steam at a pressure of seventy pounds from feed water at a temperature of 100 degs. On this basis 333,307 British thermal units of heat are derived from the fuel and imparted to the steam for each horse power. This rating has by common consent come to be called the Association rating. The Heine boiler, on the contrary, is still rated on an older basis, viz., the evaporation of thirty pounds of water at a pressure of seventy pounds from a temperature of 212 degs., which corresponds to only 29,932 British thermal units per horse power. The older horse power used for the Heine boilers is, therefore, only 89.9 per cent. of that furnished by the Babcock & Wilcox boilers, and it follows that in driving engines or in doing a given quantity of work of any kind, the Heine boilers are, on account of their rating, only required to do 89.9 per cent. of the work performed by the Babcock & Wilcox boilers, by the Association rating. In lines 28 and 29 the maximum horse power obtained is calculated respectively for the two ratings, from which it will be seen that the Heine boiler, when, by its own method of rating, developing 666½ H. P. would, by the Association rating used by the Babcock & Wilcox Co., only be doing 598.95 H. P., while the Babcock & Wilcox boilers when developing, according to Association rating, 731.78 H. P. would, according to the Heine method of rating, be developing 814.37 H. P.

Column 30 gives the percentage over rated capacity on the basis shown by the side notes; that is, the power in the Babcock & Wilcox boiler is based on the Association rating, while that of the Heine boiler is based on their own rating. The power for the former was taken from line 28, and that for the latter from line 29. Had the power of the Heine boiler been based on the Association rating, it would only have exceeded its rating by 49½ per cent. So also in the next line the square feet of heating surface per horse power is stated for the different ratings of the two boilers. If the Association rating had been used for both boilers, the heating surface per horse power would have been 4.84 for the Heine boiler, and 6.53 for the Babcock & Wilcox boiler.

QUALITY OF STEAM.

The percentage of moisture in steam in line 32 was obtained by the use of the Barrus calorimeter. On the Babcock & Wilcox boiler a perforated pipe was placed horizontally nearly across the vertical eight inch pipe leading upward from the yoke pipe connecting the three drums. The perforated pipe was, therefore, below the angle stop valve which delivered the steam to the engines. The safety valve was on an equalizing pipe connecting the drums nearer the front. On the Heine boilers it was at first arranged to put a perforated pipe nearly across the centre of the tee fitting, which was connected at the bottom to a saddle on the boiler, at the top to the safety valve and at the side to the main steam pipe through an angle stop a little distance away. The writer, however, objected to this, as a perforated pipe so located would not necessarily be in the main current of the steam, as there was room for a large portion of such current to pass on the inner side of the turn and escape the perforated pipe. On No. 3 boiler, therefore, the calorimeter pipe was run across near the bottom of this tee just above the flange, so as to indisputably be in the main current of steam of the boiler to the engine. Another calorimeter was placed on the No. 4 boiler with internal pipe crossing the vertical run of the tee about three-fourths of an inch below the centre of the lateral branch, and therefore partly out of the current to latter. The Babcock & Wilcox boiler which was first tested being very high, there was considerable vapor in that part of the building, and some drops of moisture showed on the outside of the felting on calorimeter. After running for four and a half hours, Professor Cooley said he feared the calorimeter was leaking, which would vitiate the experiments, and I requested him to change it for one of the same kind he had brought with him from the university. After the experiments with this boiler were completed, in calibrating the instruments, it was found on the contrary that the calorimeter first used was tight and the university one leaked, and so only the first part of the record could properly be used, which showed 1.088 per cent. of moisture. That shown by the leaking instrument during the latter part of the test was much less. In the tests of the Heine boiler the instrument first used on the Babcock & Wilcox boiler was applied to Heine No. 3, and a similar instrument owned by the Heine

company applied to No. 4. Occasionally some very high differences in thermometer readings showed for both of these instruments, but particularly No. 3. These, it was claimed by Professor Cooley, were due to spray falling on the exterior of the instruments when drenching the building with water at the time the flues were overheated. These abnormal readings would have increased the amount of moisture shown by these boilers, and while it could not be demonstrated whether the moisture was from the inside or outside, I yielded the Heine boilers the benefit of the doubt. With such abnormal readings erased, the percentage of moisture, as shown in line 32, was 0.755 of 1 per cent. for boiler No. 3, where, it will be recollected, the cross pipe had been lowered completely into the issuing stream of steam, and 0.484 of 1 per cent. for boiler No. 4, where the connection was nearer the centre of the tee. The instrument on boiler No. 3 was really the official one, but again yielding, the average of the two is given in the main column. The difference in moisture for the two types of boiler is very small, as shown, and would have been much less for the Babcock & Wilcox boiler if it had been thought proper to work up the records from the second calorimeter applied, and greater for the Heine, if all the records had been included.

COAL.

The method adopted, as shown by the preliminary agreement, of wheeling alternate barrows of coal to the Babcock & Wilcox boiler undergoing test and the intermediate ones to a pile which was afterward used in the test of the Heine boiler, gave positive assurance that the quality of coal used during the two tests was the same. The coal as it entered the station being quite wet, having just come in cars from the mines, samples thereof were, as stated in the preliminary agreement, dried. The results of these tests for the coal used in the two boilers were so nearly the same when one or two abnormal results were rejected as improbable, that by agreement the moisture was considered to be 4.442 per cent. during both tests, and this percentage has been deducted from the actual weight of the coal in obtaining the amount of dry fuel consumed, stated in column 9. It would doubtless have been proper to add a similar percentage to the water evaporated in both cases, but it has not been done.

CONSTRUCTION OF BOILERS.

Before closing this report, it will be of interest to discuss the question whether or not the enormous difference in results shown by the two boilers is due in any great degree to accidental conditions which can be eliminated on another trial, or whether there is in the construction or proportions of the two types of boilers sufficient reason to account for differences in results as great or nearly as great as shown by these tests. In the Babcock & Wilcox boilers the products of combustion are caused to pass transversely across and between water tubes, which arrangement is believed to be more efficient than when the gases follow along the heating surfaces. A special feature of the Babcock & Wilcox design is also the arrangement of a number of combustion chambers along the route of the gases to the chimney, in which consumed gases may become ignited and the heat of ignition utilized by additional heating surface across which the heated gases pass transversely as before. To accomplish these conditions, the boiler is high and long and the internal space is broken up into alternate clumps of tubes and combustion chambers. The result as shown on the trial was that there was no evidence of the formation of gas, and the boiler gave fair economy, even when working at nearly double its rated capacity. The Heine boiler appears to have been constructed on a different theory. The tubes are placed in one large clump and divided into longitudinal passages by tiles lying on and between the tubes. The only combustion chamber available is that in the furnace and behind the bridge wall, after which the gases are confined in comparatively narrow channels for the whole length of the route to the uptake. It appears evident that any gases unconsumed before entering the passages between the tubes must remain so, and that such gases are liable to become fired in many ways as they issue from the tubes into the uptake or smoke flues and cause trouble of the kind stated, when attempting large capacity.

HEATING SURFACE PER HORSE POWER.

Independent of these differences in construction, there is an important difference in the proportions of the Babcock & Wilcox and Heine boilers. The Babcock & Wilcox boiler is provided with eleven and a half square feet of heating surface per horse power, of thirty pounds from seventy pounds and 100 degs., or of 333,307 thermal units, as above explained, whereas the Heine boiler ordinarily furnishes only seven and a half square feet of heating surface for each horse power of thirty pounds, from seventy pounds and 212 degs., or of 29,932 thermal units. In this particular case they only furnished seven and one quarter square feet instead of seven and a half as above. It is, we understand, claimed that the heating surface of the Heine boiler is more efficient than that of other boilers, and that, therefore, less is required to do the same work. With all due respect, it should be said that there is nothing new in reducing the heating surface of a boiler, so that such reduced surface is more efficient per unit than a larger surface. *It simply does not pay.* This has been shown again and again in trials of other boilers, and the results of these tests merely confirm what is well known.

VALUE OF HEATING SURFACE.

In any boiler the surface to which the fire or products of combustion is first exposed is most efficient, because the heat is transferred at a maximum difference of temperature. As the gases pass toward the chimney their temperature diminishes, and the potential efficiency of each square foot of surface diminishes. All such surface, however, produces economy so long as it still further reduces the temperature of the products of combustion, whereby less heat is wasted in the chimney and more imparted to the water in the boiler. Reducing the heating surface for a given power merely means throwing away more heat in the stack, in case the combustion be perfect, and throwing away combustible gas and unutilized hot air in case the combustion be imperfect. In the latter case, evidently, the uptake temperature may be low even with reduced heating surface, unless the gas be accidentally lighted. The heating surface of the bottom of a kettle set on a stove is very efficient, but it does not prevent much of the heat of the fire from going up the chimney. A kettle enclosed in a furnace is familiar on the farm. The bottom of the kettle is as efficient as that on the stove, but there is in addition heating surface on the sides which acts to reduce the temperature of the products of combustion, so that with this arrangement a given amount of water can be boiled with less fuel. The heating surface of steam boilers has been progressively increased in the same way, but to a greater extent. At first, boilers were shaped like a kettle, or were cylindrical in form, and the heat was applied on the bottom and sides only. Finally flues were introduced through the cylinders, and the heating surface materially increased, with a large saving in fuel. This type of boiler gives large power for a given weight, and being accessible for cleaning will always be a favorite where these conditions are important, and fuel so cheap that economy is of secondary consideration. Such a boiler is, however, greatly inferior to the higher types of boilers now available, in which much larger proportions of heating surface to power developed are employed, and particularly to the Babcock & Wilcox boiler, which is in addition constructed in such manner as to promote perfect combustion and secure the highest protection against dangerous explosions. Boilers built with reduced heating surface may obtain the higher heating surface efficiency shown by the old flue boilers, but necessarily at the same enormous sacrifice of economy.

The relative losses in economy due to furnishing power with reduced heating surface has been satisfactorily settled when using the best fuel obtainable in the most economical form of boiler possible, by experiments made by the United States Government, collated by the writer in an article on "Boiler Proportions," embodied in the report of the judges of Group XX, Centennial Exhibition, at page 69.

The proportionate loss shown by the equation evolved in the above case when calculations therefrom are based on the same proportional reduction of surface as in the boilers tested, corresponds within less than 2 per cent. of that actually shown during such tests, from which facts the conclusion appears incontrovertible that the reduced economy shown by one type of boiler during the tests under discussion was due to the reduction of heating surface rather than to conditions which developed during such tests.

SAVING AND COST.

In conclusion, it will be of interest to examine the relative original cost of steam boilers in connection with the cost of fuel to be paid for continuously afterward. A little calculation will show that with coal at customary average prices, and boilers operated the customary number of hours in a year, the cost of coal per year will equal approximately the original cost of the steam boilers in which it is consumed. It follows, therefore, that a purchaser may pay for better boilers a price increased in proportion to the saving in fuel, when, as such saving is continuous from year to year, it will pay 100 per cent. interest on the increased cost. For instance: If the purchaser must pay $10,000 for boilers which require $10,000 worth of coal per year to operate a factory, he may pay one-eighth more, or $1,250 additional for boilers that will save one-eighth of the cost of the fuel, or $1,250. per year, when evidently the whole additional cost will be repaid to the purchaser every year, or 100 per cent. interest on such additional cost as stated. On the basis of the trials under discussion one type of boiler showed a superiority of 19½ per cent., which corresponds to a saving of 16.32 per cent. when doing the same work. It follows, therefore, on the principles above explained, that a purchaser could pay 16.32 per cent. more for the more economical boilers and yet receive 100 per cent. interest on the additional investment. These illustrations show what an important bearing the economy of a steam boiler has upon its original cost, and emphasize the fact that builders who furnish a reduced amount of heating surface are really furnishing smaller boilers to do the same work, which, although they can be furnished at less price originally, are, as shown by the trials, of less capacity as well as of less economy, making it very much for the interest of the purchaser to pay the higher price for the larger and more economical boilers provided with more heating surface for the same horse power rating.

STATEMENT FROM THE BABCOCK & WILCOX CO.

New York, February 29, 1892.

To the Agents of the Company:

Herewith please find photographic reproduction of a report of the results of competitive tests of the Babcock & Wilcox boiler, rated at 417 horse power, and of two Heine boilers, rated collectively at 400 horse power, which tests were made on the 21st and 23d of this month, under the direction of two experts: one, Dr. Charles E. Emery, the well-known engineer of this city, appointed by this Company; the other, Prof. M. E. Cooley, Director of the Department of the University of Michigan, at Ann Arbor, Mich., appointed by the Heine Safety Boiler Company, of St. Louis, Mo. The results of these tests agree with the predictions of this Company, and place the Heine boiler, both in relation to capacity and economy, exactly in its proper position as a competitor with the boiler manufactured by this company.

The questions to be settled by these competitive tests were the relative maximum capacity of the two boilers with draft available and the economy shown when operating at such maximum capacity. The question of relative capacity is clearly shown by examining the maximum power developed (see lines 28 and 29 of the table), and the relative economy is shown by examining the weight of water evaporated

Results of Test of Boilers at Rochester Railway Co., N. Y.

		One Babcock & Wilcox.	Two Heine Safety.
1	No. and kind of boiler	3 of 36 ins. diam. and 22 ft. 6 ins. long.	1 of 48 ins. × 19 ft. 7 ins. each boiler.
2	Diameter and length of shell	216 4 in. diam. 18 ft. long.	87 3½ ins. × 16 ft. each boiler.
3	Number, diameter and length of tubes	4784	2000
4	Square feet of heating surface	75.8	74.2
5	Square feet of grate surface	416.0 H. P.	200.0 H. P. each.
6	Rated Capacity	Reynoldsville, Pa., run of mine—bituminous.	
7	Kind of fuel used	10.02	10.00
8	Duration of test—hours	33819 00	33015.00
9	Total amount of fuel used—dry	3375.15	3301.50
10	Pounds of fuel per hour	2279.00	4167.00
11	Total amount of ash, including fires hauled out	6.74	12.62
12	Percentage of ash	126.68	127.16
13	Average steam pressure	1.016	1.111
14	" Draft pressure	29.88	29.97
15	" Barometer	171.80	168.25
16	" Temperature of feed	35.86	33.73
17	" Temperature of air	59.35	49 20
18	" Temperature of room	Pyrometer doubtful.	Pyrometer doubtful.
19	" Temperature of stack	23265 4.00	189382.00
20	Total amount of water evaporated into dry steam, Actual conditions	23218.96	18938.20
21	Pounds of water evaporated under actual conditions, per hour	6 879	5.736
22	" of water evaporated per lb. of coal. Actual conditions	7 475	6.255
23	" of water evaporated per lb. of coal, from and at 212°	8.015	7.158
24	" of water evaporated per lb. of combustible from and at 212°		
25	" of water evaporated, per sq. ft., heating surface per hour from and at 212° F	5.270	7.120
26	" of coal per sq. ft. grate, per hour	44.53	44.49
27	" of coal per horse power		
28	Horse power actually developed, {70 lbs. and 100°	731.78	598.95
29	Horse power actually developed, {70 lbs. and 212°	814.37	666.50
30	Percentage over rated capacity	70 lbs. and 100° 75.8	70 lbs. and 212° 66.6
31	Square feet of heating surface per horse power	70 lbs. and 100° 6.53	70 lbs. and 212° 4.35
32	Percentage of moisture in steam	1.088	No. 3, 0.755} av. No. 4, 0.484} av. 0.6195

Rochester, N. Y. February 25, 1892.

Chas. E. Emery, Expert appointed by the B. & W. Co.
W. E. Dooley, Expert appointed by the H. S. B. Co.

per pound of coal (see line 23). These results may be briefly expressed as follows :

Superiority of Babcock & Wilcox Boilers in Capacity (lines 28 and 29) ..... 22.18 per cent.
Superiority of Babcock & Wilcox Boilers in Economy (line 23) ..... 19.5 "

It will be seen that the enormous superiority shown by the Babcock & Wilcox boiler both in capacity and economy is far beyond any difference which can be made by the Heine Company in prices. In fact, the saving in economy, being continuous, is in the nature of interest, and either warrants an enormous increase in the price of the Babcock & Wilcox boiler, or, on the other hand, secures a great saving available for profits or dividends to the purchaser.

The principal questions are thus settled by a mere inspection of the report ; some less important comparisons in the table require a word of explanation. It should be borne in mind that the Heine Company do not sell boilers by the Association standard rating, fixed by a Committee of the American Society of Mechanical Engineers, which is based on the evaporation into dry steam of 30 pounds of water at a pressure of 70 pounds from feed water of 100 degrees temperature, but continue a rating 11⅛ per cent. higher, in which the feed water is assumed to be at a temperature of 212 degrees instead of 100 degrees. Line 28 shows the power developed by the competing boilers under the Association rating, and line 29 that developed by such boilers according to the Heine rating. Line 30, showing the " Percentage over Rated Capacity," is necessarily based on the rating used by each competitor, as indicated in the notes at the left. Evidently by comparing the commercial rating of 400 horse power of the Heine boilers (line 6) with 598.95 horse power actually produced under the Association rating (line 28), the Heine boilers only exceeded their commercial rating by 49.76 per cent. as compared with an excess of 75.8 per cent. by the Babcock & Wilcox boilers.

It is true that the Heine boilers, as shown by line 25, evaporated 7.12 pounds of water per square foot of heating surface per hour and that the Babcock & Wilcox boiler when developing 22.18 per cent. more power only evaporated 5.27 pounds of water per square foot of heating surface per hour, but this is because the Heine Company only furnishes ordinarily 7½ square feet of heating surface per rated horse power, or 7.25 in this case (see lines 4 and 6), while the Babcock & Wilcox Company furnishes 11½ square feet of surface per horse power. The reduction of surface in the Heine boiler makes it cheaper to construct, but this is principally for the benefit of the Heine Boiler Company, and can in no way profit the purchaser on account of the comparatively enormous consumption of fuel, which is a continuous charge and not paid for in the beginning like the price of a boiler. The increase in heating surface also gives the Babcock & Wilcox Company a decided advantage, as shown by the enormous increase in capacity when such capacity is desired. If the boilers were worked nearer their rated capacity both would be more economical, but the Babcock & Wilcox much more so, on account of its greatly increased heating surface. This test shows whether or not the increased heating surface furnished by this Company is of value.

In line 31 the square feet of heating surface per horse power, as will be observed, is also shown according to the two different ratings. If made on Association rating the Heine boiler developed a horse power with 4.84 square feet of heating surface and the Babcock & Wilcox boiler with 6.53 square feet of heating surface, the extra heating surface of the latter showing its value, as before, by the increase in capacity and economy.

The facsimile report is marked " Not for Publication," for the reason that the Heine Safety Boiler Co., through their representatives, at the time of the test, expressed dissatisfaction with the results, though in no wise disputing them, as shown by the signature of their expert, and as the expert of this company at the time agreed to use his influence to prevent the publication of the report by the press of the country, pending another test, if made within a reasonable time, this Company has informed the Heine Company that it will agree to take part in further tests if made complete both for capacity and economy in the same boilers, without alteration between tests, within 15 days from date. In the meantime the agents of this company to have copies of the report of the previous tests for private circulation for business purposes, but not for the purpose of publication in the journals of the country.

It is not expected that the Heine boiler can make much better showing than that in this report. It appears that in forcing the boiler, part of the fuel formed gas, which was periodically ignited in the flue connections to chimney, making them red hot. This is precisely what should be expected with a boiler so constructed, and can best be prevented by not attempting such a capacity.

The increased quantity of refuse (line 11) shown during the trial of the Heine boiler was not due to difference in quality of fuel, but mainly to misjudgment on the part of the fireman, in leaving more coal in the furnaces at the end of test than was the case when the Babcock & Wilcox boiler was tested. An allowance of 4.44 per cent. reduction of weight in coal was agreed upon for both boilers on account of the coal being very wet from exposure to the weather. The extra coal in the furnaces at the end of the test of Heine boiler increased the capacity shown by that boiler, and even if on another trial the same percentage of refuse be obtained for both the boilers the results will, as is evident on inspection, still be enormously in favor of the Babcock & Wilcox boiler both in ecomomy and capacity.

THE BABCOCK & WILCOX COMPANY,
Per N. W. Pratt, *Treas.*

STATEMENT FROM THE HEINE SAFETY BOILER CO.

St. Louis, March 19, 1892.

The Babcock & Wilcox Co., through their agents, are circulating among the steam users of the whole country a fac simile of a sheet of results of test of Babcock & Wilcox and Heine safety boilers recently made at Rochester, N. Y., to which they have added a two page dissertation on the same. On account of this publication and its circulation among possible customers, it becomes necessary for us to make a full explanation as follows :

On May 7, 1890, we closed a contract, through our New York agency, with the Rochester Railway Co. for four of our 200 H. P. boilers, which were subsequently delivered and put into service. These boilers were operated with the greatest satisfaction, and never, to the present time, have cost one cent for repairs nor caused a moment's cessation in the regular operation of the road. Before the boilers were fully paid for the extension of the system outgrew the power, and it became necessary for them to purchase more boilers. The Babcock & Wilcox Co. secured the order for one of their "double-deck" type of boilers, rated at 416 H. P. In due course of time this boiler was erected under their own supervision and connected into the smoke stack. From the day it was put to work it *never* gave satisfaction. Although sixteen H. P., nominal, larger than two of the Heine boilers, it *never* would do

the work of two of them, and as a consequence it was never possible to cut out two Heines for cleaning at the same time, while no trouble was experienced in operating the road with the four Heines when the Babcock & Wilcox required attention. This happened a number of times, and can easily be proven to be a fact.

Bear in mind that the Babcock & Wilcox had been erected, walled in and connected into the chimney under the plans coming from the main office and the superintendance of their erecters.

In January last, it was decided to purchase more boilers, and so great was the dissatisfaction of the railway company with the Babcock & Wilcox boilers, that the order was about to be placed with us, when the Babcock & Wilcox Co. telegraphed and wrote the railway company, stating broadly, that their boiler *was doing and had been doing as much and more than two of the Heines* and offering to demonstrate the same by a test of the two makes, for which they offered to defray all expenses.

When this challenge was laid before us, we consented to go into the matter and agreed to appoint an expert, put our boilers into proper condition and be present and take part in the comparative test, provided it could be made during the first week in February and under existing conditions.

As soon as this arrangement was made the Babcock & Wilcox Co. sent a number of men to Rochester to clean their boiler preparatory to the test. It was reported to us by one of our erecting engineers then in Rochester that they were proposing to make certain changes in their flame plates and stack connection. To these alterations of conditions we protested to the railway company both by telegram and letter, with the result that they told the Babcock & Wilcox Co., that they must run their boiler under the same conditions as existed at the time the challenge was made, and compelled them to stop the work. The Babcock & Wilcox Co., however, secured the consent of some one higher in authority and the changes were made despite our protest. Here we would have been perfectly justified in dropping the whole matter and declining to make the test, but having every confidence in the ability of our boiler to overrun its rated power and to evaporate more water per square foot of heating surface than the Babcock & Wilcox boiler could, we made no further protest and went ahead with the preparations.

Bear in mind that while the Babcock & Wilcox boiler was cut out to permit of these alterations being made, we could do nothing on our boilers.

As soon as their changes were completed they sent their expert (Mr. Chas. E. Emery of New York) to Rochester, and called upon us to test.

The regular practice of the railway company was to fire the four Heines with two firemen, or 400 H. P. nominal, per man, and one man for the 416 H. P. Babcock & Wilcox boiler also. Even after the changes had been made, which certainly made a great improvement in its workings, one man on the Babcock & Wilcox boiler was still unable to make it do the same work that one man obtained from two Heines, and, consequently, we were unable to obtain but one boiler at a time to clean. For this reason, animated with an honest desire to cause no unnecessary delay, we worked our men night and day, and made every effort to get our boilers into condition as soon as possible. For this reason also we made no regular preliminary tests, but only such as we were able to make at very short intervals during the regular operation of the road. While these preparations were being made, the representatives and experts of both companies were engaged in arranging the various preliminaries, and agreeing upon the details of an agreement under which the tests were to be made.

At the first conference, the representative of this company stated to the experts the above facts, and made the further statement that any test which might be made could in no sense be considered as proving anything in regard to the original challenge, for the reason that the Babcock & Wilcox Co. had made changes on their boiler and its setting which entirely vitiated the challenge. Further, that we were willing to go into a comparative test for the purpose solely of demonstrating the greater value of our heating surface, and further, of our ability to overrun *our* rated power to as great an extent as the Babcock & Wilcox Co. could theirs. An economy test was suggested, but we declined going into that matter at all at that time, as it had never been questioned, and no challenge had ever been made upon it. For this reason we at first declined weighing the coal at all, but finally consented to its being done, under the *distinct understanding* that we, on our part, should make no effort at economy, and that such results as might be obtained, should only be used as useful information, and valuable to each company for future tests.

To thoroughly understand the matter, it should be stated here that this company rates its boilers on the purely arbitrary standard of thirty pounds of water evaporated per hour, from 212 degs. F. into dry steam, of seventy pounds pressure, and that the Babcock & Wilcox Co. rates its boilers on another purely arbitrary standard, viz., thirty pounds of water evaporated from 100 degs. F. into dry steam of seventy pounds pressure.

It may be mentioned, as explaining this difference, that another well known company building patent boilers, rates theirs on still another arbitrary standard, viz., thirty pounds of water evaporated from 212 degs. F. at atmospheric pressure.

Either of the above standards is as good as the others, so long as *some* standard is used, for the reason that the smallest of them gives ample steam to generate a horse power in any good modern engine, in reasonably good condition.

The preliminary arrangements were concluded, and the test of the Babcock & Wilcox boiler was made on Sunday, Feb. 21, with the result as shown. Owing to sickness of our men, it was decided to rest on Monday, and make the test of the Heines on Tuesday the 23d, which was done.

Our head fireman is a Western man, entirely unacquainted with Eastern coals, excepting such knowledge as he had been able to acquire during his stay in Rochester, from watching the regular firemen at their work, and from firing himself at such short intervals as offered. He was assisted by the regular firemen of the road, who, although excellent firemen when in their regular work, were totally unacquainted with testing work, and in no sense experts.

A very good start was secured, but immediately afterwards our firemen, in their efforts to get their fires to maximum efficiency in the shortest possible time, got excited, and put altogether too much of the very gassy coal into the furnaces, in fact, much more than they could burn, with the result that the furnaces were converted into gas retorts generating gas in large quantities, which ignited in the breeching, heating it red hot, endangering the roof of the building, and, as was afterwards discovered, bending and warping the dampers into all possible shapes. Of course after this happened, it was idle to proceed, as the second hour's run showed that we were only getting power about 65 per cent. of the rating. Our representative desired to stop the test at this point, but consented to continue the same under *the direct agreement* that all the circumstances should be fully stated in the expert's report, and with the promise of Mr. Emery, the expert of the Babcock & Wilcox Co. that he would use his influence with that company to prevent the use of the information to our disadvantage.

Up to the present time no report of the tests has been made by the experts and the Babcock & Wilcox Co. have clearly violated all principles of courtesy and justice in sending out a strictly *ex parte* statement of results.

After the tests were concluded, our representative challenged the Babcock & Wilcox Co. to go into further tests, which they agreed to do. It is, therefore, a sharp business trick, played with the hope of influencing pending trades in their favor, for the Babcock & Wilcox Co. to issue *any* circular on the matter. Furthermore, it is a violation of professional courtesy, to issue such a paper in advance of the experts' report.

Referring to the Babcock & Wilcox circular in detail we would say as follows :

We offer no comments on the first paragraph, excepting the concluding sentence thereof. The test settles nothing at all excepting the ultimate capacity of the Babcock & Wilcox Co., which all present at the test admit, was reached. We, fortunately, have indisputable records demonstrating the ability of this same size of Heine boiler to overrun its rated power to a much greater per cent. than the Babcock & Wilcox Co. did at the test.

In regard to the second paragraph, we desire to say that it is in direct contradiction to the facts in so far as it refers in any way to economy, and the same remark applies to the third paragraph.

The fourth paragraph is based upon the assumption that their own basis of calculating horse power is the best and only one. It has never been formally accepted or adopted even by the Association, from a committee of which the standard emanated, and is no more binding upon the engineering fraternity than any other. There is no justice in calculating the Heine boilers on the Association basis. They are figured and built on a well recognized standard, large enough to develop a horse power on any well built and well handled engine.

Referring to the fifth paragraph of the circular, we reply that, as aforesaid, any remarks on the economy obtained are unjustified, but that otherwise we are perfectly willing to stand on the record of water evaporated from and at 212 degs. F. per square foot of heating surface, which is the real criterion of the efficiency of the boiler itself.

Babcock & Wilcox boiler,	5.27 lbs. water per hour.
Heine boiler,	7.12 " " " "

showing a superiority of 35 per cent. efficiency in favor of the Heine.

Furthermore, notice the quality of the steam furnished :

Babcock & Wilcox boiler,	1.088 per cent. entrainment.
Heine boiler,	0.619 " " "

or the steam from the Babcock & Wilcox boiler carried over 75.26 per cent. more water than the Heine boiler.

Paragraph six is correct excepting in the deductions. It certainly demonstrates the superior efficiency of heating surfaces constructed as we build them.

Paragraph seven is incorrect. We do not dispute the accuracy of the observation or the results as calculated. We are surprised, however, that no more attention has been paid to the recommendations of Mr. Chas. E. Emery, who, no doubt, has kept his promise made to our representative. No time was agreed upon within which further tests were to be made; on the contrary, our representative stated distinctly that previous engagements would prevent our taking up the matter much inside of three weeks.

Paragraph eight is merely an opinion. Ours differs materially, as may be judged from the fact that we at once challenged them to further tests, and our opinion is based upon results obtained both before and since the test under discussion.

The remarks made by the Babcock & Wilcox Co., in the concluding paragraph, in regard to the different amount of refuse found in the ash pits at the conclusion of the test are also not justified by the facts. Although an earnest effort was made to supply each boiler with the same quality of coal, yet the fact is undisputable that the coal used under the Heines contained a greater proportion of slack, with the result that our refuse contained over twice as much hard clinkers as theirs. Very little attention was paid to this at the time, as under the agreement this matter of economy was not to be considered, and when the experts' report is published it will contain no reference to the matter of economy.

HEINE SAFETY BOILER CO.
By Chas. F. Foster, General Manager.

SPECIAL NOTICES.

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FOR SALE.—38 lb. girder steel rails (side bearing) for relaying. S. P. S. Ellis, Penn Building, Pittsburgh, Pa.

FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

FOR SALE—STREET CARS.—On account of increase of business calling for larger cars, we have for sale 9 twelve-foot, double-end, box cars, with fare box in each end. Gauge 4 feet 8½ inches. Apply to UNION STREET RAILWAY CO, New Bedford, Mass.

POSITIONS WANTED.

WANTED.—A position as Superintendent or Assistant with an Electric Road, by a young man thoroughly competent in all branches. Address J. E. M., P. O. Box 792, Syracuse, N. Y.

WANTED.—S. P. S. Ellis, Penn Building, Pittsburgh, Pa., representing Johnson Company of Johnstown, Pa., invites correspondence with manufacturers desiring to be represented in Pittsburgh and vicinity.

WANTED.—A man with over 10 years' experience, desires a position to take charge of the inspection and detective department of a street railway company in any part of the country. Can furnish the best of references regarding ability, etc. Address "W. F. G.," care of STREET RAILWAY JOURNAL. 4t

HELP WANTED.

WANTED.—A firm of electrical engineers and contractors would like to be put in communication with a first rate foreman of street railway overhead and track construction. Must be able to take complete charge, keep own accounts, etc. Address "BROADWAY," care of STREET RAILWAY JOURNAL.

FOR SALE.

125 tons second-hand 38 lb steel tram rails, in excellent condition.
100 tons second-hand 25 lb steel T rails, but little used.

D. E. GARRISON & CO., - - 219 N. 4th St. Louis, Mo.

FOR SALE.

Two 150 H. P. Engines, made by the N. Y. Safety Steam Power Co. Size, 15½ in. × 16 in. Two Band Wheels, 72 in. × 15 in. Foundation Stone for Engines.
Three Hill Friction Clutch Pulleys, 72 in. diameter × 21 in. face.
Three Hill Friction Clutch Pulleys, 72 in. diameter × 12½ in. face.
150 ft. of $3\frac{13}{16}$ Shafting, with Couplings and Adjustable Floor Stands.
Three Boilers, 44 in. diameter × 26 ft. long, with four flues each; all complete with steam and mud drums, fire front, breeching, steam pipe and fittings, two large heaters and purifiers.

This is a Complete Plant for Electric Purposes,

All in First Class Order, ready to put up. For Sale Cheap.

GRAINGER & CO.,

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Electric Cars,

BOTH OPEN AND CLOSED.

QUICK DELIVERY AND AT LOWEST PRICES AND ON LONG TIME. THEY ARE REAL BARGAINS.

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FOR SALE.—700 tons, in lots to suit, 30, 35 & 40 lb. Steel T Rails, good as new.

I will buy any size of Second Hand or Worn Out Rails of every section.

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STEEL RAILS.

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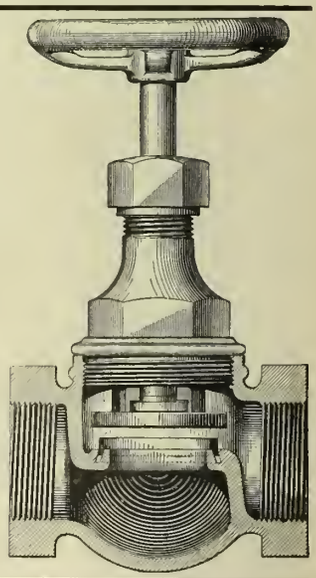
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THE STREET RAILWAY JOURNAL

Vol. VIII. *NEW YORK & CHICAGO, MAY.* *No. 5.*

The 155th Street Viaduct, New York City.

The city of New York has of late years made many improvements to facilitate communication in the upper part of Manhattan Island. One of its recent and most important works towards the attainment of this object is the viaduct that is now building in 155th Street, two views of which, with diagram, are given in this issue. The object of the structure is to bring the inhabitants of Washington Heights into connection with the Manhattan elevated railway, Harlem River and its opposite shore, Westchester.

The viaduct is composed of spans forty-three feet between centres, the columns in every other span being connected with each other by means of struts and of latticed iron braces. The columns are eighteen inches square, and rest on concrete piers supported on a foundation of piles. The width of the viaduct, between railings, is sixty-two feet, with a roadway of forty feet and two sidewalks of eleven feet each. These sidewalks overhang the outside longitudinal plate girders, as the conditions of the street limited the transverse spacing of the columns to forty feet.



FIG. 1.—155TH STREET VIADUCT CROSSING ELEVATED RAILWAY AT 8TH AVENUE, NEW YORK.

The viaduct, which is 1,400 ft. long, starts from the very precipitous bluff at Edgecombe Avenue at an elevation of sixty feet above 155th Street, and extends along this street with a uniform descent of 4¾ per cent. over the Eighth Avenue elevated station to the Harlem River, where, at a height of twenty-eight feet above the street, a wide platform will form connection with the McComb's Dam road and with the Central bridge. The illustration on this page shows the present appearance of the structure at the point where it crosses the Elevated railway station at the corner of 155th Street and Eighth Avenue, at an elevation of forty-eight feet above the street. Here, as will be seen more clearly from Fig. 2, a level plaza, 150 × 70 ft., affords ample standing room for carriages. Four staircases of a new and handsome design will lead at this point from the sidewalk of the viaduct to both the elevated platforms and to the street. These stairs will be of wrought iron, six feet wide, and will be provided with a wooden canopy supported by poles of one and a half inch wrought iron pipe. Fig. 3 shows the present appearance of the structure from the Washington Heights side.

The roadway is paved with six inch granite blocks laid on a foundation of bituminous concrete on buckle plates. The wearing surface of the sidewalks is rock asphalt on a basis of bituminous concrete. The superstructure is built of soft steel, and its weight will be about 4,000 tons. Mr. Herbert Steward is the contractor, with the Union Bridge Co. as sub-contractors for the metal work and the Hecla Iron Works as the sub-contractors for the ornamental railing and the staircases. The outlay for the work, which will be completed this summer, will be about $600,000. The viaduct is built according to the designs and under the supervision of Alfred P. Boller of New York.

A NEW electric railway will soon be in operation on Staten Island, using twelve Edison motor equipments, and two 100 K. W. generators. Among those interested in the company are C. A. Starbuck, J. C. Thompson, president of the Eames Vacuum Brake Co. and Royal C. Vilas, president of the New York Air Brake Co. The line will be about three and a half miles in length and will use about one-fourth of a mile of the Belt Line track.

Results Attained by the Buda-Pesth Electric Railway.

In connection with the incorporation of the Siemens & Halske Co., of Chicago, described at length in our last issue, the following statistics of the results of operation of the Buda-Pesth electric railway, on which the underground conduit system of this company is employed, are of some interest. During the year ending December 31, 1890, the first in which this road was in operation, the total number of passengers carried was 4,459,234 and the total income amounted to $98,851, assuming the value of the Austrian florin to be 35.9 cents. Since there were 5.64 miles in operation during this period, the receipts per mile and month were very nearly $1,461. In July, 1891, the length of the road was increased from 5.64 to 6.82 miles. During the year ending December 31, 1891, the greatest number of passengers carried in any month was 854,619 in October, and the least number, 495,373, in February, the average being 718,268 and the total for the year 8,619,214. The total income was $194,230 or $2,585 per mile and month.

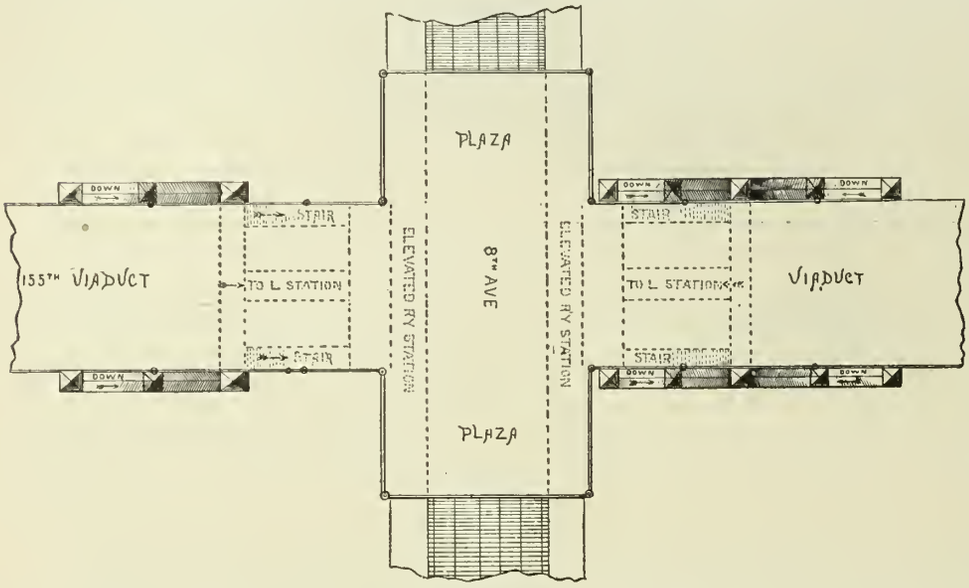


FIG. 2.—PLAN OF ELEVATED RAILWAY CROSSING—155TH STREET VIADUCT, NEW YORK.

It will be seen from the above figures that during the last year the number of persons carried has very nearly doubled and the receipts have increased proportionally. The extension of the road in July resulted in a marked increase in the number of passengers carried and the income per mile increased from $1,461 to $2,585. It would be very interesting to know the relative increase of car mileage and cost of operation, but the official reports are, unfortunately, silent in this respect.

In investigating the reports of the Buda-Pesth horse railway for 1891, a slight decrease in the number of passengers carried is noted, and the income per mile has also fallen. This fact, taken in connection with the increased traffic on the electric line, apparently indicates that the Hungarians prefer electricity to horses as a means of propulsion. While the electric railway carried 114,708 passengers and received $2,585 per mile monthly, the horse railway carried but 52,627 and received but $1,606. The latter, therefore, carried less than half the number of passengers and received only 62 per cent. as great an income per mile and month. It must also be noted in this connection that the average fare per passenger was 2.24 cents on the electric line and 3.03 cents on the horse railway. This difference, however, may be explained by the greater length of the horse railway, which is 28.4 miles, and the custom of charging a fare proportional to the distance traveled, which is nearly universal in Europe. Nevertheless, it is evident that the Buda-Pesth electric road is remarkably successful among Austrian railways as regards passengers carried and gross income per mile, for even on the almost constantly crowded lines of the Vienna horse railway the number of passengers per mile is only about 82,000 per month and the income about three-fifths as great. The working expenses are at present about one-half of the revenue, a much more favorable showing than with the horse railways where the ratio of working expenses to revenue is about twelve per cent. Any of our readers desiring a more complete record of the operations of both the roads in Buda-Pesth, will find the figures in the issue of the Zeitschrift of the Austrian Society of Engineers & Architects for March 18.

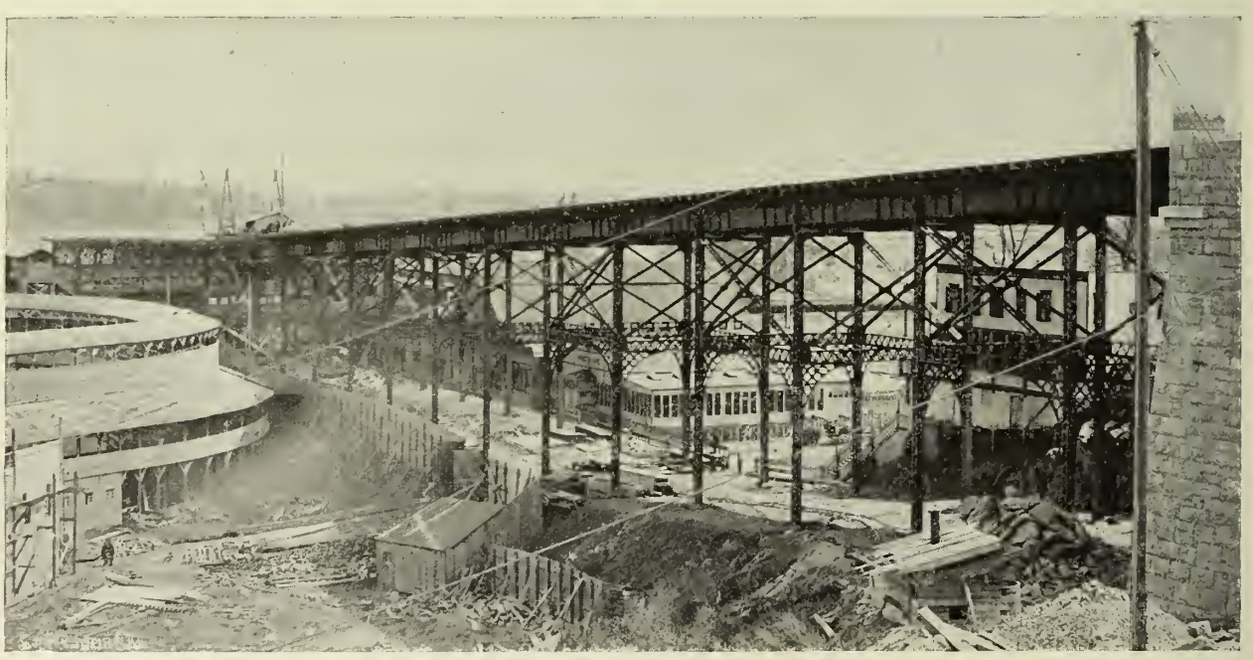
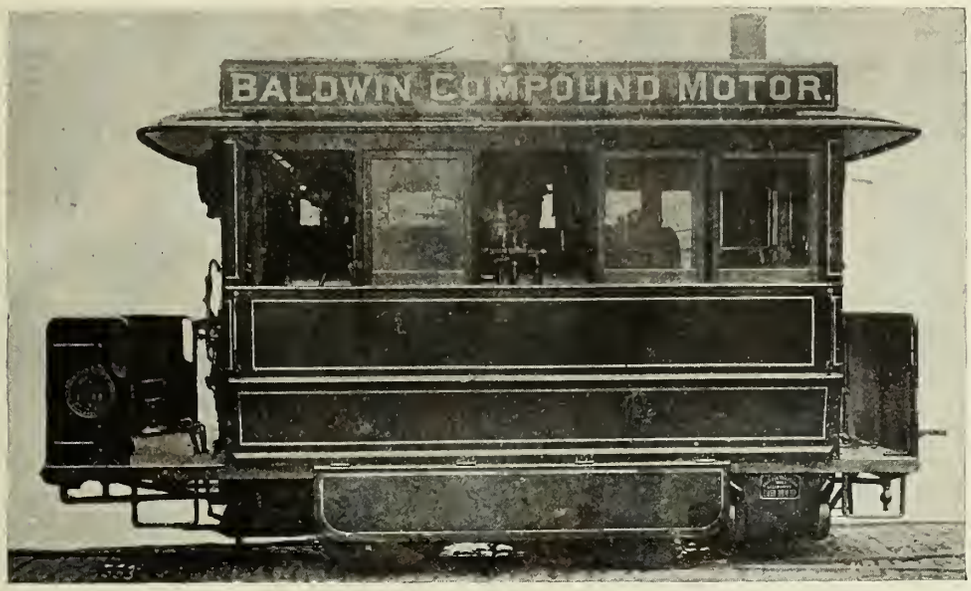


FIG. 3.—155TH STREET VIADUCT, NEW YORK—VIEW FROM WASHINGTON HEIGHTS.

THE electric railway at Ashtabula, O., is finished and was put in operation April 11, on which day 1,200 passengers were carried.

A New Compound Steam Motor.

A compound steam motor of somewhat novel construction has recently been built by the Baldwin Locomotive Works of Philadelphia for the Wilmington (N. C.) Street Railway Co., and is shown in the accompanying



NEW COMPOUND STEAM MOTOR.

engraving. The Vauclain system of compounding has been adopted. The cylinder dimensions are high pressure, seven and a half inches diameter, low pressure thirteen inches diameter and sixteen inches stroke. The total weight of the engine is 35,500 lbs., all of which, of course, rests on the drivers and is so available for traction.

One great object aimed at by the manufacturers in compounding, besides the economy effected, was noiselessness, and by the expansion of the steam in the two cylinders the pressure is so reduced that the escape of steam is attended with no noise. Moreover, when it is delivered to the condenser such a large degree of expansion has taken place that the temperature of the escaping steam is reduced to such an extent as to facilitate its condensation. The condenser consists of brass tubes placed on the roof, through which all the steam from the cylinders, safety valves, etc., is passed. As the entire volume of exhaust steam passes directly to the condenser, the motor operates by natural draft, and in order to provide sufficient steam the fire box and boiler are made unusually large.

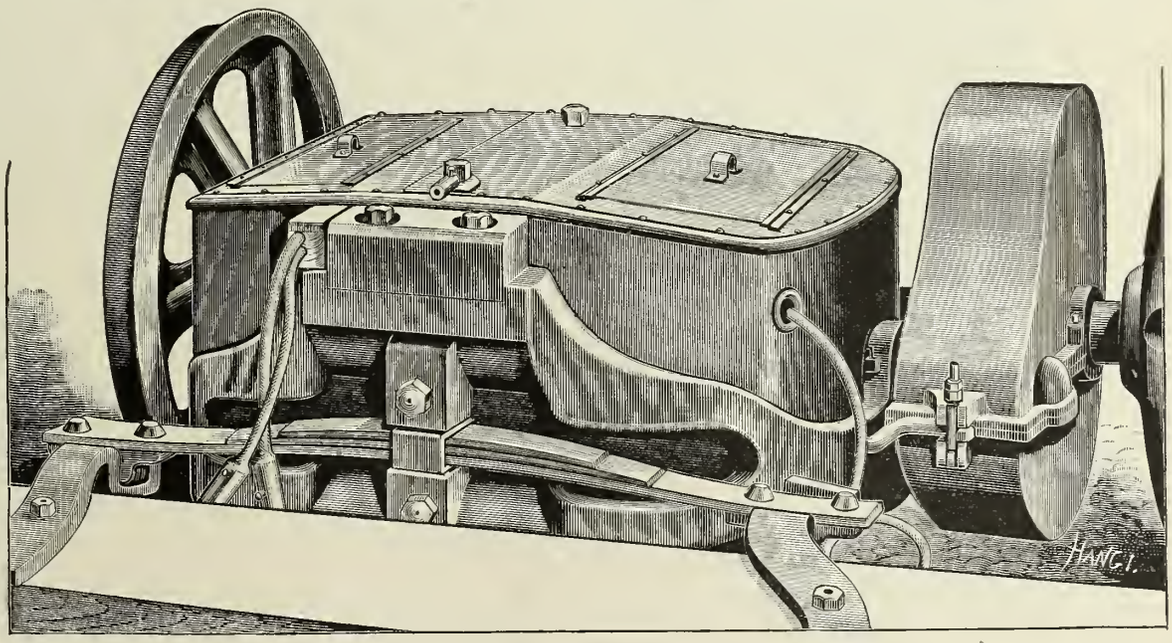
A device is provided for exhausting the steam from the cylinder through ordinary exhaust nozzles and out of the stack instead of through the condenser, when unusual power is required to surmount heavy grades or handle an unusually heavy load. This device is at the control of the engineer, and, of course, instantly changes the machine from a condensing to a non-condensing engine.

Wightman Twenty-Five H. P. Motor.

The Wightman single reduction railway motor was illustrated and described in the pages of this journal about a year ago, but since that time this motor has undergone several improvements which, in the main, relate to the protection of the field windings and the working parts of the motor against external agencies. The latest type of the Wightman motor, shown in the accompanying illustration, is entirely encased in a steel armor, which, while making the motor practically dust and water proof, still permits of ample ventilation. The motor casing is arranged with a view of offering thorough protection to the motor and at the same time permitting of easy access to such parts as require frequent inspection. The casing is made of sheet steel firmly riveted to the motor frame; and this greatly increases the strength of the motor without adding unnecessarily to its weight.

The motor gear case, too, has been improved. As now manufactured, it is of malleable iron and is in three parts, very easy to attach or take off. It is absolutely dustproof, and the parts are so fastened together that it is impossible for them to work loose.

The controlling switch used with this motor is of the standard Wightman type, having speed controlling handle and reversing handle combined in one, making the operation of the simplest possible character. Speed regulation with this controlling device is obtained without the use of any external resistance above a car speed of three or four miles per hour. There are five speed contacts possible for each direction of operation.



NEW TYPE WIGHTMAN TWENTY-FIVE H. P. MOTOR.

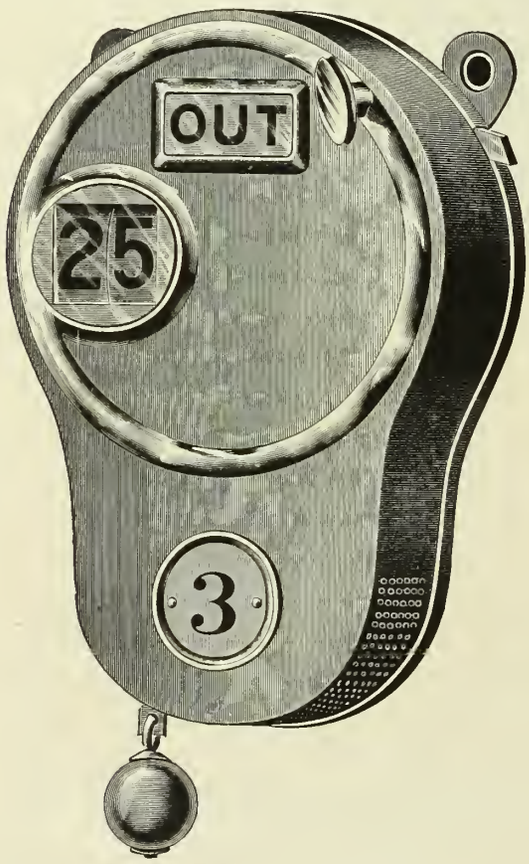
Some recent tests made by Mr. Jas. T. Gardiner, consulting engineer at St. Joseph, Mo., where the Wightman system entered into competition with other well known systems, gave flattering results for the Wightman motor.

Among their recent orders the Wightman Electric Manufacturing Co. have recently been awarded the contract for twenty car equipments and a 300 H. P. generator for the Seashore Railway Co. of Asbury Park, N. J.

New Portable Fare Register.

In the accompanying illustration is shown a new portable fare register, made by the International Register Co., of 302 Dearborn Street, Chicago. A heavy, clumsy register is a burden to a conductor, especially during hot weather, and the fact that this device, the cut of which is three-quarters the standard size, weighs only sixteen ounces and is extremely compact, is claimed as an especial advantage. The register is made in a thoroughly workmanlike manner, on well defined mechanical principles, and will not easily get out of order. The whole mechanism is made of a high grade of steel, such parts being tempered as are subject to the most wear. The outside case is of German silver, highly polished, and can be kept bright with a little care. The register is thoroughly accurate and reliable in its operation, and cannot be tampered with.

The face or trip register counts up to 100 fares, and can be shifted or reset to o from any point. The permanent register, which is seen from the back, has a total capacity of 10,000 fares; if necessary this can be made 100,000 or even 1,000,000. One valuable feature of this permanent register is the concealing slide, which can be set to cover the totals by means of a key, thereby concealing the permanent record from the conductor. This is considered an advantage by many street railway companies, for the reason that, if on a busy day the conductor should forget to ring some fares (intentionally or otherwise) he is obliged to turn over all the money he has when settling, in order to save himself, as he does not know what the totals are.



NEW PORTABLE FARE REGISTER.

Although on the market but a comparatively short time, the demand for these registers has been large, the manufacturers reporting the equipment of some fifteen roads throughout, together with a number of orders from roads putting on additional cars.

AN electric elevated railway, seven miles long, is proposed in Elberfeld, Barmen, Germany. The plans which have already been submitted by Siemens & Halske, of Berlin, contemplate equipping all the cars with motors and running them in trains of two or more. The elevated road will be situated at the side of a river.

Brooklyn Street Railways.

BROOKLYN CITY RAILROAD CO.

This company operate more miles of track in Brooklyn than any other railway company and cover a most extensive territory. To give all of the routes covered by their cars would occupy too much space, but a mention of the following principal points touched will give some idea of the vastness of this company's system: Greenpoint, Long Island City, Hunter's Point, Tenth Street, Twenty-third Street, Grand Street, Broadway, Houston Street, Roosevelt Street, Fulton, Wall Street, Hamilton, South and Thirty-ninth Street Ferries; Wallabout market; Washington, Tompkins, City, Carroll and Prospect Parks; County buildings, Calvary and Holy Cross cemeteries, Brooklyn Bridge, Ridgewood, Newtown and Richmond Hill. The charter of the company was granted in 1853, and at the present time the company own and operate under lease a total of 180 miles of track, of which 142 employ horse power, eighteen steam power and twenty electric power. The track on the portions of the road operated by horses is from forty-five to sixty-four pounds in weight, and of a variety of types, principally centre bearing, tram and girder. The cars owned by the company are 1,548 in number, of which 815 are box, 714 are open, twenty-nine are steam motors and twenty electric cars, which latter will be referred to more particularly later. These cars are from the shops of the following well known companies; Lewis & Fowler Manufacturing Co., J. M. Jones Sons Co., John Stephenson Co. and J. G. Brill Co.

The average car mileage per day (horse) is 43,475. Each horse in good health covers sixteen miles per day. The average number of passengers per day is 201,215. The total number of horses owned by the company is about 5,500. To accommodate this large number of horses and cars the company have twenty-six different depots located at various points along the routes covered by them.

The first use made by this company of electric power for the propulsion of their cars was upon their branch extending from Thirty-ninth Street Ferry, South Brooklyn, to Bensonhurst and Gravesend Bay near Coney Island. This branch, which is nearly seven miles long, is laid with sixty-three pound girder rail of the Lewis & Fowler type the trolley wire being supported by tubular iron poles. The rolling stock consists of twenty eighteen foot open cars and as many open trailers, all being of Lewis & Fowler manufacture. The motor cars are mounted on Manier trucks and each is equipped with two fifteen H. P. S. R. G. Thomson-Houston motors. A speed of from fifteen to twenty miles an hour is often maintained on this line, the route being for a large part over new streets and in suburban districts. As many as 20,000 people have been carried on this line in one day.

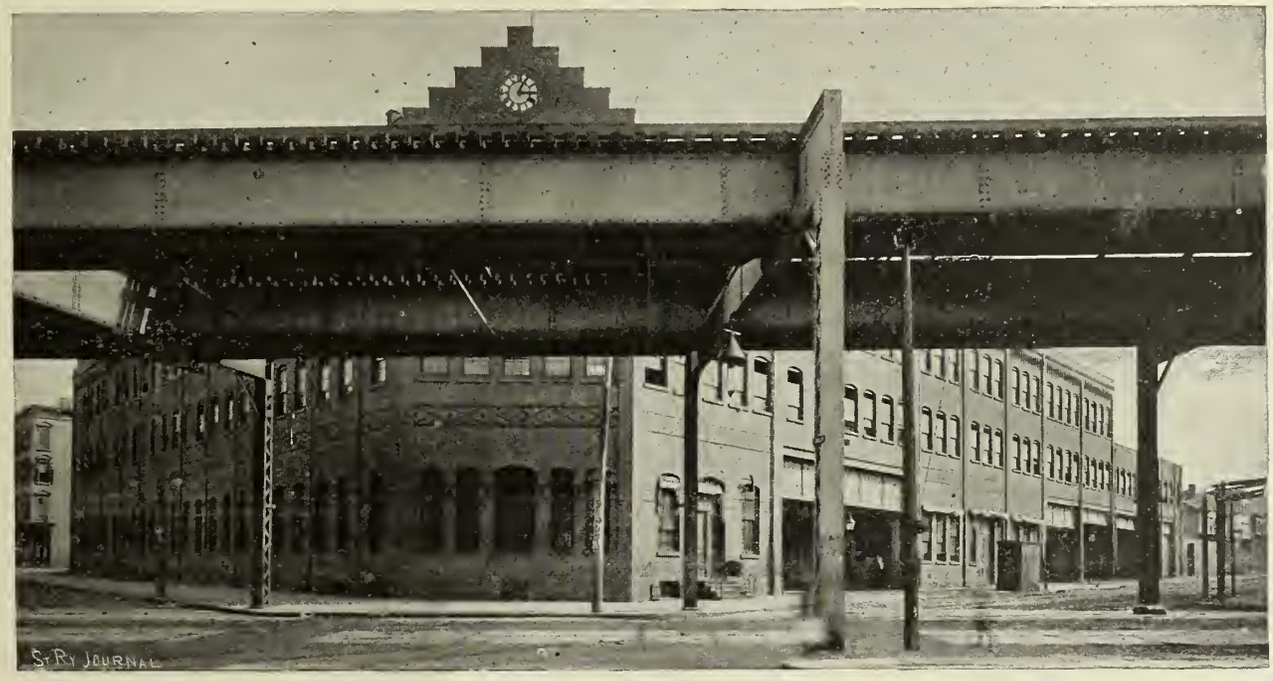
The power house is a temporary wooden structure 80 × 100 ft., and the power equipment consists of four Babcock & Wilcox high pressure boilers with a National feed water heater, two 350 H. P. McIntosh & Seymour tandem, compound engines and eight 100 H. P. Thomson-Houston multipolar generators. The flywheels are belted directly to the generators, perforated belting manufactured by Charles A. Schieren of New York being employed. The car barn is located directly in the rear of the power house, and occupies a space of 350 × 100 ft., and has a capacity for seventy-five cars.

The capital stock of the company is $6,000,000 upon which a dividend of 2 per cent. quarterly is paid. The amount of bonds which the company are allowed to issue is $6,000,000. At present only one-half this amount has been put on the market. These bear 5 per cent. The offices of the company are at 10 Fulton Street. The officers are Daniel F. Lewis, president; E. D. White, vice-president; H. M. Thompson, secretary and treasurer; Thomas P. Swin, assistant secretary and treasurer; J. C. Cameron, superintendent.

The new electric equipment of the Brooklyn City Railway, some details of which were given in our last issue, is being pushed rapidly forward. The Fort Hamilton and Hamilton Avenue lines are the ones selected upon which

the electric system will be first installed. They will be supplied with current, temporarily, from the Second Avenue station described above. The company, however, have prepared plans, and will soon commence work on an extensive power station which will be located on New York Bay at the foot of Fifty-second Street. For convenience in the receipt of fuel, this station will have a solid bulkhead dock 100 × 700 ft. close to it and fronting the bay. On this will be placed a large coal pocket from which will be run coal elevators. These elevators will fill cone shaped receptacles which will empty fuel in front of each boiler so that the firemen can draw coal as desired.

The engines will be eight in number, of 1,000 H. P. each, manufactured by E. P. Allis & Co. of Milwaukee, and of the Reynolds-Corliss type. These engines will be stronger in certain parts than any others built. The boilers will be furnished by the Babcock & Wilcox Co. of New York, and will be of extra heavy material, probably the strongest of their size ever built. The generators will be supplied by the Thomson-Houston Electric Co., and will be of about 750 H. P. capacity each. They will be erected on an elevated gallery in the centre of the power station, about sixteen feet above the ground floor, on which the engines will rest, and will be belted directly from the engines without countershafts. The arrangement decided upon is to connect two generators by friction clutches with one driven pulley, the armatures being in line, and the pulley carried on pillow blocks between the generators. This arrangement enables the operation of either generator or both directly by one engine. The size of the station will be 100 × 400 ft., and in the basement all piping will be exposed, to facilitate inspection and repairs. After the equipment of the Fort Hamilton and Hamilton Avenue lines the company will equip the Court Street, Third Avenue and Flatbush lines. The company expect to have forty-five miles of single track in operation by next fall, with 150 motor cars and the same number of trail cars.



OFFICES AND PRINCIPAL DEPOT OF BROOKLYN CITY & NEWTOWN RAILROAD CO., BROOKLYN, N. Y.

BROOKLYN CITY & NEWTOWN RAILROAD CO.

The lines of this company if drawn on a map would show the shape of a cross. One line, known as the DeKalb Avenue line, commences at Fulton Ferry and extends to Newtown Township, Queens Co.; the second line has one terminal point at the Grand Street Ferry and the other at Prospect Park, and is known as the Franklin Avenue line. The total number of miles of track owned by this company is twenty-one and a half, laid with from forty-five to sixty pound, centre bearing and side bearing rails, from the mills of various manufacturers; all recent orders, however, having been supplied by Wm. Wharton, Jr. & Co., of Philadelphia.

The rolling stock of the company consists of 218 cars of which 113 are closed and 105 open. The number of horses owned by the company is 642. The number of passengers carried by the cars of the company in 1891 was 9,620,369. During the fiscal year ending June 30, 1891, the total car miles made were 1,515,857.38. The books of the company show that the cost per car mile, including all expenses except fixed charges during the year ending June 30, 1891, was 20.36 cents. Including fixed charges the cost per car mile was 21.05 cents. The authorized capital stock of the company is $2,000,000 of which one-half has been issued. 1000 5 per cent. bonds of $1,000 each have also been issued. The dividends paid during the last fiscal year on the capital stock amounted to 4 per cent.

The offices and principal depot of the company are contained in a substantial brick building situated at the corner of DeKalb and Central Avenues. The greater part of the ground floor of this building is devoted to housing of cars in actual use. The offices of the company occupy the northwestern corner of this building. In the northeastern corner are the paint and repair shops of the company, each shop being of sufficient size to accommodate six cars. The former is completely equipped with all appliances used in making small repairs, including a band saw, lathe, power drill, forge, etc., as well as two pits to facilitate access to the car running gear. The paint shop, upon the recent visit of one of our representatives, contained six open cars which were being varnished and otherwise fitted for the coming summer service.

The second floor of the building, which is of three stories altogether, is devoted mainly to stable purposes, and this part presents a neat, clean and light appearance to the visitor. There are altogether seven rows of stalls. The passage ways are concreted, and there are a number of ventilators and light shafts. On this floor are also the blacksmith shop, where five horseshoers are constantly employed, and the harness and repair room.

The third floor is devoted to the storage of cars not in use, and here also are the feed rooms. The company cut their own feed in a room specially devoted to this purpose, from which it is taken to an adjoining room, thoroughly mixed and thence descends by a shaft to the stable floor where it is distributed by means of a number of low, four wheeled wagons. The cars and feed are hoisted to the upper floor by an elevator. The power for operating this

elevator, as well as the feed and other machinery is supplied by a thirty-five H. P. engine built by William A. Harris, of Providence, R. I., and is situated in the basement. The boiler for this engine was built by the Whittier Machine Co. The depot of the Franklin Avenue line occupies nearly the entire block bounded by Franklin Avenue, Carroll and Crown Streets, and the tracks of the Brighton Beach steam railroad; it was built in 1888.

The officers of the company are John N. Partridge, president; Louis Fitzgerald, vice-president; Duncan B. Cannon, secretary and treasurer; John L. Heins, superintendent.

The company are looking forward to substituting electric motors for horses, in the near future, but have not yet perfected their plans.

ATLANTIC AVENUE RAILROAD CO.

The tracks of this company, which cover at present twenty-three miles, are principally in the western part of Brooklyn. There are altogether ten different lines operated by this company, the cars on each line being distinguished by means of different colors and lights. These lines are as follows: Bergen Street, Butler Street, Fifteenth Street, Fifth Avenue—City Hall, Fifth Avenue—South Ferry, Hicks Street—Crosstown line, Hoyt Street—Crosstown line, Park Avenue, Seventh Avenue and Vanderbilt Avenue. The present track is laid with a fifty to sixty pound, centre bearing tram rail, most of which was supplied by the Pennsylvania Steel Co. The cars are 383 in number, of which 191 are closed cars and 192 open. These are from the works of a large number of companies; Stephenson, Brill, Jones, Lewis & Fowler and Feigel being each largely represented. An average of 166 cars is used per day and the average total car mileage is 7,640. The average number of passengers carried per day is 42,398.

The extent of territory covered by the cars of the company involves the employment of eight separate depots which are located as follows: Bergen Street and Albany Avenue; Butler Street and Nostrand Avenue; Ninth Avenue and Twentieth Street; Seventh Avenue and Twentieth Street; Fifth Avenue and Twenty-third Street; Third and Atlantic Avenues; Boerum Place and State Street; Park and Clinton Avenues. The depot at Fifth Avenue and Twenty-third Street is the largest, and here they keep 300 of the 1,600 horses owned by them. Here also they grind their own corn and oats for all the stables, 1,200 bus. being prepared per day. The grinding machinery consists of two Cogswell mills run by a fifty H. P. engine. The proportions used of corn and oats are at present two-thirds of the former to one-third of the latter; but in summer they are mixed in equal proportions. The total number of employes in the service of the company is 685.

The company are rapidly pushing forward their work of electrical construction. The power station will occupy an entire block between Third Avenue, First Street, the Gowanus Canal and Second Street, and will have a water front of 200 ft. on the canal and 630 ft. on the First Street basin. The boiler equipment will consist of three batteries of Babcock & Wilcox boilers, each battery comprising two 250 H. P. boilers. Each boiler will be twenty-three feet long, the tubes will be one-half inch thick and will rest on extra heavy shelves. The engines will be supplied by C. & G. Cooper & Co. of Mt. Vernon, O., and will consist of one 350 H. P. and three 500 H. P. tandem, compound, condensing engines. The latter size has been selected as the unit for future work, and the station has been designed for an ultimate capacity of 5,000 H. P. The flywheel of the smaller engine will be of 40,000 lbs. and the larger of 60,000 lbs. weight. The dimensions of the main shafts are twelve and thirteen inches in bearings, and fourteen and fifteen inches outside of bearings, respectively, and the cylinders are guaranteed for a steam pressure of 136 lbs after having been re-bored once. The same firm also supply one condenser and two air pumps to be run by a smaller engine. Salt water will be used for condensing purposes. The generators, as mentioned in our last issue, will be of the Westinghouse type.

The company, in preparation for the electrical equipment, are laying three different types of rails; from Twenty-seventh to Thirty-seventh Streets on Fifth Avenue, the Lewis & Fowler girder rail is employed, and from Fifth to Washington Avenues on Atlantic Avenue, a section of the Duplex street railway track is being installed. Each of these sections is about one-half mile in length. For the remaining ten miles of track which the company will construct at present they have ordered a side bearing girder rail, weighing seventy pounds per yard, from the Pennsylvania Steel Co. This rail will be mounted on chairs which will be spiked to the ties, and at the joints the Samson bridge chair, manufactured by the Tramway Rail Co. of Pittsburgh, will be employed. The tie decided upon will be 5×9 ins., and will be laid thirty inches between centres, with extra ties at each joint. The rails will break joints alternately. The ties, which have been already ordered, are 16,000 of yellow Florida pine and 10,000 of Connecticut white oak.

The poles will be tubular, mostly twenty-eight feet long, with shrunk rings at each joint, and will be supplied by Wallace & Co., of New York. Span wire construction will be used upon most of the line, but on the part of Ninth Avenue which is next to Prospect Park, side poles with fifteen foot brackets extending over both tracks have been decided upon, to avoid the necessity of erecting poles on both sides of the street. The car bodies will be supplied by the St. Louis Car Co. and the present order calls for fifty. Each car will have a length over all of twenty-seven feet and length of body eighteen and a half feet, and will be finished inside with mahogany, with ceilings of three-ply birdseye maple. There will be six windows on each side furnished with curtains of silk Burgess cloth. Rattan spring seats with backs of mahogany will be used, and both seats and backs will be supplied with Wilton carpet coverings if the company decide to use them. Each car will also carry four one and a half inch beveled edge mirrors and will be fitted for electric heaters. The bodies will be mounted on Peckham trucks and operated, as mentioned in our last issue, by Westinghouse motors. Both trucks and motors will be sent to St. Louis for attachment to the cars, and the cars will be sent to Brooklyn fully equipped from St. Louis.

The company contemplate equipping, first, both the Fifth Avenue lines from Thirty-seventh Street to the Bridge, one by way of City Hall and the other by way of South, Wall Street and Fulton Ferries and the Butler Street line from New York Avenue along Butler Street and Atlantic Avenue to South Ferry. After these lines are equipped they will be followed by the Bergen Street line from Buffalo Avenue to South Ferry, and the Crosstown line from the Bridge to Hamilton Ferry by way of Boerum Place and Sackett Street. The first engine is to be delivered on or before June 15, and the company hope to be able to have some of the cars in operation by July 4.

The authorized capital stock of the company is $2,000,000 of which $1,200,000 has been issued. The bonds authorized, new issue, are $3,000,000 of which one-half will be issued to cover outstanding bonds. The officers of the company are: President and general manager William Richardson, secretary Wm. J. Richardson and treasurer N. H. Frost. The office of the company is at the corner of Atlantic and Third Avenues. L. H. McIntire is electrical engineer in charge of the power station, and Barry & McTighe of the general construction.

THE CONEY ISLAND & BROOKLYN RAILROAD CO.

This company were the second to adopt electric power in Brooklyn and own twenty-two miles of track, of which at present sixteen are horse and six electric. The electrically equipped portion of the line extends from Coney Island past Prospect Park to, at present, the corner of Ninth and Smith Streets and connects there with the horse car portion of the line which has terminals at Hamilton and Fulton Ferries. The track on the electric section consists, for about two-thirds of the length, of T rail, the route being a suburban one. The rails used for the horse lines in the city are of the centre bearing, stringer type weighing about forty-five pounds to the yard. These

rails are now being replaced by a sixty pound stringer rail made by the Pennsylvania Steel Co., and spiked directly to the stringers, the latter being laid on ties three feet between centres, the two being connected by iron knees. The joints rest on plates. The return circuit is made by galvanized iron bonds supplemented by a return wire. This construction has been in use at the Coney Island terminus of the electric line for over a year and has given good satisfaction. The rolling stock of the company consists of 115 cars, of which forty are box and sixty-one open horse and trail cars, and fourteen are box motor cars. The car bodies are from the factories of a large number of companies, the latest having been furnished by the John Stephenson Co.

The company have two stables, the principal one being at the corner of Fifteenth Street and Eleventh Avenue, and here at present 200 horses are cared for. The other stable is at the corner of Smith and Huntington Streets in the same building with the offices of the company, and here 100 horses are kept.

The horse cars make a daily mileage of forty and the electric cars of sixty. The electric cars in winter run every half hour, but in summer run sometimes every four minutes, with one or two tow cars each. Upon several occasions the company have had thirty-six cars in operation upon the electric division, and have carried as many as 20,000 people in seventeen hours on this part of their lines.

The power station, which supplies current for the electric cars, is a wooden building at about the centre of the portion of the railway at present in operation by electric power, and contains two McIntosh & Seymour engines of 250 H. P. each. These are belted directly to four Thomson-Houston standard generators of 100 H. P. each. The boilers are of the Babcock & Wilcox type. The present electric car equipment consists of twelve cars supplied with Thomson-Houston motors and two with Edison apparatus. A speed of from fifteen to eighteen miles per hour is often attained on this route. The overhead construction employs centre poles with double brackets.

The company, however, are making rapid progress with the equipment of their entire line with electric apparatus, and expect to have all the line in operation with this power by the middle of May. They have commenced work on a new power station to be located at the corner of Ninth and Smith Streets, and having a water front of 230 ft. on the Gowanus canal. This station will contain two Corliss-Wright engines, which will be belted directly to four Thomson-Houston generators of 250 H. P. each. The boilers will be two in number, and of the Climax type. The officers of the company are H. W. Slocum, president; E. F. Drayton, secretary and treasurer; D. W. Sullivan, superintendent. The Coney Island & Brooklyn Railroad Co. also control the

PROSPECT PARK & FLATBUSH RAILWAY CO.

This company own three miles of track laid with a thirty-four pound stringer rail, four box cars and ten horses. The stable is at the corner of Franklin and Gravesend. The officers of this company are H. W. Slocum, president; H. W. Slocum, Jr., secretary and treasurer; D. W. Sullivan, superintendent. This line will probably be equipped with electric power after the work on the main line of the Coney Island & Brooklyn road has been finished.

THE BROOKLYN HEIGHTS RAILROAD CO.

This line, the only cable surface railway in Brooklyn, has one-half mile of double track, extending from the Wall Street Ferry to the Brooklyn Court House, and has a 9½ per cent. grade for a portion of the way. It was formally opened for traffic on July 20, 1891, and took the place of a line of omnibuses.

The power house is of brick one story high and located on State Street about 2,000 ft. from Montague Street on which the cars run. The driving machinery is in the basement, and power is furnished by one 250 H. P. tandem, compound, condensing engine manufactured by C. & G. Cooper & Co., of Mt. Vernon, O. The boilers are from the works of the National Water Tube Boiler Co., of New Brunswick, N. J. The driving drums are of the Walker differential ring type. The line is laid with a Lewis & Fowler girder rail having a weight of sixty pounds to the yard. The rolling stock consists of eight cars which are vestibules and finished in mahogany and cherry. They were manufactured by the Lewis & Fowler Manufacturing Co., and equipped with the Barnes automatic friction brake. The grip is of the upper jaw pattern and receives the cable on either side. The capital stock of the company is $200,000, and they have issued $250,000 in 5 per cent. bonds The office of the company is at 40 State Street. The officers are: D. F. Lewis, president; J. E. Searles, Jr., vice-president; E. Johnson, secretary; G. S. Studwell, treasurer, and A. Rogers, superintendent.

BROADWAY RAILROAD CO.

This company's lines are entirely operated by horse power, and they occupy an extensive territory in the eastern part of Brooklyn. The principal starting point for the cars is at the foot of Broadway, E. D., and from that place the lines radiate in a number of directions, the Broadway or main line extending to East New York, the branches being on Reid Avenue to Atlantic Avenue, Sumner Avenue to Bergen Street, and Ralph Avenue to Pacific Street. The company also have a two mile extension from East New York to Cypress Hills Cemetery.

The entire length of line is a little over twenty-three miles, which is all laid with sixty pound, double grooved rail. The rolling stock consists of 203 cars, of which 117 are box and eighty-six open. These run on a headway of from three to eight minutes in the day, and in the night from ten to forty minutes. The number of horses owned by the company is 700. The number of passengers carried in 1891 was 8,094,413.

The depots are on Fulton Street, at East New York, Reid Avenue corner of Chauncey Street, Bergen Street near Troy Avenue, and at the corner of Ralph Avenue and Pacific Street. The average number of miles covered by each horse when in good condition is from eighteen to twenty per day. The capital stock is $525,000, on which a dividend of 7½ per cent was paid last year. The amount of bonds issued is $350,000, which pay 5 per cent. annually. The offices of the company are at 21 Broadway, E. D. The officers are Edwin Beers, president; Robert Sealy, secretary and treasurer; H. Myerholz, superintendent.

THE BROOKLYN & JAMAICA RAILWAY.

This railway connects the city of Brooklyn with the town of Jamaica, having its terminus in Brooklyn at the Manhattan crossing and Fulton Street. It was the first electric line installed in Brooklyn and was originally equipped with Van Depoele apparatus; the overhead construction and power equipment was changed, however, to adapt it to the under running trolley, about two years ago, and two Edison generators and several Edison motors were added.

The line at present is 12.8 miles long, and is laid with a fifty-seven pound, side bearing, tram rail, laid upon 5 × 7 ins. stringers which are fastened by knees to ties. These latter have a six inch face and are laid four feet between centres. The rails are bonded for a return with cross connections between every fourth rail, and the joints are supported by plates. The overhead construction is span wire with wooden poles.

At the power station, which is situated at Woodhaven at about the mid point of the line, are two engines, one of which is a McIntosh & Seymour of 125 H. P. running at 225 revolutions. The other was supplied by the Putnam Engine Co., of Fitchburg, Mass., is 150 H. P. and runs at sixty-five revolutions. These are connected by Schieren belts, one directly, the other by a countershaft, to two generators of the Edison 100 kilowatt type, compound wound. In the power house there is also a Van Depoele generator, shunt wound, which is not in use at present. The power station has also a completely equipped repair shop.

The rolling stock consists of eighteen motor cars and five trail cars. Ten of the former are equipped with Edi-

son motors and eight with Van Depoele twelve H. P. motors, the latter being mounted in the open cars by removing a seat from the centre of the car, and connecting the armature shaft with one axle by means of a sprocket chain. The car bodies are mostly from the works of the Lewis & Fowler Manufacturing Co. and the Pullman Palace Car Co., but the company have also added several cars recently purchased from the West End Street Railway Co., of Boston. The company have also a Lewis & Fowler snow sweeper which is equipped with two Van Depoele electric motors.

The average car mileage per car per day is 108. The traffic on the road is constantly increasing. This can be seen from the fact that during the fiscal year ending June 30, 1891, 598,482 passengers were carried, while during the nine months ending March 1, 1892, the railway provided transportation for 666,058 passengers.

The capital stock of the company authorized and issued is $197,480; $410,000 5 per cent. bonds have also been issued. The officers of the company are: Samuel Spencer, president, 23 Wall Street, New York; W. S. Townsend, Secretary; Wm. T. Litson, Treasurer, and Wm. M. Scott, Superintendent.

VAN BRUNT STREET & ERIE BASIN STREET RAILWAY.

This line is two and a half miles in length and runs from the Hamilton Ferry in a southeasterly direction along Van Brunt Street to Erie Basin. The rolling stock of the company consists of fourteen cars of which six are box and eight open. Forty horses are employed. The fare is three cents. The stable and offices of the company are at 264 Van Brunt Street. The line is laid with a forty-five pound side bearing tram rail. The capital stock of the company is $75,000 and the bonded indebtedness $25,000, in six per cent. bonds. The officers of the company are president Michael Murphy; secretary and treasurer Wyllys Terry; superintendent T. J. Carey.

BROOKLYN, BUSHWICK & QUEENS COUNTY RAILROAD.

The line of this railway extends from the foot of Broadway, E. D. to St. John's Cemetery in East Williamsburgh. From the first mentioned point to the Lutheran Cemetery, a distance of four and a half miles, a double track is used, the rest of the distance being single track. The total number of miles of track owned by the company is eleven. The type of rail used is a centre bearing tram rail of from forty-seven to fifty-two pounds per yard. The rolling stock consists of forty-seven cars, of which twenty-two are box and twenty-five open. Fifteen of the box cars use fare boxes The open cars have eight reversible seats each. The stables and offices of the company are at Metropolitan, a new name recently given to the portion of East Williamsburg in which these new buildings are situated.

In October, 1891, the property of the company was put into the hands of a receiver. The officers of the company are George W. Van Allen, president; Wm. B. Wait, secretary; D. W. Binns, treasurer; F. Hartshorn, superintendent and receiver. An effort is being made to reorganize the company, and if this is done electric power will probably be adopted. When this is done the line will probably be extended to Jamaica.

ELEVATED RAILROADS.

The two companies operating elevated railways in Brooklyn are the Brooklyn Elevated Railroad Co., who also operate the lines of the Union Elevated Railroad Co., and the Kings County Elevated Railroad Co., who also operate the lines of the Fulton Elevated Railroad Co.

The Brooklyn Elevated Railroad Co. were organized May 26, 1874, as successors to the Brooklyn Elevated Railway Co., and on May 13, 1887 the, company leased the Union Elevated Railway Co., which had been organized June 10, 1886, and consolidated October 27, 1890. The lines of the Union Elevated Railway Co. were opened in 1888. The total length of line operated by the Brooklyn Elevated Railway Co., including those leased from the Union Elevated Railroad, is 17.93 miles. The rolling stock consists of seventy-six locomotives, maximum weight 45,000 lbs., built by the Rhode Island Locomotive Works of Providence, R. I., 230 passenger cars and twelve freight cars, most of the passenger cars having been supplied by the Gilbert Car Manufacturing Co. and the Pullman Palace Car Co. The number of passengers carried in the year ending June 30, 1891, was 34,424,708. The average earnings per train mile in same period were sixty-twocents,expenses thirty-five cents. The officers of the company are Henry W. Putnam, president; Elbert Snedeker, vice-president; Hugo Rothschild, secretary; Fred. Martin, general manager, and O. F. Nichols, Chief Engineer. The principal office of the company is at 31 Sands Street.

The Kings County Elevated Railroad Co. were organized on January 6, 1879, and the road was opened for traffic in November, 1889. The rolling stock consists of forty-two locomotives and 138 cars, of which 130 are passenger and eight freight. The manufacturers of the cars were the Pullman Palace Car Co., and of the locomotives, the Grant Locomotive Works, and the Rhode Island Locomotive Works.

The total length of line operated by the company is about nineteen miles, including the leased lines of the Fulton Elevated Railway Co. The number of passengers carried in the year ending June 30, 1891, was 15,992,855. The average profit per passenger carried was 0.146 cents. The offices of the company are at 346 Fulton Street, and the officers are James Jourdan, president; Wendell Goodwin, vice-president; James H. Frothingham, treasurer; H. J. Robinson, secretary; W. T. Goundie, general manager, and O. F. Balston, chief engineer.

THE BROOKLYN BRIDGE.

No article on the present status of transportation facilities would be complete without mention of the New York & Brooklyn suspension bridge over the East River, whose railway up to January 1, 1892, had carried a total number of 224,077,923 passengers, and whose footway up to June 1, 1891, when the toll was abolished, had been used by 28,171,839 persons. The general engineering data of this bridge have been already given in the pages of this journal, and, therefore, will not be repeated. The following details of operation, however, up to January 1, 1892, will not be without interest: Speed of cable, ten and one-third miles per hour; weight of cars, seventeen to nineteen tons; number of cars used during rush hours, forty-eight; largest number of round car trips per day, April 30, 1889, 2,159; next largest number of round car trips per day, December 31, 1891, 2,114; weight of each locomotive, twenty-two tons; number of locomotives in use during rush hours, five; shortest headway between trains, one and a half minutes; total number of railway passengers carried during 1891, 39,890,205; largest number in one month, October 1891, 3,623,016.

As the above figures indicate, the carrying capacity of the bridge has long been overtaxed, but owing to various complications the plans for improving the terminal facilities and increasing the capacity of the cable railway have not yet been put in practical shape. Some of the difficulties, however, have been removed. The bonds which were at one time unsalable, on account of low rate of interest, are now being readily negotiated, and as soon as the remaining difficulties, which relate mainly to proper connection with the Brooklyn elevated roads and the space necessary for the New York terminal, are adjusted the work of reconstruction will at once begin. The plans contemplate ornamental station buildings at each terminal, having wide incoming and outgoing platforms with a track on either side of each, and an additional track the entire length of the bridge. The new rails, however, are to be laid very near the line of the present track, the object of the double construction being to operate two cables while the grips remain,as at present, in the middle of the cars. Two reserve ropes will also be provided which can readily be put in service in case of the failure of either of the operating ropes. The power station building is nearly completed and the driving machinery, which is being manufactured by Robert Poole & Son Co., of Baltimore, is about ready for delivery. A new 1,000 H. P. engine which is being manufactured by William Wright, of Newburgh, is also nearly finished.

Cable Construction, Third Avenue, New York.

With the advent of spring, work has been resumed on the Third Avenue (N. Y.) cable construction, and the new contractor, Mr. Thomas E. Crimmins, of New York, is pushing the work with a vigor that insures its completion before another winter. The portion of the line which was left open during the winter by the former contractor has been closed, and the horse cars are now running over the new construction from the Harlem River to Sixth Street. The new work is being advanced on the Bowery below Sixth Street and will continue to the terminal near the Post Office. The new construction differs somewhat in detail from that previously finished. In place of a concrete pedestal provided for the yokes a continuous concrete foundation is laid six inches thick which is brought to a perfect grade, and on this the yokes are placed, increasing somewhat the facility of adjusting yokes and rails.

In excavating the pits for the terminal sheaves at Sixth Street where the two divisions of the line meet, it has been found necessary to deepen the foundation piers of the elevated railway posts. Three posts on each side are being shored up, and the foundations increased to a depth of about fourteen feet. The preliminary work on the Bowery consists in changing the sewer manholes, which are about 125 ft. apart, and come directly in the line of the downtown track. The brick work of the manhole is being removed down to the line of the sewer and an arched transverse chamber is constructed of sufficient length to bring the manhole outside the tracks. This work requires an excavation at each manhole of about twelve feet in depth.

The work of excavating for the foundation of the Bayard Street power station is progressing rapidly, and is one of the most interesting, as it is also one of the most expensive, features connected with the cable enterprise. The present status of the work is clearly illustrated in the accompanying engraving which gives a good idea of the difficulties which beset the work. The earth formation being quicksand, it is found necessary to excavate to a depth of nearly thirty feet, and in order to preserve the adjacent streets and buildings it has been found necessary to shore up the bank with very heavy timbers. About one-third of the foundation walls are already in place, and the work of excavating and extension of the walls is shown in the engraving. One of the most interesting features in connection with the excavation is the placing of new foundations under three of the posts of the elevated road. The new brick piers, which are also shown in the illustration, are forty-five feet in depth, the foundation being ten feet below the water line. DeGenovese & Towle are the contractors for the excavation and foundation, and T. P. Galligan & Son have charge of the work of shoring the banks. The contractors have adopted a novel plan for assisting the horses to haul the loaded wagons up the incline. A half inch wire rope is provided, which is attached to the end of the wagon tongue, and being led around the stationary sheave at the head of the grade is operated by means of a stationary engine and reel. The wagons are loaded by means of a dump bucket and swing derrick, as shown in the illustration.



EXCAVATION AT CORNER OF BAYARD STREET AND BOWERY, NEW YORK. FOR THIRD AVENUE CABLE RAILWAY STATION.

The work of tearing out the interior of the Sixty-fifth Street stable preparatory to the erection of the power plant is now under way. The original court is being enlarged by taking portion of the stalls from each side, but the exterior will remain intact. It is the purpose of the company, however, after the power plant is completed, to

replace the remaining portion of the stable with a more ornamental structure. When completed this will probably be the largest cable power station in the world, as it is to be equipped with four 1,500 H. P engines.

The work of excavating for the pulley vaults in front of the Sixty-fifth Street station has not yet been commenced. In the construction of this vault it will also be necessary to place new foundations under six of the elevated railway posts.

The Laclede Car Co., of St. Louis, who have the contract for 200 closed cars, have twenty-six of the cars completed and are rapidly progressing the work on the others. These cars were illustrated in our March issue, but those recently constructed are more highly finished than the sample car which we illustrated.

New Track Crossing.

In the accompanying engravings are shown two views of a new girder rail crossing being put on the market by the Lewis & Fowler Girder Rail Co., of Brooklyn, N. Y. As will be seen, the crossing is not of cast iron, but the regular rolled rails are used in its construction. The rails are halved to fit into each other, and each of the four corners of the window frame are mounted upon a special type of cast iron chair with clips, making the construction as strong and durable as, if not more so than, at any other part of the line. Four intermediate chairs are also used between each two corners The corner chairs weigh 100 lbs. each. A one-half inch filling piece is used in the groove as in the regular cast iron crossing, to provide smooth running for the cars while passing the crossing. Fig. 1 shows the crossing complete, and Fig. 2, has the rail on one side removed to show the method of construction.

The Lewis & Fowler Co. have also designed a new and important rail joint for their girder rail construction. The chair at the joint is of rolled steel, twenty-two inches long, and is fastened to each rail by four bolts as well as by four clips in the usual method. The chair is mounted on 5 × 7 in. ties. Any weight of rail can be used, and the joint seems most strong and durable.

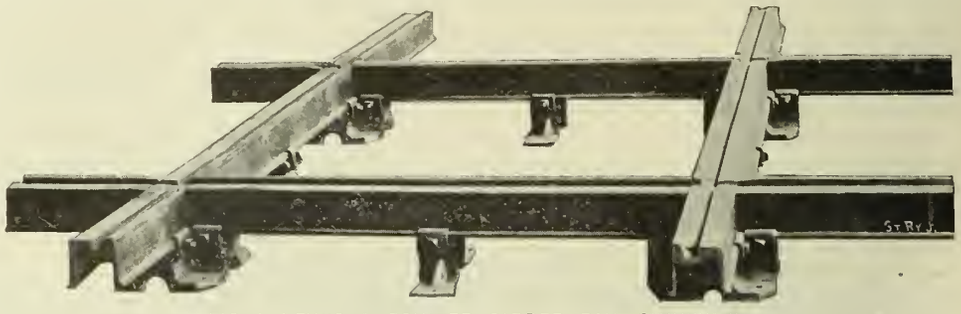


FIG. 1. LEWIS & FOWLER GIRDER RAIL CROSSING.

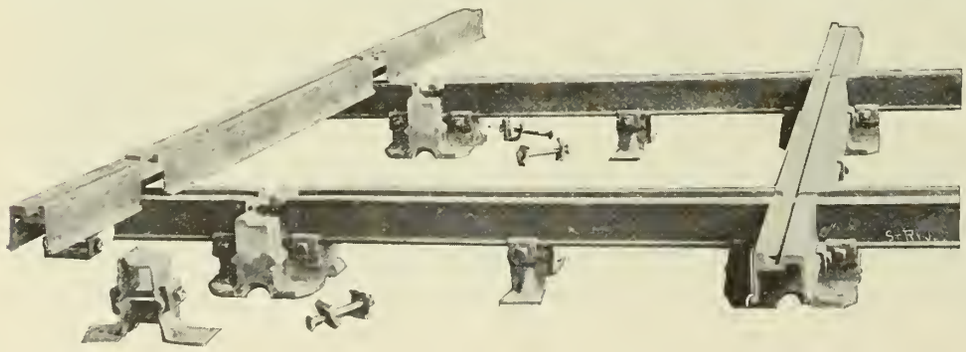


FIG. 2.—LEWIS & FOWLER GIRDER RAIL CROSSING WITH ONE RAIL REMOVED.

THE Love electric conduit road, of which a description appeared in the March number of the STREET RAILWAY JOURNAL, is now operated by the North Chicago Railroad Co. The road has not been finally accepted by the latter corporation, but as the Love company had completed their tests of the road and had demonstrated that its operation was successful, as far as they were concerned, it was deemed best to allow the regular employes of the cable company to take charge of it in order that a still more severe practical test might be had of the workings of the system. Thus far the operation of the road has been entirely satisfactory to the North Chicago Railroad Co. Should the tests now in progress prove satisfactory in all probability the system will be installed on several lines now operated by horses.

The Broadway (N. Y.) Cable Railway.

The work of laying the conduit and rails for the extensive cable line on Broadway, which we have several times referred to in former issues, has been entirely completed for some time, with the exception of a short loop between Bowling Green and South Ferry, and the engineer in charge of the works is now engaged upon the final details of the two main power houses and other parts of the equipment.

The principal power station will be located at the corner of Broadway and Houston Street and will have a frontage of 127½ ft. on the former street and 200 ft. on the latter street. The building will be a handsome eight story structure, built in the Renaissance style, the lower part being of granite and the upper of buff brick with terra cotta trimmings. Mullioned windows extend from the third to the sixth floor, above which is a frieze extending around the building, and at the top is a second frieze and cornice. The architects of the building were McKim, Mead & White, of New York, the well known designers of the Madison Square Garden, New York.

The machinery for operating the cable plant in both stations will be below the level of the street, and it has been necessary to excavate to a depth of forty feet at the Houston Street station to obtain the room which will be required.

The power will be supplied by four Dickson-Corliss engines, built by the Dickson Manufacturing Co., of Scranton, Pa., thirty-eight inches diameter, by sixty inches stroke, running at sixty revolutions and operated in pairs (see accompanying illustration for plan of machinery). The frame of each engine is cast in one piece from cylinder to the end of the pedestal of the crankshaft ; it is the style known as the trunk-bed; it contains the guide of the crosshead, which is bored out in a true circle and in true line with the bore of the cylinder, which is telescoped with the bed, and held in position by heavy bolts. The frame is flat on the base and rests the whole length on base plates which cope the foundation, and has a number of heavy lugs cast on for the foundation bolts. In the frame is also formed the bearing for the crankshaft; this bearing has side boxes, adjustable by wedge blocks extending the whole length of the bearing and held by bolts ; the bearing boxes are all lined with the best babbit metal. The crankshaft is of best hammered wrought iron, eighteen inches in journals, twenty inches diameter in body ; the journals being thirty inches long ; the crank is made of cast steel eleven inches thick and carries a steel crank pin eleven inches diameter, eleven inches long, made of best open hearth steel. The crankshaft carries a flywheel twenty-four feet diameter, made in nine sections ; the centre is forced on the crankshaft, and the arms with a section of the rim cast in one piece with the arm, bolted to the centre. The whole wheel is turned true on its own shaft, and weighs 100,000 lbs., finished weight. The connecting rod is made of best hammered wrought iron, strap end for crankpin end, and a solid end on crosshead end. The boxes are of cast steel lined with best babbit metal.

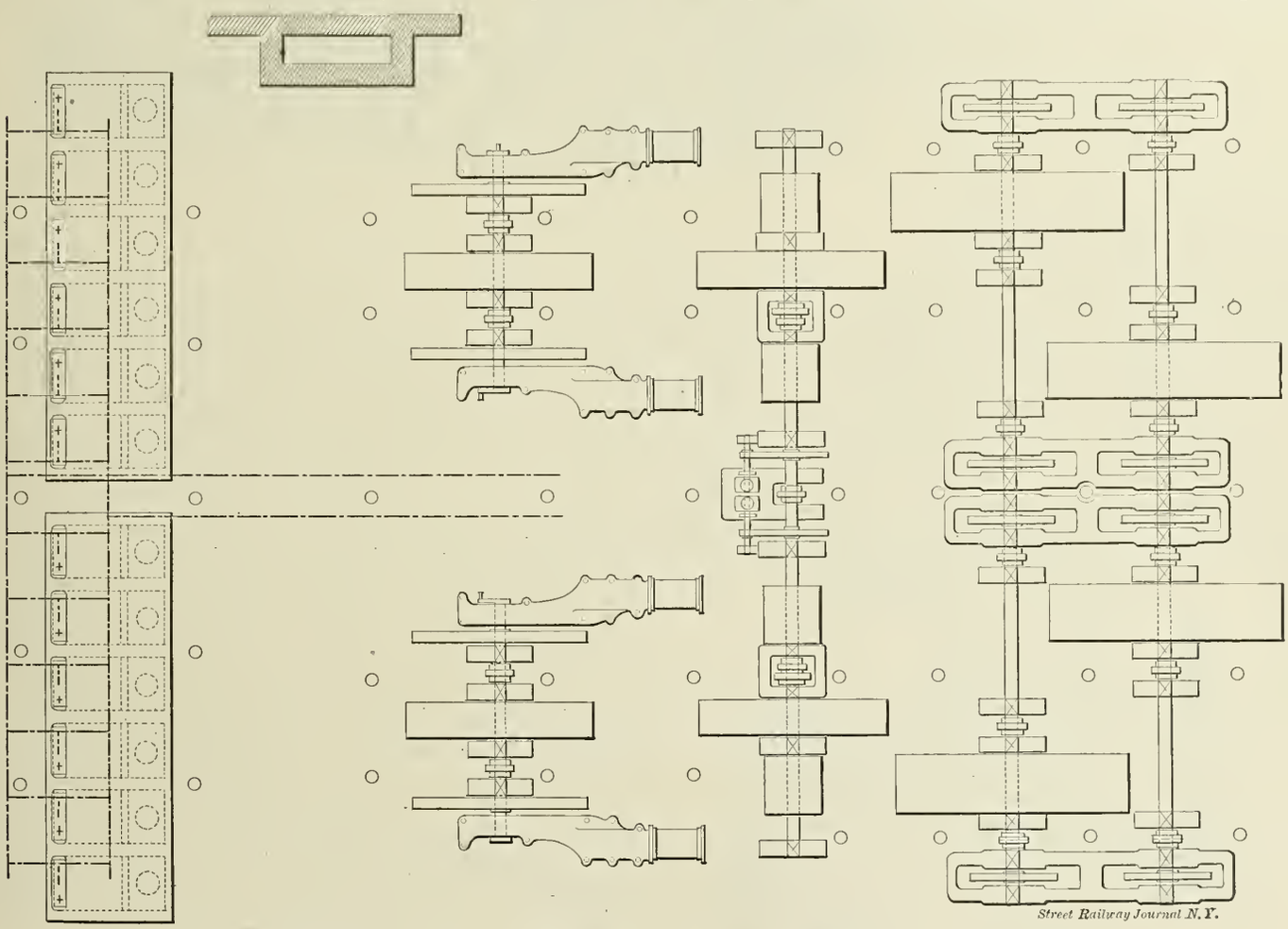
The crosshead is also made of cast steel, and has adjustable slippers sixteen inches wide and twenty-eight and three-quarter inches long with the faces babbited and turned to fit the bore in the frame. The piston rods are of best forged, open hearth steel six and a half inches diameter, keyed in crosshead and forced in the piston, with a large nut on the back to secure it. The piston is of cast iron, fitted with sectional steam packing.

The cylinder is made of hard cast iron; the Corliss valves are eight and a half inches diameter, worked from a wristplate, which in turn is worked by an eccentric on the crankshaft. The wristplate is an open wheel; the dashpots are bolted right to the side of the cylinder, behind all the connections and levers of the valve motion. The cut-off device is regulated by a Porter governor which is driven by a belt, but is fitted with a stop arrangement; in case the governor belt should break, the engine cannot run away.

The steam nozzle on cylinder is twelve inches diameter, the exhaust fourteen inches diameter. The throttle valve is fitted with pilot valve, and is located below the floor, as steam and exhaust nozzles are arranged on bottom of the cylinder. The engine complete is built in a very substantial manner; only the very best materials are used, and in point of workmanship these engines can only be favorably compared with similar engines of the best makers, and no doubt they will make a good record, when put into operation.

Referring again to plan of machinery, it will be seen that each pair of engines operates a common shaft upon which is mounted a twenty-six foot drum, and that these drums are connected to drums of the same size on a jack shaft. This shaft drives the cable shafts by means of four nine foot drums which are each connected to one thirty-two foot drum on each of the cable driver shafts. Power is transmitted in each case by two-inch cotton ropes, twenty ropes being used between each of the engine and jack shaft drums and thirty-two ropes between each of the jack shaft and cable shaft drums. The largest wheels weigh over 100 tons each, and have a face of eight feet three inches. The cable drivers are twelve feet in diameter, designed for five wraps and are eight in number, since, as stated in a former issue, a duplex cable system is used.

As has been seen, the station has been planned to reduce to the minimum the necessity of shutting down from accident to any part or set of parts of the machinery. In the first place, clutches between each engine and driving drum allow either engine to be disconnected if desired. The driving drums on the jack shaft are also arranged with clutches so that any one of the four engines can transmit power to any set of drums, and as each engine of each pair is of sufficient capacity to operate the entire plant, any three engines can be out of service without interfering with the operation of either cable system. In addition to the engines mentioned above a small auxiliary engine will also be installed to turn the shafts when the power of the large engines is not available.



PLAN OF HOUSTON STREET POWER STATION—BROADWAY (NEW YORK) CABLE RAILWAY.

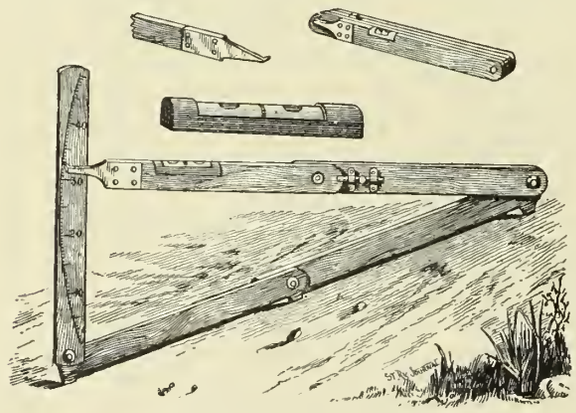
The cable drivers and rope drive drums will be furnished by the Walker Manufacturing Co. of Cleveland, O. The contractors for the entire power machinery are the Pennsylvania Iron Works of Philadelphia, Pa. The boiler equipment will consist of twelve water tube boilers of 250 H. P. each, supplied by the Heine Safety Boiler Co. of St. Louis, Mo. The three 1,000 H. P. feed water heaters, which will be required, will be supplied by the Goubert Manufacturing Co. of New York.

The second station of the company will be at the site of the present stables at Fifty-second Street, Seventh Avenue, Fifty-first Street and Sixth Avenue, but will occupy only one-quarter of the ground floor of the block. In the rest of the space will be the car houses, storage rooms and offices of the company. The engines, of which there will be two, will be of the same size and type as those used in the Houston Street station, except that the cylinders are thirty-six instead of thirty-eight inches in diameter, and they will have a capacity of 1,000 H. P. each, while 1,200 H. P. are used in the Houston Street

station. On the main shaft there will be two ten foot drums, driving two thirty-two foot drums with thirteen two-inch cotton ropes. The cable drivers are twelve feet in diameter, as in the Houston Street station, and have five grooves. The arrangement, as will be seen, is similar to that at the lower power station except that the capacity is a little less than half and there is no intermediate jack shaft, which, of course, is not necessary since there is only one pair of engines.

To Measure Grades.

While the exact determination of a grade may be necessary before actual construction is begun on a railway, an approximate figure may answer every purpose in a preliminary calculation. To obtain this approximate result quickly may be extremely convenient under some circumstances, and the pocket instrument shown in the cut was designed to serve this purpose. The illustration tells the whole story. It is composed of light strips which fold as shown. On the lower strip are three little projections which may be forced into the ground slightly so that the instrumentt can be made to assume very closely the line of the grade. The upright portion is divided as a scale; in the illustration it denotes per cent. At each division is a tiny hole into which fits the tooth at the end of the horizontal arm shown in detail. In the horizontal section is fitted a spirit level shown in the figure. It can be readily seen that with a reasonable degree of care a reading substantially accurate may be secured. The instrument when



HANDY GRADE MEASURER.

unfolded is about twenty inches in length; when folded it is just half that length. The illustration is reproduced from *La Nature*.

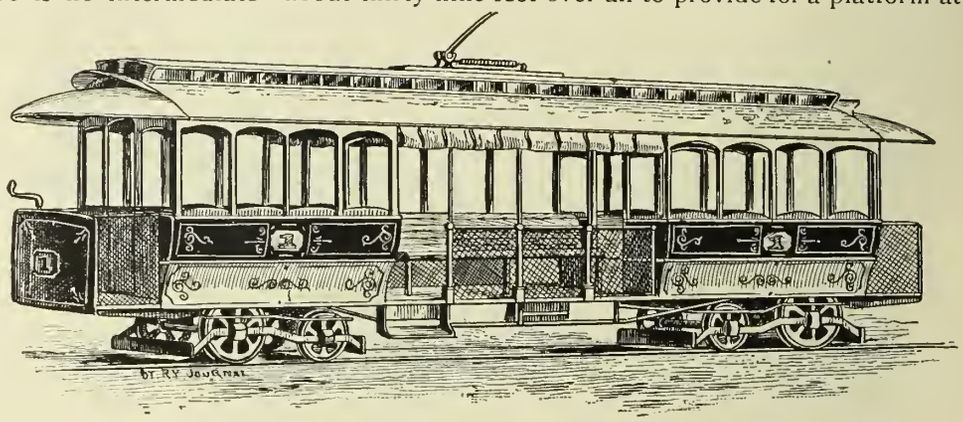
Gas Motors for Chicago.

The Connolly gas motor has recently been tried on the streets of Chicago, and the officials of the North Side Railroad Co. are well pleased with its operation. Practical tests have demonstrated the advisability of some changes in the motor for use in heavy street car traffic. In all probability two new motors will soon be built somewhat heavier in construction. If these prove satisfactory, as Mr. Yerkes anticipates, they will probably be used for drawing cars at night.

JUDGE TRUAX, in the New York Supreme Court, has dissolved the injunction recently obtained by the W. J. Johnston Co. against W. T. Hunt of the Electrical Age Publishing Co. The action was brought by the former company to restrain Mr. Hunt, a former employe of the Johnston Co., from acting in the employ of the latter company.

New Cars for Lexington, Ky.

The accompanying illustration shows a novel type of combination car which will soon be in operation on the lines of the Passenger & Belt Railway Co., of Lexington, Ky. The car body will be thirty-four feet in length and about thirty-nine feet over all to provide for a platform at each end for the motorman. The only entrances will be at the sides by steps one, on each side, about two and a half feet in width, which are placed at one end of the open part of the car. The front and rear platforms will not be accessible to passengers. The open space in the centre of the car is fourteen feet in length and contains two rows of seats back to back ten feet in length, leaving two feet at each end of the open space for a passage way. The car will be mounted on two of Brill's No. 11, Maximum Traction trucks. If the first car of this pattern is a success the company will probably build several others of the same type.



COMBINATION CAR FOR LEXINGTON, KY.

The company are also contemplating the construction of a street sprinkling car with an open platform at each end of the water tank and an upper deck over the whole. The car will be supplied by the United Tramway Sprinkler Co., of Louisville, Ky., and the sprinkling devices and tank of their regular pattern, but instead of being eighteen feet over all the car will be from twenty-two to twenty-four feet over all to accommodate the platforms. The plan of the company is to use the car for street sprinkling purposes, ordinarily, but during rush hours and on extra occasions the tank will be emptied and it will be used for passenger purposes to draw trail cars and carry a few passengers. In this way the company will have both a sprinkling car and an extra motor car constantly available with only one electrical equipment.

Proposed Impracticable Legislation.

The following bill which has passed the Massachusetts House of Representatives and is now before the Senate, is of that class of unnecessary legislation to which we have referred editorially in this issue. It would be interesting to know how a street railway company can be operated if its employes are not allowed to "swing," as is now the practice on most lines. It is to be hoped that the members of the Senate or the Governor have enough railroad sense to prevent such a measure from becoming a law.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

SECTION 1. Ten hours' work, to be performed within twelve consecutive hours, shall constitute a day's work for all conductors, drivers and motormen now employed or who may be employed by or on behalf of any street railway company in any city or town. No officer or agent of any street railway company shall exact from its employes more than the said ten hours' work for a day's labor; *provided, however*, that in case of accident, or unavoidable delay, extra labor may be performed for extra compensation.

SECTION 2. Any person violating the provisions of this act shall be fined for each offence a sum not exceeding one hundred dollars.

SECTION 3. The act shall take effect on the first day of August in the year eighteen hundred and ninety-two.

Points on Power Stations.

By William Lee Church.

Not the least marvelous feature of the extraordinary development of electric railway interests, has been the comparative freedom from disastrous mistakes. Looked at from the other side, this is equivalent to saying that street railways have paid from the start. As much as this can hardly be said for any other parallel industry. Electric lighting was notoriously prolific of financial disappointment for many years, and it is only at a comparatively recent date that capitalists have come to understand that electric lighting can profitably be conducted only under the direction of the highest grade of engineering supplemented by close business management. It is undoubtedly true that the experience gained in the exploiting of electric lighting has been turned to account in the development of electric railways, but the marvel still remains that an industry which three years ago was almost unknown, except as a curiosity, should in this short time have attained to a first magnitude among business enterprises, with so little to regret in the way of failure. It is also undoubtedly true, that there are many roads now doing well, which under still better engineering might have done better, and, indeed very notably better. Nevertheless, the disposition to let well enough alone, serves as an equalizer of what might otherwise be at least a relative disappointment.

It is a narrow mind which will attempt to keep to itself special knowledge on subjects of this nature. The broad education of the public leads through a general increase of intelligence to a greater certainty of success, which in its turn, redounds directly to the interest of the educator. The writer and his associates have, in the course of events, accumulated certain well grounded experiences which are of interest to the promoters of electric railways. It is our purpose to give the benefit of this experience as freely as may be to the railway interests at large, and random articles may be expected in the columns of this journal from time to time accordingly.

The subject under consideration at this moment is that of the relative capacity of engines, generators and boilers in the power station. To go at once to the root of the matter, we refer to the diagram which is the chart of ampere readings from a single generator operating an electric extension line to a cable railway. The generator in question was of the direct coupled, multipolar, slow speed type, popularly known as the "Kodak." Readings were taken at intervals of fifteen seconds, and the portion selected for the diagram covers a total time of twenty-one minutes. While following in general appearance similar charts taken from all railway service, it is noticeable that at several points the load entirely vanished for a few seconds. This was due to the fact that but few cars were operated on this extension, and the grades were numerous and abrupt in both directions. It would frequently chance that for an instant all cars would be on a down grade, and the circuits entirely open. The most abrupt change is seen to be from ten amperes to 135 amperes in less than one half minute. At 4-59 there was a change from 130 amperes to no load, occurring in three-quarters of a minute. It is worth remarking that under this violent treatment, which is never ceasing throughout the day, the change of speed of the engine and coupled generator could not be noted by any ordinary speed counter. So closely has instantaneous and complete governing been secured through the use of inertia as the governing force, that variation of speed can no longer be detected by the speed indicator and expressed in variations per minute, but must be searched for by the chronograph and expressed in variations per stroke.

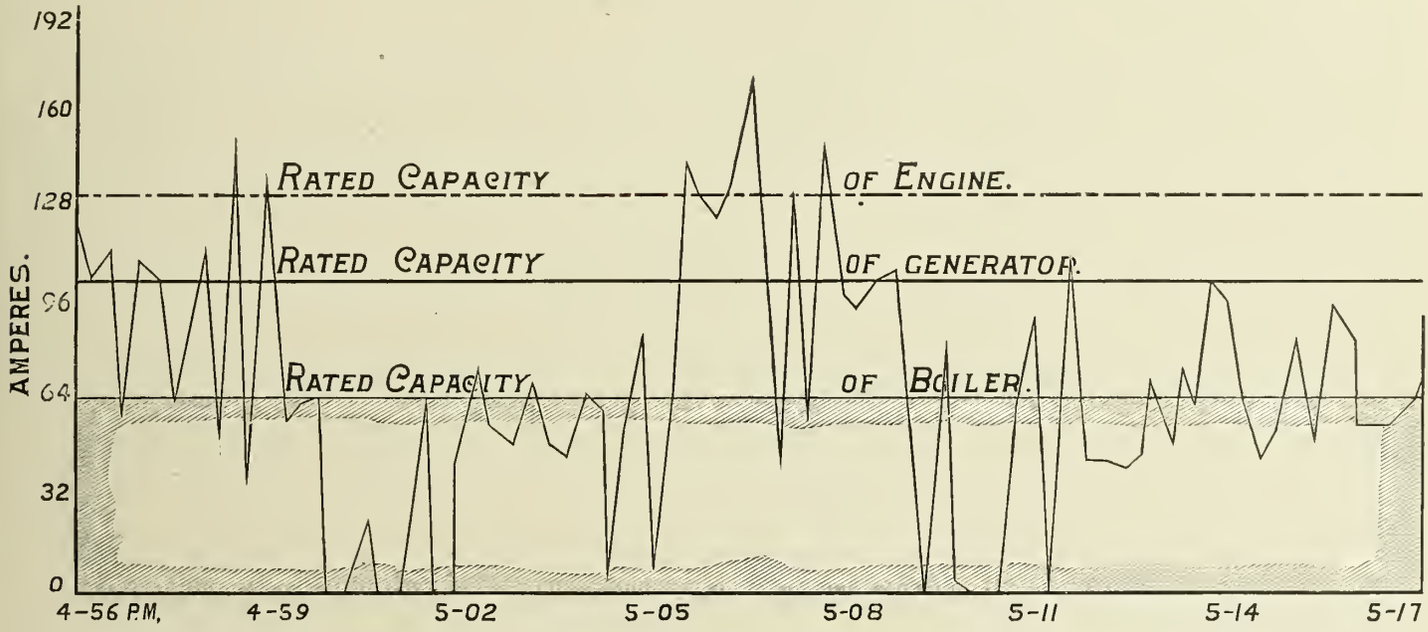


FIG I —DIAGRAM OF AMPERE READINGS ON ELECTRIC RAILWAY WITH FEW CARS, TAKEN AT INTERVALS OF FIFTEEN SECONDS.

Passing to the question of capacity, we will take the generator as the unit of measure. This is, moreover, the natural unit, since the expression for the capacity of a station is in terms of electrical horse powers at the ammeter. In dealing with a problem of this kind, there has sufficient data been accumulated to insure a very close estimate of the nominal amount of generating capacity required to operate a certain number of cars, taking always into account in each special case the grades and curves of the road, nature of the special holiday service, frequency of stops and other governing considerations. In some respects it would be better if the maximum demand upon the generator could be known, as indicated by the summit of the curve occurring at about 5-06 on the diagram ; but this is, in the nature of the case, hard to determine. But to facilitate our discussion of the problem, assume that the maximum capacity were known to be 175 amperes, as indicated. We would then locate our nominal generating capacity at some point as indicated by the heavy black line. The reason of this is found in the fact that an electric generator can stand an overload, or even an excessive overload, provided it does not have to stand it long. The question is simply one of heat. The overload here was seen to continue for only about one minute, during which time the generator could carry it with ease with no perceptible rise of temperature to injure the insulation. If this load had been continuous for an hour or so, as would occur in an electric lighting station, a much higher relative generating capacity would be required, approximating the maximum load.

In this connection it is well to point out that, generally speaking, a long, easy grade is more trying on the generating plant and will call for a greater capacity of the generator, than a short heavy grade. I recall an instance where the lowest point of the road was on a bridge crossing a stream, on either side of which was an abrupt, heavy grade for not over 100 yds. Beyond this, the grades were comparatively easy, but persistently uphill. Although not obvious to the untrained eye, it was the long continued and easy grade which governed the proportioning of the power, and the short grades at the bridge were practically ignored.

Having settled upon the capacity of the generator and located it in the relative position indicated, we next determine the capacity of the connected engine. I am speaking, of course, in this, of power stations in which the generation is in independent units, and I shall undertake to show in subsequent articles, what is rapidly becoming established, that a railway station can only reach its minimum capitalization and maximum earning capacity when so designed. Now, an engine has no such capacity for excessive overload as a generator. In other words, the element of time does not enter into the engine problem, but it becomes a question of how much the engine can actually lift by main strength without taking the governor to an extreme which shall slow down the speed. In general terms, the engine should not be called upon to perform, even for a short time, more than 20 per cent. or possibly 25 per cent. above its rating; this assuming, of course, that it is honestly rated. I append herewith

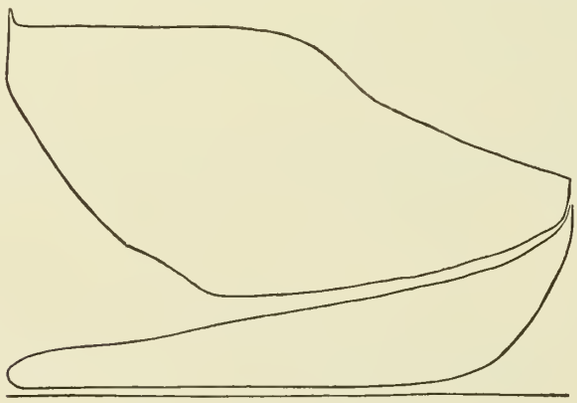


FIG. 2.—INDICATOR DIAGRAM.

three indicator diagrams from a non-condensing, compound engine, of which the intermediate size indicates about the fair load at which the engine would be rated, and the largest shows the ability of such an engine to meet excessive overload. I do not know that I have ever seen this latter card equaled, since it represents 33 per cent. overload with an absolutely perfect distribution of steam, and no loss between cylinders. The smallest card indicates the load which might occur a few seconds later in the performance of railway work.

The engine capacity, therefore, must be sized up with reference to the maximum load, and would have a nominal rating greater than that of the generator, being located at some point as indicated by the broken line. It will, of course, be understood that the ability of the valve motion of the engine to take care of momentary overload beyond its own rating is further supplemented by the value of the flywheel, although recent practice in connection with the inertia governor tends towards exacting less from the flywheel and more from the steam distribution. The final selection of the engine as to size will depend in every case upon the local conditions of steam pressure as the principal factor.

I will point out further that the capacity of the engine should be determined without reference to condensation. In the vast majority of cases water for condensation cannot be had, and compound engines of this type are now designed to yield an almost uniform fuel duty when non-condensing over the full ranges of load that occur in railway service. But even where it is determined to condense, the condenser should still be treated simply as an adjunct of economy, and not as a part of the power. This is for the obvious reason that a condenser may become choked or disabled or leaky, and the vacuum may be poor or lost entirely under sudden fluctuations. The engine must by all means be of adequate capacity to walk away with the load without leaning upon its compara-

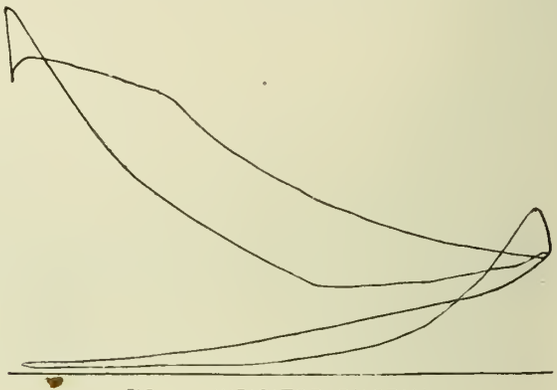


FIG. 3.—INDICATOR DIAGRAM.

tively uncertain assistant. This caution is, by the way, no discredit to condensers, but is simply a necessary consequence of the conditions under which condensers are generally called upon to operate.

We next reach the boiler capacity. It will be obvious that the boiler has to deal only with the *average* of the total load. In the diagram this average is indicated by the shaded rectangle, and is somewhat startling as compared with the apparent power of the remainder of the plant. In this particular, electric railways exactly resemble rolling mills, saw mills and kindred industries, where the load is spasmodic, with variations lasting but a few seconds, or at most, but a few minutes. The stored heat in the water of a boiler is enormous in quantity, and responds instantly to a release of pressure. That is to say, the boiler is an immense reservoir of power as to volume, and, provided the drain upon it is not continued too long, it will stand exactions far beyond its nominal capacity, and without any effect whatever upon the firing. In the earlier stations which we constructed, we did not give sufficient consideration to this fact which ought to have been obvious. The result was a boiler plant approximately equal to the engine capacity, a large portion of which plant is perforce lying idle and unproductive of anything but interest account. Having first encountered this relation as a matter of experience, it did not take long to arrive at the reasons lying back of it, and as a consequence all our stations are now designed with some

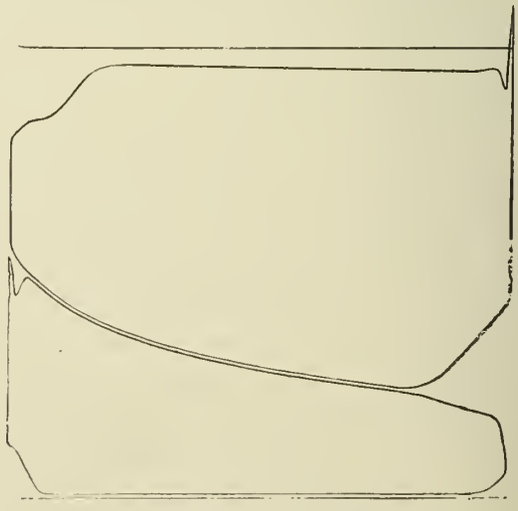


FIG. 4.—INDICATOR DIAGRAM.

such proportion of boiler power as is indicated on the diagram.

There has been altogether too much "rule of thumb" in electric railway work, as in other departments of engineering. For instance, "rule of thumb" says, in ordinary mill work, that there should be 20 per cent. more ca-

pacity of boiler than of engine. This rule applied without judgment to electric railways and without considering the characteristics of the engine used, would result in doubling the necessary investment in boilers and in the buildings to accommodate them.

In this discussion I would not be for a moment understood as advocating cheese paring in the matter of any of the items comprising the generating unit. I am referring only to a question of relative proportion. The intelligent engineer who knows the results of his work are to be interpreted in the light of dollars and cents earned, will follow the excellent advice: "While you are a gittin', git a plenty." The relative proportions, however, will be found very closely as indicated. We would introduce the caution that a relay boiler should always exist in every station. A large station will carry a relay unit throughout, but even a moderate station should show one relay boiler and a relay feed pump. The engine and dynamo can be fairly trusted to take care of themselves, since any ordinary repairing can be quickly made between running hours. Not so with the boiler, which is liable to occasional repairing or cleaning that will throw it out of service for one or more days, and this is not permissible in connection with street railways.

The actual size of the boiler will, of course, depend upon the type of engine used. With the compound engine above described, making such diagrams as are here shown, and running non-condensing, an allowance of thirty pounds of water actually evaporated for each indicated horse power will give abundant margin for all contingencies. It must be borne in mind that the duty under an average load is a very different thing from the duty under a variable load represented by the average. Under the uniform load twenty-three pounds of water would be the actual engine performance, and the boiler could be proportioned with reference to this figure. Under the violent fluctuations of railway service the average duty of the engine will rise to about twenty-eight pounds, and if the maximum average load is taken, and the boiler proportioned for thirty pounds, there will be a sufficient margin. These remarks apply only to the particular type of engine under discussion, as other compound engines, not possessing the feature which secures uniformity of duty, will range up to at least forty-five pounds under light loads and often to sixty pounds, and represent an average duty not better than thirty-five to forty pounds. The same is true of every form of non-compounded engine, whether high speed or low speed, both of which show a tremendous falling back of fuel duty under variable load. But, in the language of Rudyard Kipling, "That is another story," and is worth another article.

The Street Traffic in Berlin.

By Our Special Correspondent.

The first street railway built in Berlin was opened for traffic June 22, 1865. It was five miles in length, started from near the royal castle and extended to the neighboring city of Charlottenburg. During the next eight years no street lines were built in the city. In the year 1873, however, the construction of four lines was commenced, all of which ran from points just outside the centre of the city to the new suburbs. The authorities at that time did not allow the construction of street railway lines inside the "heart of the capital," as they were afraid that horse cars would impede the other street traffic, and might be dangerous to life. At present this heart of the capital is crossed by street railway lines in every direction without causing the trouble feared nine years ago.

At the beginning of the year 1871 the Berlin street railway lines had a total length of fifteen and a half miles. During this year, however, the great development of the Berlin street railways commenced, and in 1881 there were 107 miles, and in 1888 177 miles of road in operation in Berlin. The increase in passengers, rolling stock and horses during these seven years is shown in the following table:

Year.	Passengers Carried.	Cars.	Horses.
1881	58,675,576	558	2,424
1888	117,009,010	966	5,192

In 1888 each inhabitant of Berlin rode an average number of 87.3 trips per year. Corresponding statistics show an average number of rides in Vienna during the same period of only 42.6 per inhabitant, and in other European great cities a still less number.

It was supposed that this rapid development of street railways, by which 966 cars with 5,192 horses were introduced during a relatively short time, would cause a diminution of other vehicles engaged in the transportation of passengers. But statistics show that only an insignificant effect was felt, and that even this disappeared soon.

The following table shows the increase in Berlin from 1881 to 1888 of omnibuses, cabs and carettes. The latter are large 'buses used to make excursions to the country on Sundays and holidays:

Year.	Omnibus.	Cabs.	Carettes.	Horses to Draw these Vehicles.
1881	134	4,631	290	8 795
1888	217	4,695	378	9,531

The increase of cabs and carettes between 1888 and 1892 has been very small, and it is very probable that it will be equally small in future, because the development of the street lines and of the Berlin City Railroad (elevated) has diminished the call for this class of vehicles. But a very remarkable feature is the large increase in the omnibus traffic. During the seven years from 1881 to 1890, eighty-three new omnibus cars were put in service. This is equal to an increase of 62 per cent. The number of passengers carried by the omnibuses during the same period increased from 9,690,774 to 23,487,855. This increase shows that an omnibus service on a considerable scale is possible in cities in which an extensive street railway system exists, as in Berlin. This fact was doubted at the time that the first street railway lines were built, as it was supposed that the railways would ruin the omnibus business. The liberty in the movement of the omnibus, and the possibility of taking up or setting down passengers at any point, together with cheap fares, enable the omnibus to compete successfully with the street cars.

A relatively small number of passengers are carried by the little steamers which run on the river Spree, the number in 1888 being 394,134. As the course of the river Spree will be improved very soon, it is thought that this steamer traffic may be increased.

The development of the Berlin, City & Ring Railway (elevated) is shown by the fact that in 1881 1,802,287 passengers were carried, and in 1888 7,152,460 passengers were carried. From these figures may be deducted about 30 per cent. which do not belong to the real city traffic, as this percentage is composed of passengers passing through Berlin or going to or from the steam railway stations.

ON February 22 an electric railway was opened in Gera a city of Germany. The total length of line is six and a half miles and the Sprague-Edison system is in use. The maximum grade is about 5 per cent. The rolling stock consists at present of fourteen motor cars and of the same number of trail cars. The fare charged is ten pfennigs or two and a half cents. Fare boxes are used, and consequently the American system of a single fare for any distance traveled is in force. The citizens of Gera seem to be very well pleased with the electric motive power, and in one day 15,000 persons were carried on the road, a high number considering that there are only 40,000 inhabitants in Gera. The line was built by the General Electric Co., of Berlin, the same company who installed the electric street railway in Halle, recently described in these columns.

The Tramcar Omnibus.

In a description of the street railways of Brussels, given in the February issue, mention was made of a type of vehicle differing from anything used in the United States, and called a tramcar omnibus. This vehicle is not peculiar to the Brussels tramways, as it is used in Hamburg and on the streets of several other European cities, and is adapted to run either on the pavement or on the railway tracks. The fifth wheel, shown in the view, is the only one provided with a flange, and when the vehicle

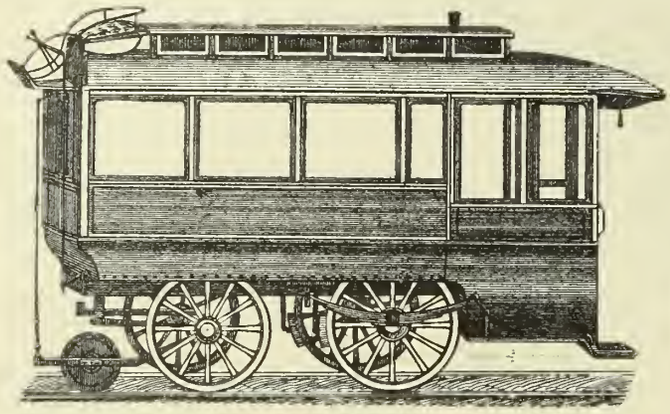


FIG. 1.—HAMBURG TRAMCAR OMNIBUS.

is operating on the tracks this wheel rests on one rail and its flange runs in the rail groove or slot, keeping the other four wheels, which are constructed to track gauge, on the rails. If, however, in the course of the route a narrow street occurs in which the authorities have not allowed the laying of a track, the tramcar omnibus turns off the track by raising the fifth wheel, and crossing the street turns on the track again by lowering the fifth wheel. The car is also useful in localities where a continuous street railway track is laid, but where there is only space for a single line of track. Here no sidings and switches are necessary, as one omnibus can turn off the track to pass a car or another omnibus.

In Fig. 1 is shown a tramcar in use on the Hamburg

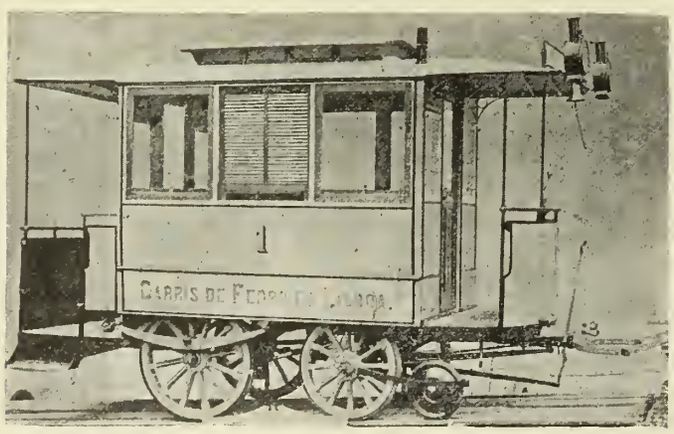


FIG. 2.—LISBON TRAMCAR OMNIBUS.

street railway. It has a seating capacity of thirteen passengers inside and standing room for seven outside, making a total of twenty. The handle of the lever for raising the fifth wheel and the handle of the brake lever, are illustrated very clearly. This car is to be drawn by one horse, but if grades on the road occur, another horse is connected in tandem. Fig. 2 shows a tramcar omnibus on the street railways in Lisbon, Portugal.

Progress in the East.

A French company are now building a street car line in Tashkend, the capital of Russian Turkestan, where, not very many years ago, any white man who visited the place would have lost his head.

Street Railways in Milan, Italy.

The Sociatà Anonima degli Omnibus di Milano is the title of the stock company having a monopoly, practically, of the street transportation business in the city of Milan, Italy. The length of line operated by this company is sixty-two and a half miles, about two-thirds of which is laid with the Marsillon compound rail. During the past year the system has been extended about two-thirds of a mile, the Marsillon system being used.

The rolling stock belonging to the company consists of 501 vehicles, of which seventy-one are omnibuses, the service provided by these 'buses comprising an important part of the company's business. The total receipts during the last year from all sources was $763,174. The total expenses during the same time, including fixed charges, but exclusive of dividends, was $678,623, of which $242,561 was for motive power.

The number of horses owned by the company at the end of the year was 1,304, an increase of nine over that of 1890. These were valued in the annual report of the company at $73.25 each. During 1891 140 horses were purchased by the company at an average price of $144.60. Ten were born, and ninety-one, including eight dead horses, were sold. The latter brought $6 each. An average of 1,243 were in daily service.

The following statement, taken from the annual report of the company, shows the average consumption per horse per day for the last three years. In addition, each horse had six and a half pounds of straw per day for bedding.

	1889.	1890.	1891.
Hay	17.3 lbs.	18.8 lbs.	18.3 lbs.
Oats	9.7 "	8.4 "	8.6 "
Beans, etc	1.7 "	3.1 "	2.6 "
Vegetables	.4 "	.4 "	.3 "
Total	29.1	30.7	29.8

Overhead Wires in Washington.

By a resolution passed by the House of Representatives at Washington, April, 11, the Metropolitan Street Railway Co. of that city will be allowed to use overhead wires for the propulsion of their cars.

It will be remembered that in 1888 Congress enacted a law providing that from and after the date mentioned in the act no overhead wires should be erected within the limits of the city of Washington, and it was also ordered that all overhead wires then in existence should be removed. Congress followed this law with another passed a year or two ago providing that on or before July 1, 1892 every surface road in the District of Columbia should abolish horse power, and that no road should thereafter be chartered with authority to use horses for the movement of cars. The number of curves in the line of the Metropolitan Street Railway prohibited the adoption by them of the cable, and they have recently been to a great expense preparatory to the installation of a storage battery system. Finding that it would be impossible to have their storage cars in operation by July 1, 1892, they petitioned to Congress for an extension of time. It was during the discussion upon this point that the resolution was passed extending the time for one year, and permitting them to use overhead wires. The resolution also provided that within thirty days from the passage of the act the company should "increase their service to such an extent that it will no longer be necessary for any of the passengers to stand up, and no fare shall be collected for any passenger in any of the cars until furnished with a seat therein."

IT is reported that a new company, in which Russell B. Harrison and Charles C. Upham, general manager of the Lincoln (Neb.) Street Railway Co., are interested, are negotiating for the street railway at Evansville, Ind.

Consular Reports on Local Transportation in European Cities.

The Department of State at Washington about a year ago determined to secure for the information of municipal governments and others interested a report on the status of local transportation in the principal foreign cities. With this end in view the assistant secretary sent a letter to various consular offices requesting information on certain points, the results of which have been compiled for a publication soon to be issued by the department. From advance copies of this report we are enabled to give the following abstract of the most important conditions noted in the principal cities of Europe :

AUSTRIA-HUNGARY.

Prague.—Local transportation is effected exclusively by street cars which were installed in 1875. The plant is owned by a Belgian capitalist, Edward Otlet, and the management is in the hands of his representatives. The franchise is for fifty-one years, for which a tax is paid to the municipality of about $112 for each mile of track laid during the first ten years and of $177 per mile during the subsequent years. A further tax of nineteen cents, to be paid every three months, is levied upon every square yard of ground occupied by stations or waiting rooms. The company also keep the pavement in repair between tracks and for a short distance on each side, and remove snow in winter. The zone system of fares is in force, the rates being two, four and six cents. Cars are run from 6 A. M. to 11 P. M. Conductors and drivers receive thirty-six cents for twelve hours work a day. The service is said not to be entirely satisfactory, and the cars are often overcrowded in spite of a regulation forbidding the carrying of more passengers than can be seated. The net profit of the property for last year was 100,000 florins on an investment of 3,000,000 florins.

Vienna.—Horse cars, omnibuses and, in the suburbs, several steam dummy lines and one electric line furnish transportation. The horse cars run in summer from 6 A. M. to 12 P. M. and in winter from 7 A. M. to 11 P. M. The cars are owned by two stock companies, the Vienna Tramway Co. and the New Vienna Tramway Co. Fares are on the zone system, and on the lines of the first company vary from three cents the minimum fare to seven cents, according to the distance traveled, with slight reduction if a number of tickets are purchased. Three cents entitle a passenger to a ride of from two to two and a half miles. The street railway companies pay as taxes 5 per cent. of their gross receipts to the municipality for their franchise, besides the regular taxes to the government. The franchise is granted for a certain number of years, at the end of which the railways become the property of the municipality.

The electric railway in the suburbs is operated on the overhead system, and the charge is ten cents for a ride of about five miles. The minimum fare on the dummy lines is two cents for one and a quarter miles.

The total number of cars of both horse railway companies is about 900, the aggregate mileage is seventy-two, and together they carry about 50,000,000 passengers a year. The cars are generally overcrowded in spite of a police regulation limiting the number of passengers carried per car.

The Vienna Tramway Co. paid a dividend last year of 10 per cent. the New Vienna Tramway Co. of 5½ per cent. It has been said that a transportation enterprise has not been known to fail in Vienna.

BELGIUM.

Antwerp.—There are seven street railway companies in Antwerp, the first horse cars being introduced in 1873. The zone system of fares is in use on most of the lines. The charges are prescribed by the city authorities, and must not exceed two cents for two-thirds of a mile. All the companies pay a considerable amount to the municipality for their franchises.

Brussels.—The street railways are owned by two companies, one line being about twenty-three miles long, the other two and a half miles. Rates of fare vary from two to five cents according to distance traveled, and an annual rent is paid to the municipality as well as general taxes. The profits realized by the companies are said to be only moderate.

DENMARK.

Copenhagen.—Rates of fare are from 1.34 cents for second class (outside) to 4.2 cents. The minimum fare is for a ride of about 1,700 to 1,900 yds. The fare most frequently charged is 2.68 cents for distances of from 2,000 to 3,000 yds. Discount is made where a number of tickets are sold. The franchise is granted upon consideration of the grantees keeping the pavement between rails and two feet on each side of the track in repair, and franchises as a rule are for thirty years. The cars are not allowed to carry more than a certain number of passengers, and this rule is strictly enforced.

FRANCE.

Bordeaux.—Public transportation is monopolized by an English stock company. Rates of fare, irrespective of distance, are: First class four cents; second class (on top of the car) three cents. Officers, soldiers and sailors are carried at half fare, and municipal officers and police free. Cars run from 6 A. M. in summer and 7 A. M. in winter to 10:30 P. M. The company paid the city for their franchise and pay taxes amounting to about $34,000 annually. In 1890 the receipts of the company were $585,000; expenses, $483,000 ; car mileage, 1,794,741 ; average receipts per day per car, $13.82 ; average number of horses, 1,212. Cost of forage per week, $2.27. The service is satisfactory to the inhabitants, but is said not to be equal to that furnished in America.

Havre.—Rapid transit is furnished by horse cars, omnibuses and cable cars, divided respectively : 7.9 miles ; 29.6 miles, and 12,000 ft. The zone system of fares is in force. The fare is three cents per section first class, and two cents per section second class. Cars run from 6 A. M. to 11 P. M. in summer and from 7 A. M. to 10 P. M. in winter. The street railway company pay a yearly tax to the city of $3,474, and declare a yearly dividend of 10.1 per cent.

Lyons.—Omnibuses, horse cars, and steam cars furnish the means of local transportation. Rates of fare for first class are four cents within city limits, and six cents beyond. Second class fares are half these. Police regulations are strictly enforced against overcrowding cars. The General Omnibus & Tram Co. of Lyons pay $16,000 per year to the municipality for their franchise, which was received nine years ago, and was for twenty-five years. There are several surface steam lines within the city limits, but the locomotives are not allowed to make a greater speed than five miles an hour.

Marseilles.—All horse cars are owned by one company who charge fares of from two to nine cents. The municipality imposes a tax of 2¼ per cent. on gross receipts of the company for their franchise, and limits the fare to one and a half cents for each two-thirds of a mile. On several lines the company charge less than the prescribed amount. The investment is understood to be a profitable one for the stockholders, but the service is not good, and the cars are often overcrowded.

Paris.—Transportation is furnished by omnibuses, horse cars, dummies, compressed air motors, stored steam cars, storage battery cars and one cable road in the suburbs. Inside the city limits the rates of fare are six cents for first class and three cents for second class, irrespective of distance traveled. The first class rate also includes transfer to another line if desired. The General Omnibus Co., of Paris, who control a large number of the street railway systems, pay to the city $400 annually for each vehicle. In addition to this the city has the right to one-half of the profits when stock dividends exceed 8 per cent. For the new lines of street cars a tax of six cents is collected for each round trip. The service is said to be, as a general thing, satisfactory to the public, but at certain hours of the day, and on Sundays and holidays the transportation facilities are sometimes insufficient. The companies are, as a rule, financially profitable.

GERMANY.

Aix La Chapelle.—The street railways in this city are owned by a corporation who pay a yearly license to the city of $125. The company also pay 6¾ per cent. of their profits to the city and 3 per cent. to the state. The company charge three and three-quarters cents between any two points within the city or suburbs, except to one suburb about four miles distant, to which the fare is ten cents.

Berlin.—Berlin has street railways, omnibuses and one line of elevated railway. On the street railways the zone system is in force and the lowest fare is two and a half cents, with an increase of one and a quarter cents for each additional section. The rates of fare are subject to the approval of the local authorities. The companies are responsible for a certain part of the cost of widening the streets, paving, etc. and pay the city from 4 to 7½ per cent. of their gross receipts in addition. In 1890 the Great Berlin Street Car Co., who operate the majority of the lines paid a dividend of 12½ per cent.; the Berlin Horse Car Co. of 1 per cent. ; the other two transportation companies, nothing.

Bremen.—In the cities of Bremen and Bremerhaven there are eight horse car lines and one electric line (Thomson-Houston system). The fare on one of the horse car lines is five cents for complete distance (five and a half miles), and two and a half cents for one-third of this distance. Another company charge seven and a half cents for five and a half miles, or two and a half cents for any distance not exceeding one-third of this. The companies are said to pay well.

Cologne.—Horse cars furnish the only transportation in Cologne, and are all leased to one company for a period of thirty years, after which the city comes into possession of the property, with the exception of the rolling stock, buildings and grounds, which it will have the right to purchase. The fares vary from 2.4 to .6 cents. The amount paid to the city annually by the company was, up to and including 1888, $666 ; up to and including 1893, $1,332 ; up to and including the year 1916, $2,665. In addition, after payment to the managers of the company of a bonus and 5 per cent to the stockholders, the municipality receives 15 per cent. of the residue. In 1890 the company paid 5½ per cent. dividends.

Dresden.—The average number of cars in use in 1890 per day was eighty-six and a half ; length of line, 28.6 miles, the passengers carried per day by all the lines averaged 38,496. The pay of conductors and drivers varies from sixty cents to seventy-five cents per day. (For profits see report on Hanover, where the street railways are owned by the same company operating here.)

Frankfort.—All the horse car lines are under the control of a single company, who operate about fourteen miles of line and own 128 cars. At present the zone system is in use, the least fare being two and a half cents. with an increase of one and a quarter cents for each additional section. Roughly stated, a five cent fare, which is the maximum, entitles a passenger to ride about two miles. The company pay the city a fixed yearly rental of $7,040 plus 6 per cent. of the gross receipts and one-half the net earnings above 10 per cent. of the same. The gross earnings in 1890 were about $338,112. There is also an electric line to Offenbach, a distance of five miles, which pays the city of Frankfort 3 per cent. of that part of its gross earnings which are proportional to the portion of its line within the city limits. There are also several steam tramways. The shares of the company sell on the local exchange at 142 per cent. premium.

Hamburg.—All the horse car lines are under the control of one company. On one route, which has a length of four miles, a uniform fare of two and a half cents is charged. The other routes are divided

into sections of about three-fourths of a mile, and the zone system is in force, the lowest fare being two and a half cents and one and a quarter cents charged for each additional section. All the companies pay to the city a tax of from one-quarter to three-eighths of a cent per passenger carried, and keep a certain portion of the street over which they run in repair, as well as paying the ordinary taxes. The dividends paid by the operating company are from 5 to 5½ per cent. annually.

Hanover.—There are 14.46 miles of street railway lines in Hanover, which are owned by two companies, one of which at present pays over 5½ per cent. on the company's capital (about $614,000) as annual rent, and after 1894 will pay 6 per cent. during the lease, which lasts until 1917, at which time the property may be purchased by the city at a moderate valuation. The other company (the Tramways company), pay only regular taxes, but pave a certain portion of the streets over which they run cars, and at the end of their concession all of their immovable property will pass into possession of the city without compensation. Fares range from two and a half cents to six and a quarter cents. The annual dividends of the Tramway company, which own eighty-nine cars in Dresden, have in recent years amounted to 6 per cent. This, however, has been rendered possible by large profits in Dresden, where the lines are owned by the same company, the profits in Hanover justifying a dividend of not more than 2 per cent.

Mayence.—Fares vary from two and a half cents for the first three-quarters of a mile to four and three quarters cents. An extra charge of from one and a quarter to two and a half cents is made, however, on trips after twelve o'clock at night. The company pay 1½ per cent on their gross receipts to the city at present, and after 1895 will pay 2½ per cent. They also pay regular taxes, and 15 per cent. of all earnings over 6 per cent. on the capital. The franchise is for thirty-five years, and at any time after fifteen years the city has the right to purchase the property on one year's notice.

Nuremberg.—The street car mileage is twenty-three, most of which is double track. The maximum fare allowed for five-eighths of a mile is two and three-eighths cents, and for any distance, four and three-quarters cents. The company have to maintain and keep in repair clean the portion of the streets through which their cars run, and also pay to the government an income tax, which last year amounted to about $1,220. Dividend paid by the company in 1890 was 5 per cent. The wages of conductors and drivers are from fifty to eighty-four cents per day. The receipts of the company during 1890 were 442,724 marks (about $106,000). The company own 178 horses and seventy-six cars.

ITALY.

Florence.—Local transportation is furnished by omnibuses and horse cars, with one electric and two dummy lines in the suburbs. Fares on the horse lines are from three cents for one mile to eight cents for four miles, on the electric, fourteen cents for four and a half miles. The city is privileged to take possession at seventy-five years from date of organization of all immovable property of the street railway company without indemnity. The companies pay customary taxes and earn a gratifying return upon the capital invested.

Naples.—Horse cars, two dummy lines and two incline plane lines are in the city. The horse car company pay about $161,590 to the city annually, and are required to employ not less than 100 cars in winter and 150 in summer. Rates of fare vary from one to six cents. The street railway company earn about 3 per cent. on money invested. At the end of a certain time the street railway property will pass to the municipality.

PORTUGAL.

Lisbon.—The street railway tracks are all owned by one company who pay considerable for their franchise as well as do certain paving. Rates of fare vary from two to eight cents, according to the distance. The tracks of the company are free to any individuals or companies who wish to operate their own cars upon them, and such cars are only required to turn out upon the pavement when they meet the regular cars. Street railway stock is reported to be considered a good investment.

RUSSIA.

Moscow.—The horse cars are owned by two companies, both prosperous. One line charges fare on the zone system, the sections being from two to three miles in length, and the fare for each section being three cents. The second company charge three cents irrespective of distance. There is a tax of $3 per year per driver, and the companies keep the roads over which they run in repair, but make no other payments beyond ordinary taxes.

St. Petersburg.—The street cars are owned by two companies. Fares on one are two and a half cents inside and one and a half cents on top for any distance; on the second, three cents for inside seats and two cents for outside seats. Payments are made for franchises.

SPAIN.

Barcelona.—Fares on horse cars are two, three and four cents within the city, and do not exceed ten cents to the most distant suburb for first class passage. New companies pay the municipality a tax of twenty cents per meter for their franchises.

Grao of Valencia.—Fares for the urban horse cars are two cents to any part of city. The suburban horse cars charge no more than one cent for each two-thirds of a mile and in some cases less. The corporations pay a certain tax to the city according to their length of track and also 10 per cent. of their net profits.

SWEDEN.

Stockholm.—There are two companies owning street railways in this city. Fares are uniformly two cents, with one or two additions of one cent on extra branches. No payments for franchises are made, but the usual taxes are assessed.

SWITZERLAND.

Berne.—There are 1.8 miles of track. Fare over the entire line is four cents; one-half the line two cents. The income during the last three months of 1890 was $6,341, and the expenses $5,058. Compressed air motors are used.

Zurich.—The horse railways are the property of a single company and comprise 8.4 miles of track. The fare consists of an arbitrary charge of one cent, with an additional charge of one cent for every two-thirds of a mile or fraction traveled. This makes the cost of an average ride from two to three cents. Discounts are made where a number of tickets are purchased. The company pay for certain maintenance of the streets when their net profits exceed 5 per cent. of their paid up capital, otherwise, there is no monetary return besides ordinary taxes to the franchise granting authority. The municipality has the right to purchase the property of the company at any time during the length of the franchise, which is fifty years, upon the payment of a certain price. The company pay about 5 per cent. dividends annually. There is also an inclined plane railway a quarter of a mile in length. The fare is two cents and the company paid in 1890 a dividend of 6.45 per cent.

TURKEY.

Constantinople.—There is only one system of horse cars in this city, and this is owned by a stock company. The rates of fare are three, four, six and eight cents, according to distance traveled. The municipality does not assess any taxes or share in the profits. The corporation pays about 5 per cent. on the present value of the shares.

UNITED KINGDOM.

Birmingham.—The horse cars and most of the omnibuses are in the hands of four companies, the most important of which is the Birmingham Central Tramways Co. The rates of fare on several routes are two cents per mile. The companies pay the municipality regular taxes, an income tax, and an annual license per driver, per car and per horse power for steam power. They also pay a certain rate as leases of roadway. Conductors' wages are from 85 to 97 cents, drivers' from $1.09 to $1.34, motormen's from $1.15 to $1.40. The Central Tramways Co. paid a dividend in 1890 of 5 per cent. on the guaranteed stock and 4 per cent. on the common stock.

Belfast.—The street railways are owned by one company, and horse cars are used except on one line where steam is employed. Fares are from two cents to six cents, depending upon distance, the minimum fare carrying a passenger from one and a quarter to one and a half miles. The company pay the municipality $242 per year per mile of track, and the latter has the option of purchasing the lines at the end of a term of years. The company have in operation twenty miles of track and ninety cars, earn about 11½ per cent. on their capital stock yearly and declare dividends of 8 per cent. There are twenty miles of track and ninety cars. Drivers and conductors receive from 75 cents to $1.00 for ten hours work.

Dublin.—The principal system of transportation is furnished by horse cars owned by one company. There are thirty-two miles of track and 156 cars. Fares vary from two cents to six cents, according to distance traveled. The average fare is about three and a half cents. The municipality receives no compensation beyond ordinary taxes, but a government tax is paid of $19.46 per car. The receipts during the six months ending June 30, 1891, were $296,581.48; expenses $230,708.30. The company pay from 4 to 5 per cent. annually.

Glasgow.—The systems of public transportation are horse cars, omnibus lines and underground railways. The minimum rate of fare is two cents for street cars and for third class on the underground cars, which entitles the passenger to the ride of about one mile. First class underground fares are about one-half more. The municipality receives ordinary taxes and a fee of £150 per mile per annum for the franchise.

Liverpool.—The street car lines are laid down, owned and kept in repair by the municipality. Fares range trom two to fourteen cents. The car company pay 10 per cent. on the cost of the rails to the municipality per annum. The facilities afforded are said to be satisfactory and financially profitable to the companies.

London.—There are ten street car companies, eight of which use horses, one storage batteries and one cable. There are about 950 cars in use on these lines. There are also three underground railways, two using steam and one electric power. The street railway and third class underground fares are generally two cents a mile. The car companies have to keep a certain portion of the street in repair, and pay ordinary taxes and a small license per car.

THE monthly reports of the Melbourne Tramway & Omnibus Co., of Melbourne, Aust., show a large falling off in receipts during 1891. In the month of November the decrease in receipts was over $18,000 as compared with the receipts of the corresponding month in the preceding year. The cause of the falling off in the number of passengers is attributed to the general dull times which cause the public to practice economy.

To meet this reduction in income the management of the Tramway company found it impracticable to discharge any more hands, since the lines are being worked with the smallest possible staff. The only other alternative was to cut down salaries, and this was done, the reductions being from 5 to 20 per cent.

It is thought that this reduction will be only temporary.

Report of the Boston Rapid Transit Commission.

The Boston Rapid Transit Commission, which, it will be remembered, was appointed in part by the governor of Massachusetts and in part by the mayor of Boston, submitted its report to the Massachusetts Legislature on April 5. This report is divided into several chapters, each treating of certain salient features. It recommends a radial system connected with a central circuit for distributing passengers in the central part of the city. The radial lines contemplated extend to South Boston, Roxbury, Cambridge, Charlestown, and to the East Boston and Chelsea Ferries. An elevated railroad is recommended for all parts of the city, except where tunneling is considered absolutely necessary.

The commission first discusses in their report the

SCOPE OF THE INQUIRY

and defines the Metropolitan district to include the towns and cities within a radius of ten miles from the Boston City Hall. It finds that the traffic within this district is constantly increasing, and that the conditions as to streets, steam railroads and street railroads are wholly insufficient to answer present requirements, to say nothing of the future. The congested district within the centre of the city is defined, and it is pointed out that, even with no change made in the street lines, these highways could be utilized to much better advantage if the city government of Boston were to adopt the street regulations that obtain in many cities of the old world.

RELIEF OF STREETS.

Speaking of London streets, the report says: "The streets were no wider, but they were more free. They were kept open, and the stream was kept flowing by the police. Why should we not be as capable of exacting their full capacity from our streets? We, accordingly, framed a code of street regulations embodying the features that no carriage should be allowed to stand longer than two minutes at a time on the sides of certain parts of specified streets; that certain kinds of heavy wagons should be excluded from traversing parts of certain streets during specified hours, and a rule to regulate the order of passage along some crowded thoroughfares. We think that wheeling through the city would be much improved if the street car rails, when worn out, were replaced by the Liverpool pattern of rail."

ELEVATED STRUCTURES PREFERABLE.

The advisability of adopting a system of tunnels which was urged upon the commission by a number of those who appeared before it is discussed at some length, and the conclusion reached that not only would the expense be too great, but the changes in this climate would render the use of deep tunnels exceedingly dangerous to the health of the community, since in the summer time there would probably be a variation of from thirty degrees to forty degrees between the temperature in the tunnel and the temperature in the outer air. This decision, however, referred only to deep tunnels, like the "Greathead," which are not believed comparable in anything like the same degree to light and well ventilated subways, like the New York Fourth Avenue tunnel, nor even to a short bit of tunnel which the apparent necessity of the situation in Boston forced the commission to adopt subsequently, as a short link in the system of otherwise above-ground transit determined upon by them.

STEAM RAILWAYS.

So far as location is concerned the commission finds that the citizens of the Metropolitan district, of Boston, possess in their steam railroads facilities without parallel in any other large city of this or any other country; and state that the possession of such terminal stations close to the heart of the city would be considered elsewhere well worth the expenditure of many millions of dollars. To properly use these facilities, the establishment of three union stations, one on the north and two on the south side of the city, was recommended.

STREET CARS AS OBSTRUCTIONS.

The consulting engineers to the commission were so much impressed with the unnecessary impediments to travel caused by the multiplication of tracks in streets not wide enough for teams alone, that they recommended the complete abandonment of all the surface tracks within the circuit of the elevated road, and the transfer of passengers from the surface system to the elevated wherever the former impinged upon the latter. Many citizens who appeared before the commission advocated the same idea. The commission, however, while believing that this suggestion was an ideal solution of the problem, and that, if the city had to-day no surface cars within the circuit route, there would be no reason for their introduction, were yet of the opinion that the public had been so long accustomed to direct street car connections with the retail shops and theatres as to render the change in question too radical for adoption. They, therefore, recommend such a readjustment of the surface system as shall, on the one hand, permit the cars to get through the congested district with greater speed than is possible to-day, and, on the other hand, land passengers within a few hundred feet of all the retail shops, if not at the door of each.

THE REMEDY.

The end can be accomplished, in the opinion of the commission, by the use on the part of the street cars in passing from the northern to the southern parts of the city of a double track tunnel under the Common from Park Square to Park Street, thence from Tremont Street to Scollay Square, and thence under and through private property to Adams Square (this tunnel to be built on the east side of the tunnel recommended for the elevated road), by creating two or more new and wide thoroughfares from north to south (on the lines of Tremont Street, Portland Street and Cross Street); by limiting the tracks on all the streets to the number strictly necessary; by removing them altogether from all the cross streets except Causeway, Hanover, Eliot, and possibly, Cornhill; and by reserving some through streets exclusively for foot passengers and teams. Such a readjustment of the surface system supplemented by an elevated railroad and by a proper code of street traffic regulations, would, the commission thinks, not only facilitate travel for teams, carriages, foot passengers and cars, but would be profitable to the street railway company, and appreciated by the general public.

The commissioners declare that they are unable to specify with precision the exact changes that should be made in the surface lines, and think that at the proper time a careful and critical survey should be made by competent persons, to ascertain exactly what can be done in this direction, with due regard to the needs of the public and the reasonable requirements of the West End company.

Then follows the plan of the

PROPOSED ROUTE,

consisting of a radial system to the four suburbs, South Boston, Roxbury, Cambridge and Charlestown, with a line to the ferries to East Boston and Chalsea, connected with a circuit route, as already outlined. The location of the latter, as previously adopted by the commission, was illustrated in our February issue.

The length of the proposed system will then be divided as follows:

Circuit	3.30 miles.
Charleston line	1.75 "
South Boston line	2.53 "
Roxbury line	2.05 "
Cambridge line	3.30 "
East Boston branch	0.49 "
	13.42 "

OPERATION.

The system, as proposed, may be operated in several general ways, viz:

1st. By running a certain number of trains continuously around the circuit in opposite directions upon the two tracks for the accommodation of the local traffic within the limits of the circuit.

2d. By running other trains from the several radial lines around the circuit in either direction and out again over the same radial line.

3d. By running certain trains from the several radial lines partially around the circuit in either direction and out over other radial lines.

Briefly stated, the

SUBWAY

recommended may be described as a brick and masonry arch, with its crown about five feet below the surface, having a width of thirty feet in the clear and measuring nineteen feet in height. The tunnel built of the same materials, will be of equal capacity, but carried down about twenty-five feet beneath the surface, measuring from the top of the masonry. The station on the Common would require a descent of twenty-five feet, and that at Scollay Square about twenty-seven feet.

THE ELEVATED STRUCTURE

is a skeleton platform of longitudinal iron plate and girders, supported upon wrought iron posts set in pairs at intervals of forty-five feet, connected by spanning girders of the same length. The structure has room for three tracks, and strength equal to the weight of the heaviest railroad cars. The platforms for shipping passengers are between the tracks, but the delivery platforms are on the ontside. The elevated stations are, of course, covered in and planned to present a pleasing exterior effect. An attempt has been made also, by the addition of one or two architectural and ornamental features, to give a lighter and more agreeable tone to the roadway itself than that produced by that in New York and Brooklyn, In most essentials, however, it closely follows the latest built lines in the latter city.

Referring to the

COST OF BUILDING.

The report presents a mass of statistics and calculations. The mile or so of tunnel and subway is placed at $1,500,000; the two and a quarter miles of iron structure at about $1,050,000. For overhead stations they allow $160,000; for subterranean stations. $120,000; for storage track and grounds for cars, about $400,000, making a total of what may be called the main lines of $3,230,000. The ten miles and a fraction of branch lines at $425,000 per mile amount to $4,278,009, and twenty-five stations $500,000 more. To which must be added about $1,000,000 for equipment of the combined systems complete, and the total amounts to about $9,000.000 for construction and equipment. Add to this an estimated land damage of $4,000,000 and the grand total is $13,000,000.

THE CAPACITY

of such a system operated as a circuit is largely determined by the capacity of the inner circuit. This is calculated to be 500,000 people per day. The radiating lines will, therefore, not need to be of equal capacity to the interior ones. The maximum equipment required for them would be sufficient to handle 300,000 people per day. The most largely used of the radial lines is assumed not to deliver over 100,000 people per day in the city.

COST OF OPERATION.

After analzying these various items, and comparing, correcting and reconciling the results, the conclusion is reached "that the 13.42 miles comprised in the Boston project might be operated at a total yearly cost of $870,152, assuming that it was carrying only

100,000 passengers per day, perhaps one-fifth of its capacity. This number of passengers seems a fair one to estimate upon. This is upon the assumption, also, that the system is operated as a circuit with branches.

INCOME

Upon the basis of 100,000 passengers per day, relying upon the figures derived from the Brooklyn lines, they find the calculation takes the following shape : "Operating expenses, $725,000; taxes, $200,000; total, $925,000; and assuming, as before, that the fare is a uniform one of five cents for each passenger, it would give us a daily income of $5,000, or a yearly gross receipt of $1,825,000. This would furnish a net return of $900,000.

Assuming that we were to carry 200,000 persons per day upon the system proposed in this report, operated as a circuit road at a five cent fare, this would give $3,650,000 gross per year. Deducting from this the highest rate of operating expense which is found upon any elevated road in this country, and taking that to be, with taxes for a system of the length of ours, $1,589,500, and we still have a net yearly return exceeding $2,000,000.

If it be decided, as we now incline to think will be found more practicable and convenient, to treat it as two distinct lines of double track road from South Boston to Charlestown on the one hand, and from Roxbury to Cambridge on the other, with shuttle connections through Eliot Street on the south, and Causeway Street on the north, then the cost of operation is somewhat greater than that of the circuit plan, the difference arising mainly from the greater requirements for equipment. So that the account stated on this basis stands as follows : The operating expense for carrying 100,000 people per day increases from $725,000 to $870,000, including taxes in both cases, making your total expenses, including the item of $200,000 for taxes, $1,070,000, against $925,000, according to the previous estimates, and reducing the net income upon the plant from $900,000, as we stated it above, to $755,000 yearly."

MOTIVE POWER.

The commission do not describe definitely the motive power which they think should be used to operate this road, yet think it should not be steam. They say : "The application of electricity to the propulsion of vehicles is yet in its infancy, the cable is not superseded, pneumatic power has its advocates. An entirely new motor is quite conceivable. We are, therefore, not ready to fix now what shall be the special kind of force or the exact method of application which should be selected to propel cars which, probably, will not start for two or three years to come. If in the meantime something better has not been discovered, we look for an electric locomotive as the coming offspring of the future ; but the estimates of operation in this report have necessarily been made up on the basis of steam locomotion."

Regarding the

TERMS OF THE FRANCHISE.

to be granted to any corporation building or operating roads, the commission says :

"It would seem that the legislature considered it probable that the 'practical method' of rapid transit, whatever it might be, which the commission might agree upon, would be valuable and readily salable to some corporation which could afford to pay something for the franchise, and undertake to build and operate it upon terms which would return compensation to the cities or towns traversed by it.

If private enterprise saw its way clearly to a profit in the undertaking, it might still happen that it would insist upon such terms of immunity from interference and perpetuity of tenure, or other special franchise, that a prudent public policy must deny their concession. In that event there would seem to be no alternative between entire abandonment of the project or the direct intervention of the community in its own person and on its own behalf. We are quite alive to the dismay which falls upon a great body of intelligent citizens at the mere suggestion of such a thing. They instantly invoke a long procession of ghastly spectres to drive us from that path. And it may well be that, upon weighing all the arguments and remonstrances on either side, the legislature may conclude that until it can be done by private enterprise, it had better not be done at all."

A MINORITY REPORT

was also handed in by Commissioner James R. Richardson, who concurred in the report of his associates, except where they advise the construction of two lines, for three tracks each, through the old part of the city of Boston. To relieve the congested district in the centre of the city, which he thinks is not provided for by the circuit railway, he suggests one elevated, double track road, extending from north to south, as straight as practicable through the central part of the city, as near the main line of travel as possible, and so located as to draw off laterally at all points the great confluence of travel in the overcrowded section. The route of such a railway suggested is as follows : Coming from Roxbury down Washington Street as far as the vicinity of Waltham Street, thence through to Harrison Avenue, and extension to Bedford Street, through private property across Avon Street to Summer Street, crossing Summer Street through Hawley Street to Milk Street, down Milk Street to Post Office Square and Congress Street, through Post Office Square and Congress Street across State Street to Exchange Street and Dock Square, through New Washington Street or Union Street to Haymarket Square and Haverhill (or Canal) Street to Causeway Street with a station at the steam railway stations. A few other recommendations, differing in some particulars from that of the other members of the commission, were also made.

Public Rights in Private Property.

BY R. M. FISHER.

The late Chief Justice Waite, of the United States Supreme Court, in rendering a decision in a case against the State of Illinois, made the following statement: "When one devotes his property to a use in which the public has an interest, he, in effect, grants to the public an interest in that use, and must submit to be controlled by the public for the common good to the extent of the interest he has created."

The "devotion" or dedication, is the setting apart of land for the public use. It is essential to every valid dedication that it should conclude the owner, and that, as against the public, it should be accepted by the proper local authorities, or by general public user. In this case dedication is a term applicable only to public ways. Neither the act of the owner nor the act of the public need be evidenced by any formal act. There are two kinds of dedication, statutory and common law dedication. (Elliott. Streets and Roads.)

The first is one made in conformity to the provision of a statute. It is generally held, that in order to constitute a valid statutory dedication, the provisions of the statute must be substantially complied with, and such acts as are required must be performed substantially in the manner prescribed by the legislature. This is necessary to give the dedication validity as a purely statutory dedication, but, in some instances, a dedication, invalid as a statutory one, may be a good common law dedication. Incomplete or defective statutory dedications will often be sustained as common law dedications, and if the streets marked on the defectively executed or recorded plat are accepted by the public, they will become public streets. *Gossilin* v. *City of Chicago*, 103 Ills., 623. Indeed it has been held that even where there is no acceptance on the part of the public, they will be regarded as streets, and will be kept open for the benefit of those who have purchased lots with reference to the location and existence of the streets and roads represented upon the maps or plats. *Common Council, etc.*, v. *Cross*. 7 Ind., 9.

While the donor may vest the fee in the public by the statutory dedication, he is not bound to do so, unless the statute imperatively requires it, but may reserve the fee and grant only an easement to the public. (23 Ia. 248 ; 19 Conn. 250 and 13 Ill. 312.) A statutory dedication operates as a conveyance of an easement, except where the statute declares that a fee shall pass, and is, essentially a grant of interest in land, while a common law dedication generally operates by way of estoppel. (6 Ohio, 298 and 27 V't. 265.) The one concludes the owner upon compliance with the statute, while the other concludes him upon the ground that he has suffered the public and individuals to acquire rights upon the faith that he *devoted* the land to the use of the public as a street. A common law dedication may be classified as an express or an implied dedication. In either case there should be an appropriation of the land to public use by some express or implied intent. No particular form is necessary ; any language or instrument indicating an intent to devote the land to the public use would bind the donor from the time of acceptance by the public. Where the acts of a donor are such as would fairly and reasonably lead an ordinarily prudent person to infer an intent to devote land to the public use, and such intent is acted upon by the public, the owner cannot after such acceptance revoke the appropriation.

Applying this rule to cities which in turn grant franchises to private street railway corporations, such city and railway company claiming against the owner of the fee an easement in lands, must show either a grant, a continued user for twenty years or facts from which an intent to devote the land can be fairly inferred. The general principle which runs through all kindred cases is that the donor must bear the loss or burden, which his conduct has led the city to act upon in good faith.

Where land is *devoted* to the public it will pass to the corporation created for the control of that locality, and the law invests such government with title to the streets of the locality in trust for the public for the use to which they were set apart by the owners of the fee, when the land was *devoted* to the public. (118 Ill. 61; 11 Ala. 63.)

An owner may annex conditions and limitations to his gift, but he cannot annex any condition which will have the effect to take from the proper local authorities the power to improve the street in the same mode or dedicate it to the same use as other public streets are improved or dedicated in that locality. (31 Ohio, St. 506.)

A city has no right, however, to infer that one who *devotes* land to a street that the grant exceeds that which the public use of the street measures, for as the use is the foundation to the public right, it necessarily determines its extent. The title which the local authorities acquire in a street is in trust for the public, and they acquire this title, not for all purposes, but for one general purpose, that of a street over which all citizens have a right to pass and repass at pleasure. Under every just principle of law the one who devotes his property to such public use cannot be deemed to have devoted his property to a diversion of the one general purpose. But legislative power, as usually conferred upon municipal authorities, usually confers upon the latter the power to control and regulate the streets, and the power thus granted is generally very extensive. Just how far these powers extend, in any particular case, must be determined from the city charter; but it is safe to say in a general sense such power is sufficient to bind one who devotes land for public use to the extent of being controlled by the public for the common good, at least to the extent of the interest created. Cities usually have authority over the use of vehicles, and, may therefore, prescribe the routes to be followed by omnibuses. (*Commonwealth* v. *Stodder* 2 Cush 562.) So street cars may be regulated under authority to regu-

ate omnibuses. (*Railway Co.* v. *Philadelphia*, 58 Pa. St., 119. See, also, 6 Fed. R. 555.) Legislatures may authorize a city to permit street railways to make use of its streets (12 How Pr. N. Y., 187) but not to the extent of creating a monopoly. (20 Am. & Eng. Corp. cas. 263.) The general rule is well established that a city is not liable for consequential damages necessarily caused to the donor of land for public use unless so provided in the charter, and such donor "must submit to be controlled by the public for the common good to the extent of the interest he has created."

A street railway is a way constructed upon a street or streets for the purpose of passenger transportation. In this age of improvement and surprising genius, it will not do to designate a street railway as a "horse railway." The term "street" is also too restrictive for street railways, as they may be, and are often, operated upon suburban highways by means of the most improved mechanical power. A distinctive and essential feature of a street railway, when considered in relation to other railroads, is that it is a system for the transportation of passengers, and not of goods. Hence, it cannot be said that when the street or road was devoted or appropriated, that a private corporation should divert the way from its usual and appropriate use to an essentially different use, for the purpose of corporate gain. A street railroad is not, in a strict sense, a railroad. The view which generally prevails with the courts in following the weight of authority, is that an ordinary railroad constitutes an additional burden, which entitles the owner to withold his submission and control without just compensation, but that the mere construction of a street railway does not impose any additional burden upon the land which he has devoted to public use. (See, *Rights and Remedies of Abutters*, chap. 25. *Eichels* v. *Evansville, etc. Co.*, 78 Ind. 261; *Jersey City etc., Co.* v. *Jersey City. etc.. Co.*, 20 N. J. Ey. 61.)

Where an ordinary street railway is constructed in the usual way, and so built as not to materially impair the easement of access, such use of the street according to the adjudged cases do not affect the grantor, and the public interest created is paramount to any reserved rights he may have. But if the system is so constructed as to materially impair the rights and accustomed use of the grantor, it would place an additional burden, entitling the owner to adequate compensation; especially would this be true where the grade or elevation or alteration in any street is made solely for the necessary use and economy of the street railway company.

"When one devotes (or dedicates) his property to a use in which the public has an interest he, in effect, grants to the public an interest in that use and must submit to be controlled for the common good by the public to the extent of the interest he has created," is a doctrine within the principle recently asserted in the elevated railway cases and other kindred cases relating to the interests of street railways. This doctrine has been subjected to severe criticism, and private corporations have met stubborn resistance in their use of the streets of a city for their own benefit, but as this question is pretty firmly settled by authority it is useless to resist it. It is questionable, however, with many learned jurists if the doctrine ought to be further extended. Justice Mitchel of the Minnesota Supreme Court (see 35 Minn. 112) is inclined to hold that the maintenance and operation of a street railway constitutes a servitude additional to, and different from, the use for which the streets were acquired, or otherwise a new use of the streets, not contemplated at the time of their dedication. He said "that it was difficult to see that this road differs from any ordinary commercial railroad except that it uses the entire length of the street as its depot at which it receives or lets off passengers. As operated, it is, to a certain extent, in aid of travel on the street, but this is a secondary and incidental, and not its main and principal purpose." Even in this remarkable age of public improvement, courts have been censured for giving away to enterprises that seemed to promise great public good in a manner somewhat unmindful of the rights of the individual property holder, grantor or abutter, and have sacrificed his rights to a presumed public benefit without takng into account individual losses and discomforts.

It is quite true that in a great majority of instances, no injury is done the abutter or grantor by the operation of a system of street railways; hence, he must submit to be controlled by the public through its given franchises to the interests of a common carrier for passenger travel. But it does not follow, because there is no injury in a large majority of cases, that there is no injury by reason of the unexpected use of the street in any case. To what extent a grantor has devoted his property to public use, depends upon the facts of that individual case; hence, it is not just to turn the sufferer away by affirming that the occupancy of the street by a street railway, in a legal sense, does the owner of the fee no harm, and "must submit to be controlled by the public for the common good, to the extent of the interest he has created." It is unsafe to assume that whatever may be the fact as to actual loss, no compensation can be enforced by law, for the simple reason that a street railway in the eye of the law cannot injure the owner in fee. Until a limit is established regarding the interest of the public, this doctrine is not likely to inspire a man who knows what he has suffered, with a very exalted respect for the law that compels submission without, in many cases, just compensation for his loss and discomfort.

It is true, as history proves, that city councils are quick to grant important and valuable privileges without restriction, which they subsequently feel the necessity of limiting, but not until after it is too late; and it is undeniably true that courts have not been entirely free from the same general influence which moved the councilmanic bodies.

In a general sense, street railways are highways, but they are not in a strict sense public ways, because their owners hold a private proprietary right in the franchise, and where such railway is operated for private gain, it cannot be said that they are primarily for the public benefit. While the public is incidentally benefited, this benefit is not the chief purpose of the organization and operation of a street railway.

While it is true that a street railway for the transportation of persons is for public use, it is also true that it is private property, and although the street or road over which it passes remains a public street or road, consistent with the unimpaired use of the street railway, the latter is, notwithstanding, in the use for which it was built, a private road for the accommodation of the public and the profits of its owners, upon which no one but its owners have a right to run a car. (51 N. Y. 295.) There are certain uses to which, in modern times, the street may be subjected to, uses not merely conducive to, but almost necessary for, the comfort, health and prosperity of the public, and the sanction by custom and approval by experience of such uses is sufficient to control submission for the common good of any interest created by the grantor. Among certain uses here referred to is the use of street railways upon the surface of a street. Property devoted to a street is simply an easement or servitude, carrying with it, as its incidents, the right to use and improve the soil for the purpose of the public good, and while the owner retains the fee and all rights of property not incompatible with the public enjoyment he must, in accordance with the weight of authority, submit to be controlled by the public for the common good to the extent of the interest he has created.

Strike in Chicago Averted.

A strike of conductors and drivers of the West Chicago Street Railway Co. was threatened in April, but the men, after considering the matter an entire night, decided not to abandon their positions. The trouble arose out of differences of opinion regarding "tripper cars." There are two organizations of employes of the West Side road, known as Union No. 1 and Union No. 2. The company have been putting on "trippers" who work during the rush hours. They are employed three or four hours, or perhaps more, and receive $1.50 per day. Union No. 1 claimed that this employment of trippers constituted a violation of an agreement relating to wages which it had made with the company, and threatened to strike. Union No. 2 stood by the company and was prepared to furnish "trippers" from its ranks. The company, to the surprise of the men, assumed an aggressive position and posted the following notice in all the barns:

It has come to the notice of the management of the West Chicago Street Railroad Co. that certain persons are spreading mischievous reports to the effect that it is the ultimate intention of the company to lower the scale of wages to $1.50 where $2.10 is now paid. The management would not notice these reports but for the fact that, notwithstanding the idea is very ridiculous, yet we are informed that some of our employes really believe that such is the object of the company.

To leave no doubt in the mind of anyone, the management wishes to say that such reports are entirely without foundation and made only to mislead the credulous, and that no reduction of wages is contemplated in any department.

The management further says that it is the desire of the company that all such mischief makers as above noted should leave its employ at once so that their places may be filled by more honest employes. They are continually endeavoring to stir up strife between the employes and the company, and it will be a great benefit to both when such persons cease to be on its pay rolls.

Union No. 1 held a meeting to reach a final settlement, and after debating the matter from eleven o'clock at night until the time for running out morning cars, decided not to declare a strike.

Signs in Chicago Street Cars.

The North Side Street Railway Co. of Chicago, are continuing their fight against those who indulge in the habit of tobacco chewing in the street cars. They have posted placards in the cars calling to the attention of tobacco users the enormity of the offense of polluting the floors of public conveyances. It requires a brazen front to persist in the violation of decency with signs like the following staring one in the face:

Pigs do not chew tobacco. Query: Is a man who does and spits on the floor, neater than a pig?

You don't wear dresses, do you? If you did you would not spit on the floor—as a matter of self-protection.

Track Construction.

From Advanced Sheets of "Street Railways" (Trams).

By C. B. FAIRCHILD.

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A prime requisite in all street railway operations, is permanency, and in the long chapter of expense items that inevitably accompany mechanical traction a large percentage (as high as fifteen on some electric lines) is due directly or indirectly to defects in the tracks. Hence, it is desirable to reduce this percentage to the smallest possible limit, and roads that are designed to do a large amount of business must advance their tracks to such a condition as will allow of cars being run on short headway and at a high rate of speed, or they will imperil their very existence by defects inherent in the permanent way.

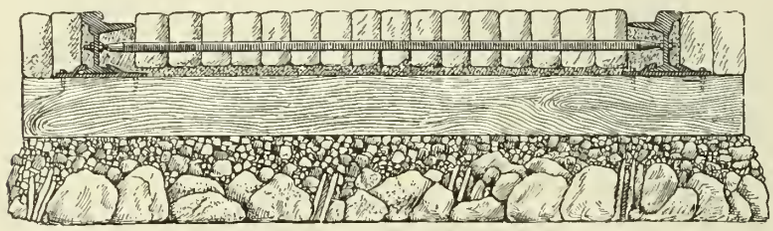


FIG. 1.—CROSS SECTION OF TRACK ON BALLAST FOUNDATION—GIRDER RAIL SPIKED TO TIES.

Among the many depraved traits that inanimate matter possesses none have caused greater surprise or reflected more severely on the skill of engineers than the behavior of rails and joints since they were made to do service under electric cars, and notwithstanding that a great amount of inventive genius and experimental effort have been expended in improving the details of foundations-ties, rails, and joints, street railway companies every, where feel more or less solicitude lest they fail to secure the highest standard of excellence desired.

Although no construction with which we are acquainted meets all requirements in a fully satisfactory manner under all conditions, great advances have been made, and this line of engineering, which heretofore has been considered a humble branch of the profession, is now receiving the attention of the best engineering talent of the country, and some of the modern arrangements represent notable and important improvements over former practice; still the possibilities of improvements are not yet exhausted, and when more practical knowledge shall have been acquired and disseminated, and engineers discover by failures what not to do, track construction will doubtless be advanced to a more creditable condition, but it cannot be expected, in spite of all that will be done, that incessant labors will not be necessary to keep the best of construction in first class condition.

Were it not that the significance of the above points is frequently ignored by street railway companies, an apology should be made for presenting them; but some street railways have been built for sale rather than for use, and others, on account of lack of funds, are sometimes constructed in a manner known to be imperfect, in the hope and expectation that they will gradually be improved after earning power is attained. Such expectations will never be realized in electric traction. Although it was possible with horse traction for cars to be operated with little danger for long periods over defective tracks, it is not so with the new power; for any defects in the joints, which are usually the weakest places in the track, rapidly grow worse, so that, not only are the rails worn, but much greater damage is inflicted upon the trucks and car appliances. The problem from a street railway point of view would seem to be easy of solution, but, unfortunately, it is complicated, usually, with conditions named in the franchise, which relate to paving, rail sections and care of tracks.

In treating the subject it is necessary to consider the preparation of the foundation on which the tracks are to be laid, the selection and adjustment of ties or their equivalent, the fastening of rails to ties, the type of rail, the connections between rails, the proper laying of rails on curves, the construction of turn-outs, frogs, switches, crossings and paving.

SURVEY.

In case a new line is to be constructed a survey of the route is first necessary, but this requires some knowledge of elementary geometry and other mathematical sciences, and great care is necessary in taking the measurements, recording the data and general conditions; hence, this work is usually delegated to specialists in this line, and since it is a custom with rail makers to employ men well versed in this work who make all necessary surveys and estimates free of charge to parties ordering a rail equipment it is not essential that the details of the work be treated in this connection. It is important, however, that the street railway companies for whom the work is being done direct that spiral transition curves be employed in laying out the work for turns, in order to lessen the danger of derailment and reduce the strain and shock to cars and motors, which with mechanically propelled cars is very great on circular curves. In case, however, one wishes to study this subject, a little pamphlet entitled "The Railroad Spiral" will give the desired information.

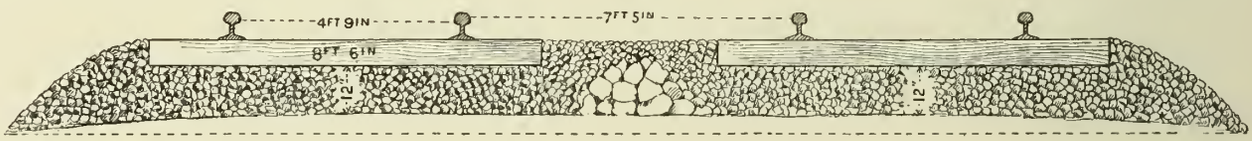


FIG. 2.—CROSS SECTION OF STEAM RAILWAY CONSTRUCTION WITH STONE BALLAST.

FOUNDATION.

In no class of roads is it so essential that there should be a thoroughly good roadbed as with electric lines. In the absence of a proper foundation it is useless to expect good results from the superstructure no matter what the type or weight of rail may be. Differences of opinion formerly prevailed in regard to this matter, but positive conclusions have now been reached, and these are that it is just as essential as in steam practice to have a ballast of clean broken stone, gravel or furnace slag, at least a foot deep under the ties, with the space between the ties filled up evenly to the top, and provided with tile drains at proper intervals to remove any excess of moisture that may percolate through the pavement. In placing the ballast coarse, large stones, set edgeways, may be placed at the bottom in order to provide for drainage, but care should be taken to keep the coarse stone from coming up to the bottom of the ties, as these should rest only on gravel or finely broken stone (Fig. 1). Those who have experienced trouble from the paving blocks being forced from their beds by the churning action of the ties, accompanied by a flow of soft mud, will appreciate the importance of the

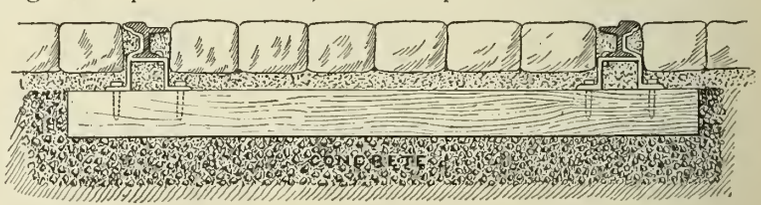


FIG. 3.—CROSS SECTION GIRDER RAIL ON CONCRETE FOUNDATION.

above drainage requirements. In some cases proper ballast has been provided, but provisions for drainage being neglected unsatisfactory results followed, as is likely to be the case, especially where the formation is of clay; hence, the suggestions for drainage are emphasized. Fig.

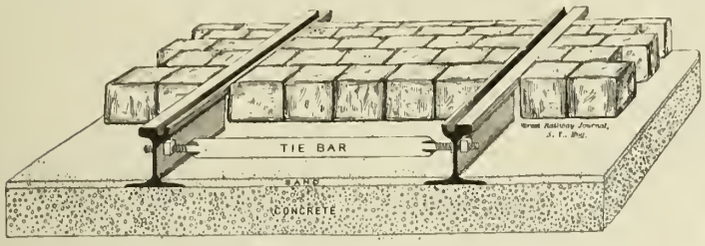


FIG. 4.—BIRMINGHAM TRAMWAY CONSTRUCTION.

2 illustrates one method of ballasting employed on the steam lines of the Pennsylvania railway. The term ballast is applied to material employed in this manner, because stones that had been used for ship ballast were first employed for this purpose on st am lines near Newcastle, England.

Another important factor in securing an enduring roadbed is the track laborer, and special attention should be given to the selecting and drilling of the men employed and to impressing upon them the importance of *thorough* and *conscientious track work*, especially in tamping, for much defective track is due to careless and insufficient tamping. In some sections it may be difficult to secure the services of men who are willing and competent to perform this part in a reasonably correct and efficient manner, but the importance of strict thoroughness should be understood by the contractors and section foremen at least.

We are aware that a foundation of concrete has been provided on some lines in place of stone ballast, and that in a few instances a creditable service has been secured (Fig. 3), but disastrous results have usually followed the use of concrete in this form or as pedestals under joint chairs. Especially will it be found imprudent to lay concrete on soft or newly made road bottoms. These remarks refer to electric lines. Concrete foundations have been quite generally employed on foreign lines employing animal power, and in most cases have proved quite durable, but there are many conditions that militate against such construction in this country. Some of these are the climate, the condition and care of streets, first cost, paving requirements, etc. Figs. 4 to 11 illustrate English practice in this respect and show the different methods of fastening rails.

TIES.

The selection and adjustment of ties will be governed somewhat by the kind and price of material in local markets. A number of varieties of wood are used, and different methods of preparing it are adopted, some being sawed, others hewn; the latter are generally considered best, for the rounded edges allow of thorough tamping, but in all cases the bark should be removed before the ties are placed on the foundation. Yellow pine is generally considered best for ties, but adverse elemental forces frequently bar the use of certain woods in some localities, in which case it is necessary to be governed by experience had on old lines. The dimensions of ties for electric lines should be 5 ins. × 7 ft., or better, 6 ins. × 8 ft., and they should be seven feet long for standard gauge, and not less than sixteen should be used for each thirty foot rail. The spacing at the joints may be determined by the width of the ties employed, as shown in Figs. 12 and 13, but the type of rail will govern the spacing of ties somewhat. In case the rails are spiked directly to the ties, the use of a Servis tie plate, or the ordinary steel tie is recommended, as they prevent the cutting of the rail into the tie (Figs. 14 and 15).

Metal ties have been employed in electric service to a limited extent in place of wood, and considerable inventive effort has been expended in this direction, but no very satisfactory results have been obtained, so far as we are informed. There is also a system designed to obviate the use of ties which employ broad based metal chairs with specially prepared foundations; of this we will speak later on.

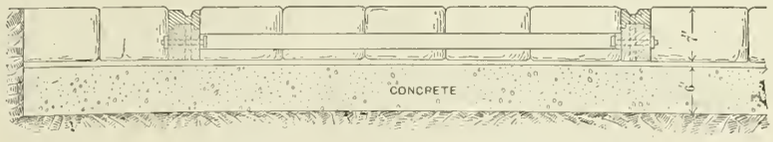


FIG. 5.—EDINBURGH TRAMWAYS.

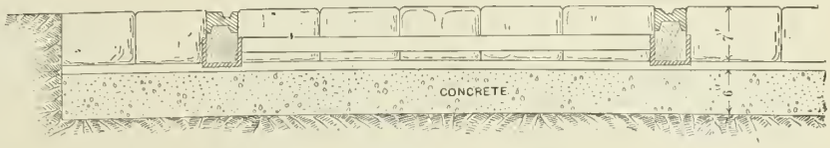
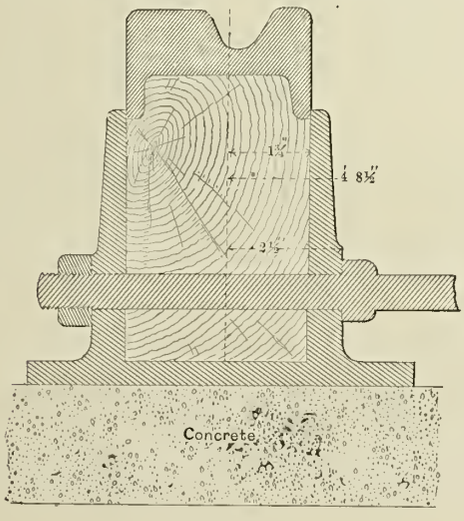


FIG. 6.—DUNEDIN TRAMWAYS.

RAIL FASTENINGS.

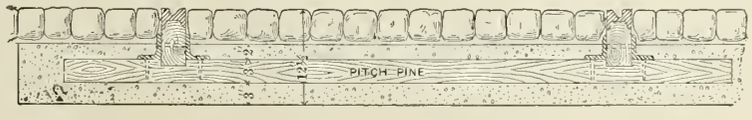
The method of fastening rails to ties will, in many cases, be governed by the local requirements in regard to paving. The best results, by far, are obtained where the rail, be it a Tee or girder type, is spiked directly to the ties. In locations where low wooden blocks, vitrified brick or asphalt are employed as paving material, rails of the ordinary height, of four and a half or five inches, may be thus secured. In case the pavement is to consist of granite sets of ordinary depth, it will be necessary to support the rail upon chairs or wooden stringers, or employ a specially designed rail of sufficient depth to allow it to rest directly upon the ties. In case chairs are used (Figs. 16 to 18), those of wrought metal are preferable to those of cast iron, as the latter are apt to break, especially in cold climates, and it is also of advantage to have the rail and chairs united by electric welding. Both from a street railway point of view and that of the local authorities, the employment of chairs for supporting the ordinary



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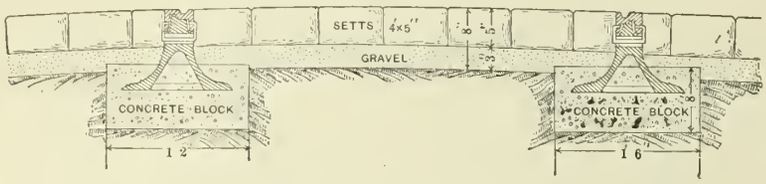


FIG. 7.—MANCHESTER TRAMWAYS.



SOUTHPORT TRAMWAYS. FIG. 8.

types of rails on electric lines is undesirable, as it will be difficult to keep the rail in position, and a frequent disturbing of the pavement will be necessary. As a substitute for chairs the best results have been secured in some localities by the employment of a longitudinal stringer on which a girder rail of the ordinary depth is placed (Fig. 19). In case the stringer is employed, care should be exercised in selecting the kind of wood that is known to be the best to resist decay in any particular soil or climate, as in the case of ties, and the stringers should be cut in as long and uniform lengths as possible. The stringer may be secured to the ties by means of cast knees, as shown in the figure. While this construction has given satisfaction in paved streets having a moist soil, it has not proved to be desirable in unpaved streets where the soil is sandy.



SECTION THROUGH CHAIRS.

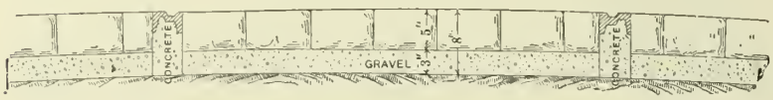
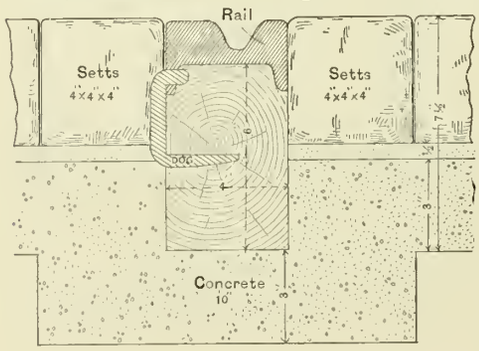


FIG. 9.—BRISTOL TRAMWAYS—SECTION BETWEEN CHAIRS.



It is proposed in certain localities to employ a girder rail having a broad base and of sufficient total height (ten inches) to allow of its being spiked directly to the ties, and yet provide space for the paving blocks and gravel bed above them. This, theoretically, is an ideal construction, but it remains for service to demonstrate if the first cost and increased surface wear, because of the increased stiffness, are not prohibitory.

Attention should be given to the type of spike employed for rail and chair fastening. For fastening the rail directly to the tie or stringer railroad hook spikes not less than four and a half inches long are recommended. Those having specially designed points (Fig. 20) are preferable, as they cut the fibre of the wood better than the chisel pointed spikes and have better holding qualities. Double headed spikes (Fig. 21) may be employed to advantage for fastening chairs and tie plates, for when driven there is sufficient space left between the plate and second head to readily admit the claw bar when it is necessary to draw the spike, so that the head is not as liable to come off, as is the case with the common spike.

THE RAIL.

Service has demonstrated beyond question, thus far in the history of electric traction, that the Tee type of rail, when of proper dimensions, and spiked directly to the ties, has given the best satisfaction from the operator's point of view wherever its use has been allowed. Hence, for suburban lines, and lines operating on paved streets in small cities, the use of the Tee rail is recommended. It may be questioned, however, if its use on paved streets, where there is a good deal of vehicular traffic is economical, on account of the rapid wearing out of the pavement next the rails. When this rail is laid in streets paved with wood or stone blocks, it is necessary to chamfer off the corners of the blocks next the gauge side of the rails to provide a channel for the wheel flange. Some of the claims made for this type of rail are its vertical and lateral stiffness, durability, ease of draught and small first cost. When used it should be modeled after the designs employed on the leading steam roads, one of which is illustrated in Fig. 21, which shows the standard rail and connections at present employed on the Pennsylvania lines; but should this type be employed for electric service the nearer it is copied in weight as well as design, the more satisfactory will be the results.

The use of the Tee rail, however, is necessarily confined to a limited field in street railway service, owing to local requirements and conditions, so that for the larger service, unless a new type should be developed, some form of the girder rail must be employed, on mechanically operated lines at least.

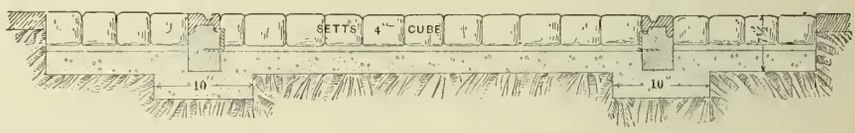


FIG. 10.—WIRRALL TRAMWAYS.

From the shape of the head, girder rails may be divided into three kinds, designated centre bearing, side bearing and grooved (Figs. 23, 24 and 25). Each of these forms may be rolled with or without a base flange, or the web may terminate in a bulb. Only those having a wide base, however, are suitable for electric traction. There are other forms designated by variations in the web; one is known as the double web or box rail (Fig. 26); another as a split or duplex rail, which is rolled in two parts, with the head and tram each provided with a web and designed to be laid with broken joints (Fig.

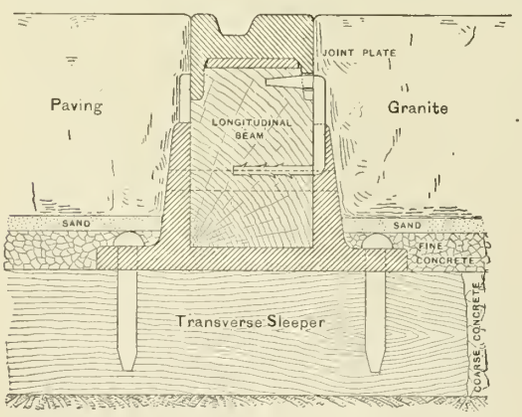
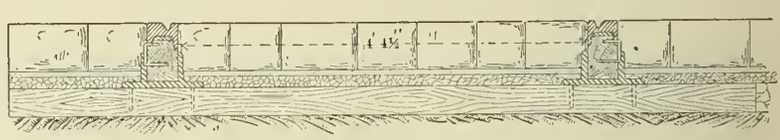
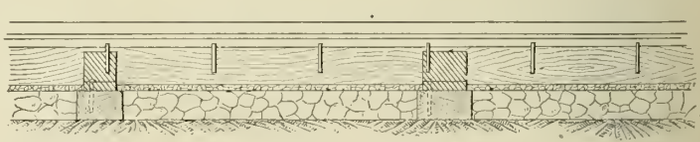


FIG. 11.



CROSS SECTION.



GLASGOW TRAMWAYS. LONGITUDINAL SECTION.

27). Neither of the latter types, however, requires a base flange.

In reference to the form of the head, the centre bearing head is the most desirable from the operator's standpoint; because, from the shape of the head, it readily sheds dirt and offers less resistance to the wheel than



Fig. 12.—Three Tie Joint.



Fig. 13.—Suspended Joint.

other types, but its use is prohibited in many localities because it is difficult for the wheels of vehicles to mount the head in getting in or out of the track; hence, it is necessary to employ the side bearing or grooved rail, or a compromise between them, something that will give reasonable satisfaction both to wagon owners and the operating companies.

Exactly the best width of head for a given weight of rail can hardly be determined. A wide head reduces, theoretically, the pressure per square inch of wheels, but on account of the slight coning of the wheels their actual contact is only from one-half to three-fourths of an inch. If the head is wide it must be thin, with a given weight of rail, so that its side presents less surface, with a higher rate of flange wear, and a greater variation in the gauge of the tracks. The heads must be deep enough to allow of a reasonable amount of wear, beforethe wheel flange will come down upon the tram.

Practice has determined that the best average width of head, for anything above a fifty pound per yard rail, lies between two and two and a half inches, with a depth of one inch or an inch and an eighth at the gauge line. Every possible fraction of the remaining half inch in the width has been adopted, but no one can prove that each is not the best. In any case the head should be so designed that the weight of the wheel will come directly over the web, to prevent any tendency of the rail to cant over, which will be the case if the slightest leverage is given to the weight. In designing rails for animal traction it may be necessary to so place the web that it will bear the weight imposed upon the head as well as that imposed upon the tram from vehicular traffic; but for electric traction this is not necessary, for the car service is first to be provided for; and since this is usually so much harder than the wagon service the latter may be ignored.

The tram or flange of a girder rail should be so designed that it will last as long as the head. As the part next to the head is the most subject to wear, it may be thickened at this point and allowed to taper away to the extreme point in order to economize in weight. The flange of the rail under electric traction is not liable to wear out before the head, as is the case with animal traction, unless the street traffic should be extremely heavy; hence, not so much attention should be given to its design as formerly, except in the direction of width. In regard to the width, most companies will be governed by local requirements, and if they must provide for wagon travel the tram should be as narrow as the requirements will allow (as narrow as two inches if possible), both to reduce the tendency of the rail to cant inwards, by reducing the leverage, and to add to its paving qualities. The latter is an important consideration, for if the tram is very wide the adjoining paving blocks, when they settle, are apt to cant under the tram, making a dangerous trap for horses' feet. This tendency, however, can be provided for to a certain extent by filling the pocket of the rail under the tram with concrete before the paving blocks are put in place.

The web of a girder rail is usually pared down to from one-fourth to seven-sixteenths of an inch. So far, no web of any of the leading patterns has broken down from being too thin. Any variation from the above is of little importance, for no one can say whether a sixty-fourth should be added or removed unless an unusually high (ten inch) rail is to be employed, when a bead may be added along the centre of the web on each side. The height of the web, however, is quite important; and were it not for paving conditions it would be easy to perfect the rail as a beam and establish a standard height for given weights because the stiffness of a beam increases as the cube of the height; and it has been found in steam practice that a well proportioned rail of about four and a half inches in height will carry loads of five or six tons per wheel to the best advantage. But it has also been ascertained that rails only half an inch higher wear out more rapidly on the surface than the lower rails of the same quality. This is explained by the fact that the higher rails, being more rigid, decrease the time of impact of the hammer blow of the wheel (whose destructive effect is as the square of its velocity) and so increase the power of the blow. As before stated, it is yet to be determined

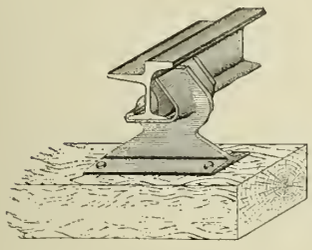


Fig. 14.—Steel Tie Plate.

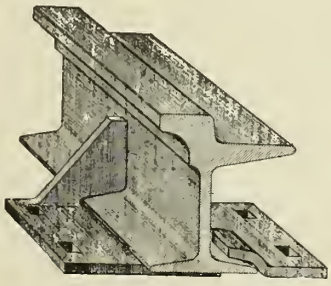


Fig. 15.—Brace Tie Plate.

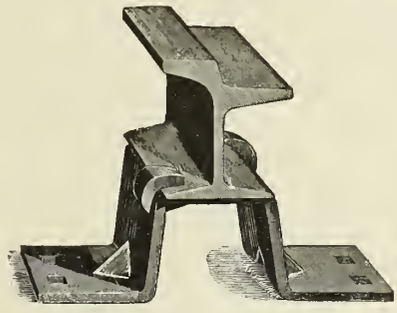


Fig. 16.—Clip Tie Chair.

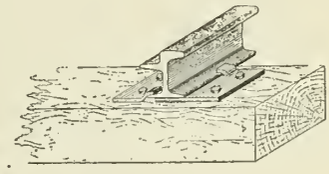


Fig. 18.—Rolled Steel Chair.

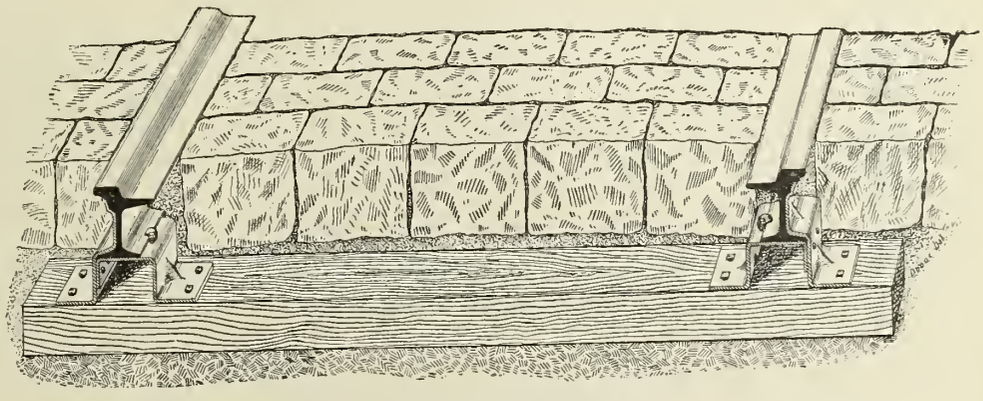


Fig. 17.—Cross Section Street Construction, Girder Rail, Wrought Brace Chair, Marshall Clips.

whether this increased wear, due to increased stiffness, will militate against the employment of a deep rail to obviate the use of chairs or stringers. Of course, where the ties, or yokes in cable lines are placed quite a distance apart, and it is thought desirable to suspend the joints, a deep rail will, theoretically, carry the load without much deflection out to the end and impose less service upon the joint connections, and the rail, being deep, allows the use of deep connecting plates. The relative advantage of a deep beam even under these conditions, when the first cost and value of scrap are considered, is a difficult question to determine, and must be left until new conditions of roadbed, load and manufacture shall have indicated further improvements in the weight and proportion of steel rails for street railway service.

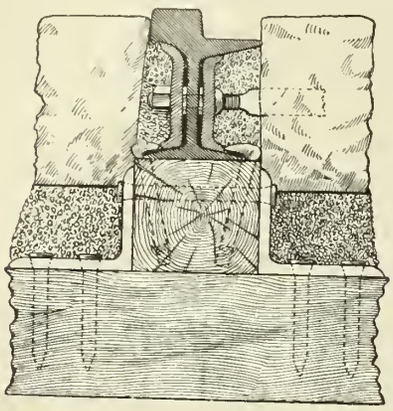


FIG. 19.—GIRDER RAIL WITH STRINGER SUPPORT.

The width of the base of the ordinary girder, which is designed to be spiked directly to the ties, is not so difficult to determine as the height, and the best practice makes the base and the height the same. With a wide base the tendency of the rail to turn over is not so great, and it is not as liable to cut into the tie or stringer. When employed with chairs it should also be wide, and the base of the chairs should be spread to correspond with the total height.

The grooved girder rail (Fig. 25) was an importation from English practice, and where the conditions are favorable it has given excellent results. Its use, however, is recommended only in mild climates and on streets that are kept scrupulously clean, for the reason that, ordinarily, the groove will become packed with dirt, bits of ice, snow or mud, thus causing the wheel to rest upon its flange, and increasing the resistance and tendency to derail the car. It must be laid to a close gauge; and it is estimated that it requires, ordinarily, from 30 to 40 per cent. more power to operate cars upon it than on the side bearing or Tee rail. The flanges of the wheels wear rapidly on both sides, and there are other minor objections to its use, so that it is an imposition on the part of city authorities to require that it be used except where the conditions are favorable, as above noted. It is, no doubt, a desirable rail from the point of view of the public, for it offers little or no obstruction to wagon traffic, as the pavement can be laid flush with the surface on both sides; and where the streets are paved with asphaltum it can be driven over in any direction without its presence in the street being detected. If, however, the pavement is not carefully maintained and is allowed to settle irregularly, the rail becomes exposed, wagon wheels form ruts, and its obstructive features soon exceed those of other types. In some cases, where the use of this type of rail has been insisted upon by state or city authorities, a compromise has been effected by forming the groove with an inclined or dishing wall on the inside, or terminating the point of the tram a little below the level of the head (Fig. 28. With this arrangement the flange of the wheel tends to cut through and crowd the obstructions out of the groove, and the pavement may be laid flush both with the tram and the head.

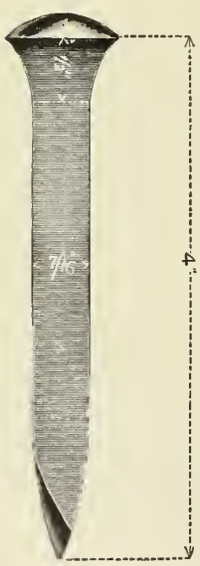


FIG. 20. SPECIAL POINT CHAIR SPIKE.

Fig. 29 illustrates a high (100 lb.) girder rail before referred to, and which has been designed for use on some of the Boston lines. The engraving shows the rail at the joint, and also a section of the girder or "standard" joint which is designed for use with this and other types of girder rails. Between the ties the rail is to be spiked directly to the ties, as it is of sufficient height to allow of paving with regulation granite sets without any blocking up.

The box or double web girder rail, illustrated in Figs. 26 and 30, has been designed to obviate some of the alleged defects inherent in the ordinary patterns of girder rails. Some of the claims made for it are that it has great vertical and lateral strength with a minimum amount of metal; excellent paving qualities, in that the vertical sides offer ample support to paving blocks and prevent their tilting over even though they settle below the level of the head; facility of adjustment to chairs or ties (Fig. 31), without any bolt holes through the webs, and admits of employing durable joint connections, in that the rails are rolled with the flanges slightly flaring and terminated with a bead at the lower edge, having an inclined top which is designed to engage with the inclined bead of the clamp, and, from the natural tendency of the web to spring outward, holding the rail and chair firmly together, thus taking up any wear that may occur at the point of contact between them.

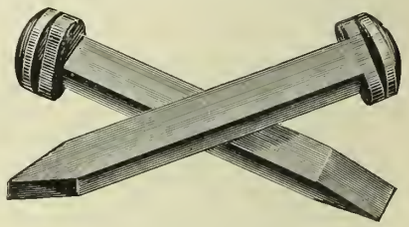


FIG. 21.—DOUBLE HEADED SPIKES.

The head may be rolled to correspond with any of the forms employed in the other types of girder rail. Designs for special construction to accompany the use of this rail, including curves, switches and chairs for uniting this rail with other types have been quite fully worked out, and the promoters are competing in the market for a share of the street railway business.

The designs of a duplex rail shown in Figs. 27 and 32, illustrate a commendable effort to obviate the troublesome joint defects which to a greater or less degree are inherent in every type of rail, and to provide an all metal structure. This is a comparatively new system, and it has not yet demonstrated its wearing and staying qualities by long and hard service which is the only test that can recommend any system for general adoption. Theoretically, the mechanical principle on which it is constructed—that of under and overlapping connection—is correct, but what depraved traits service will develop cannot be anticipated. It would seem, however, to be worthy of trial.

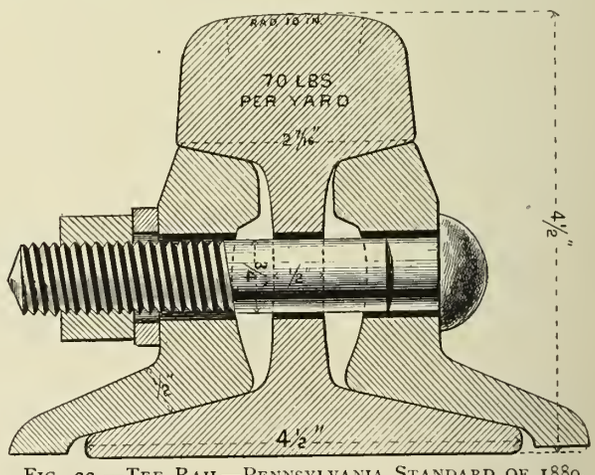


FIG. 22.—TEE RAIL—PENNSYLVANIA STANDARD OF 1889.

The system as shown consists of a split rail having two members which constitute the head and tram, which are rolled separately, so that each is provided with a plain independent web. When in position the members overlap, forming semi-joints, so that they give to each other mu-

tual support, and form in cross section a box rail which has excellent paving qualities. When worn either member may be replaced without rejecting the other. The top may be rolled to correspond with any of the standard forms, either side bearing, grooved or semi-grooved.

In order to obviate the use of wooden cross ties and stringers, provision is made for supporting the rails on

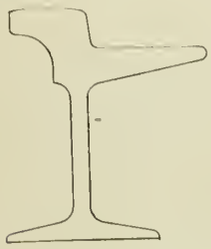


FIG. 23.—SIDE BEARING GIRDER RAIL.

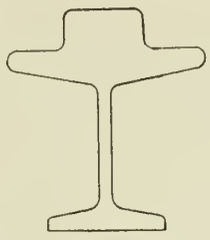


FIG. 24.—CENTRE BEARING GIRDER RAIL.

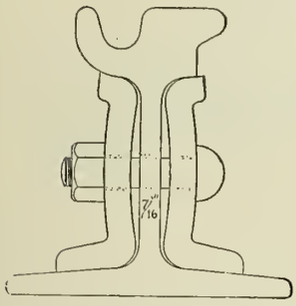


FIG. 25.—GROOVED GIRDER RAIL —WASHINGTON TYPE.

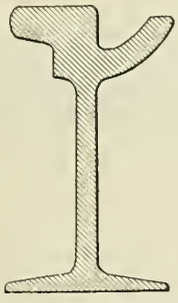


FIG. 28.—GROOVED GIRDER RAIL —NEW YORK TYPE.

deep metal chairs which have a broad concave base, and are designed to rest upon the soil where it is sufficiently firm, or upon pedestals formed by tamping broken stone, sand and gravel firmly into a pocket which is excavated for the purpose. The chairs are spaced two feet eight inches between centres, with stout tie bars at every alternate chair, and wedge keys at every chair. Designs for all special work are provided, making a complete system.

A method of track construction which has been designed with a view of employing a tram or flat rail, so as to obviate the joint defects that usually accompany this type of rail, is illustrated in Fig. 33. The essential features of the system consist in placing a flat bottom, heavy

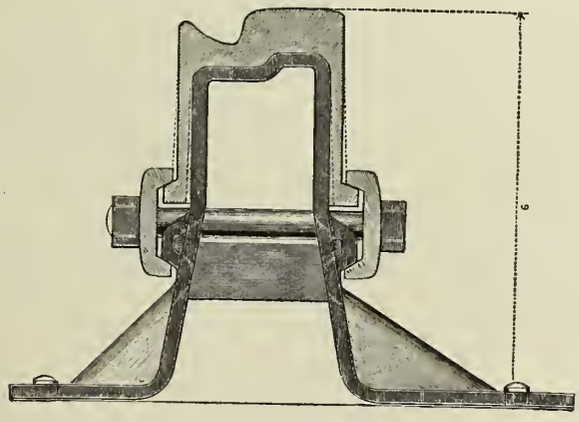


FIG. 26.—BOX GIRDER RAIL.

rail, having dependent flanges, upon a longitudinal stringer which is faced on each side at intervals with metal plates which are so bolted as to break joints with each other, the rail and stringer. The independent flanges and plates are pierced with oval hobs, through which spikes are driven so that rail, plates and stringer are held firmly together. The stringer is thoroughly protected on the top by the rail and plates, and may rest upon ties or a tamped ballast foundation. How far this arrangement tends to a solution of joint defects remains for service to demonstrate.

THE RAIL JOINT.

The establishment of proper connections between the ends of rails so as to form a continuous line without permitting them to touch each other, except when the highest temperature prevails, and at the same time avoid the damaging effects of the space left at the ends which is necessitated because of expansion and contraction, is one of the most difficult problems that confront the street railway engineer, although it seems comparatively simple. The space required for expansion at the end of rails is in proportion to the length of the rail, and should always be exact, for if too close the rail would be torn from its fastening by the force of expansion, which is estimated to be from six to nine tons per square inch of section, which corresponds to ten pounds per yard, or in a seventy pound rail, from forty-two to sixty tons. The expansion of a thirty foot iron or steel rail is .252 in. or one-fourth of an inch for every 100 degs. of temperature, and the highest temperature of a rail in summer is about 130 degs. Fah., or about 100 degs. above the freezing point, so that when thirty foot rails are laid at a temperature near the freezing point a space of at least one-fourth of an inch should be allowed, and half as much with a fifteen foot rail. At eighty degrees, or fifty degrees below the highest temperature, only one-eighth of an inch is required. When the highest temperature prevails, the rails should be laid so that their ends touch each other. The matter has undergone a long series of experiments at the hands of steam railway engineers, the experiments ranging through various forms of chairs, bridges, fish plates and angle bars, with a tendency favorable to the latter, because they afford additional strength as compared with most other devices; and yet, those who have had the longest experience in the service express the belief that it is practically impossible to provide a joint that will not need constant attention. This is a rather discouraging statement for the street railway manager, for the rails of his lines are hid away under the pavement where they are not readily accessible; hence defective joints may be accepted as the "social evil" of the street railway system. By employing a properly designed heavy rail (not less than eighty pounds per yard), joint defects do not develop so readily as with a lighter rail, but even with the heaviest rail they still exist to an extent not generally realized.

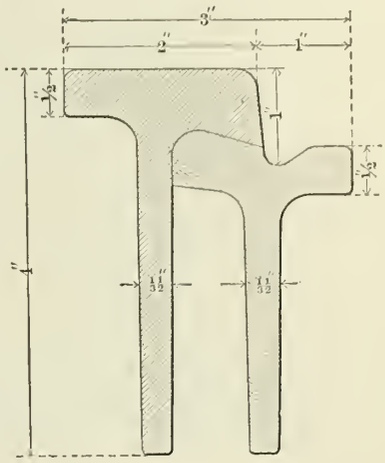


FIG. 27.—DUPLEX RAIL.

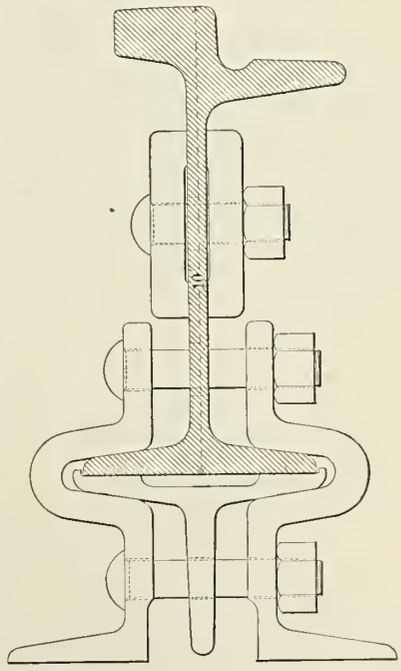


FIG. 29.—PROPOSED HIGH GIRDER RAIL.

The nearest approach to a solution of the problem, which long service has demonstrated, is the employment of slightly curved steel channel bars on both sides of the rail where the ordinary types of girder or T rails are employed (Figs. 25 and 34). The curve in the channel bar allows them to spring slightly when the bolts are tightened

up, causing the plate to wedge in tightly between the head and base of the rail, while at the same time it acts as a nutlock which prevents them from working loose.

In order to secure good results with such connections, it is necessary that the rail be so rolled that ample space under the head and tram and on the base be provided on which the bars may rest, and so drilled as to allow for expansion and contraction. Heavy lock nuts or grip bolts must also be provided, and the nut should have an enlarged chamber on the inside to protect some of the unused threads of the bolt, so that when it becomes necessary to tighten up the bolts new and clean threads may be brought into service (Fig. 35). Opinions differ as to the proper length of channel best for this purpose. As the ends of the rails go up as well as down, there would seem to be nothing gained by the employment of an extra long bar, and the ordinary length of twenty-eight or thirty inches, with four or six bolts, will doubtless give as good results as the thirty-four or thirty-six inch bar. When the nut is being set up, the bolt should be continually struck with a heavy hammer, and just before the paving blocks are put in place the wrench should be applied and every bolt set up as closely as possible. Almost any type of joint will stand for a time, perhaps a year, without attention, but after a certain period the parts will become worn from constant chafing due to changes in temperature, when they will require readjustment; and that type which requires the least attention is, obviously, the most desirable, without reference to the first cost. The repair of joints usually necessitates the removal of a portion of the adjacent paving, and, if this is of asphalt or of stone sets grouted with cement or mastic, the difficulty and expense of removing them is quite considerable. In this case it will be found economical to provide at each joint cast iron boxes with a removable lid through which access may be had to bolts, so that they may be tightened up at frequent intervals without disturbing the pavement (Figs. 36 and 37). In case a joint tie settles, the boxes are of no advantage as it will have to be tamped up, and this will necessitate the removal of the pavement, but for taking the "stitch in time," which is highly important in track maintenance, the boxes are very convenient.

It may be stated as a rule that low joints should never

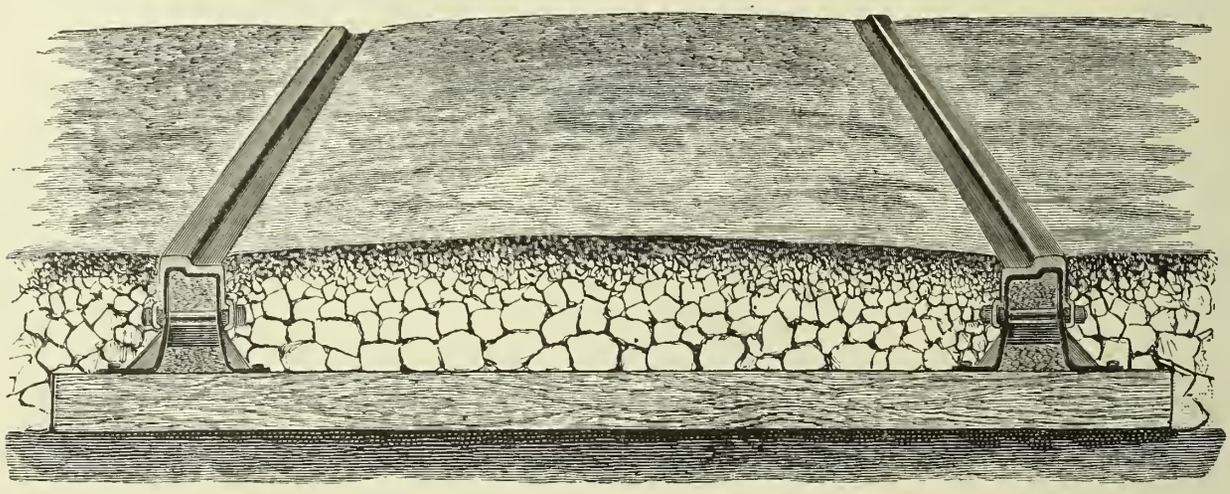


FIG. 30.—BOX GIRDER RAIL IN MACADAM PAVEMENT.

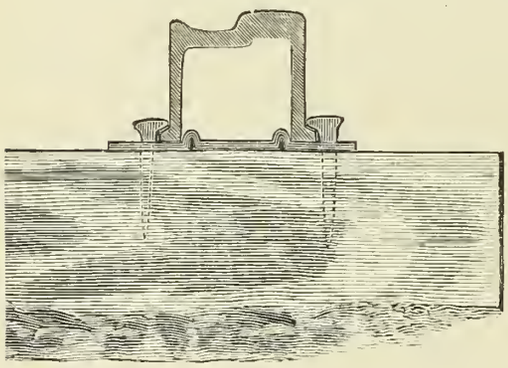


FIG. 31.—BOX GIRDER RAIL SPIKED TO TIE.

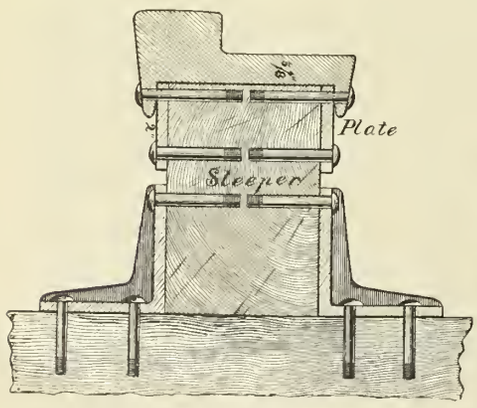


FIG. 33.—TRAM RAIL WITH DEPENDENT FLANGE SUPPORTED ON REINFORCED SLEEPERS.

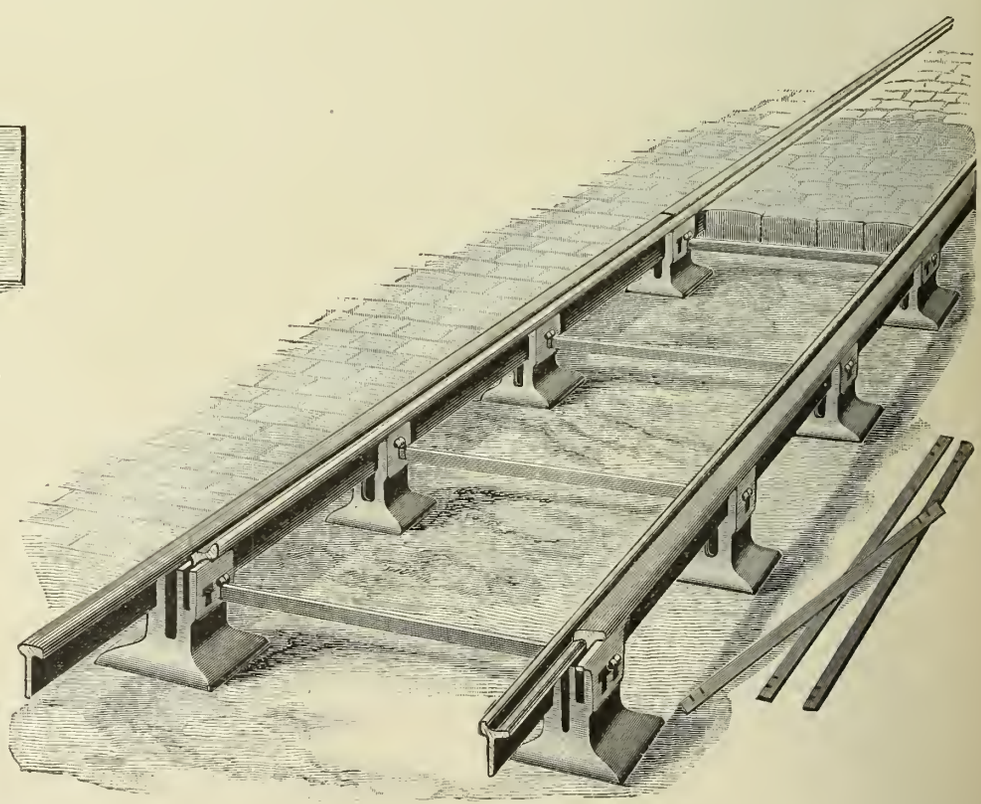


FIG. 32.—DUPLEX CONSTRUCTION.

be allowed with mechanical traction, for in addition to the damage inflicted upon the rolling stock as before noted, if the rail becomes arched vertically from depression at the ends it will be difficult to ever again maintain it in a level position after the joints are raised, owing to the constant effort of the metal to assume the arched form, resulting in the loosening of the connections under the middle of the rail.

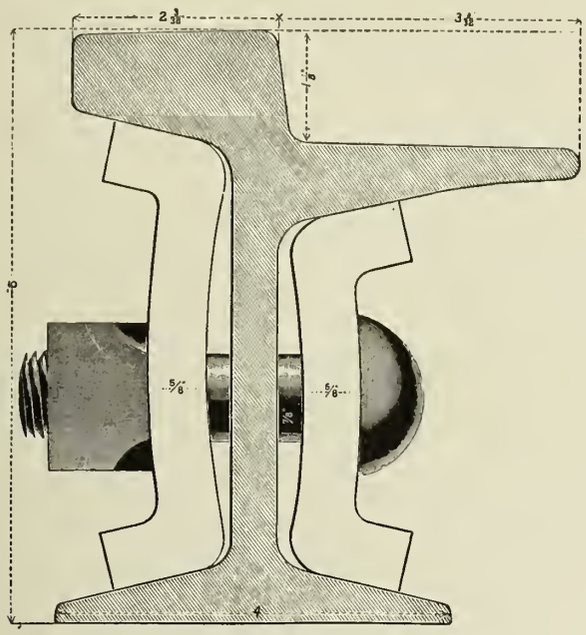


Fig. 34.—Channel Bar Connection.

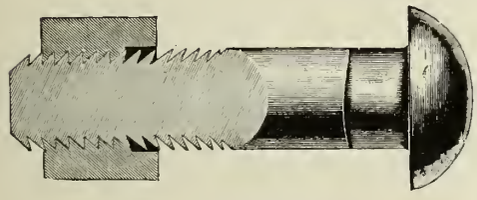


Fig. 35.—Grip Bolt.

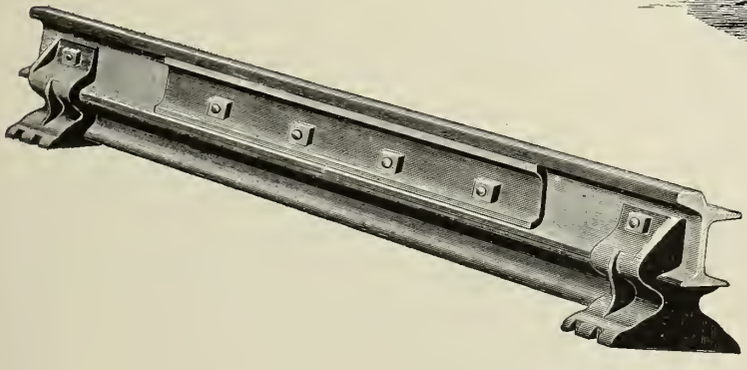


Fig. 39.—Samson Joint.

posite each other; neither is it a good plan to break joints with the middle of the rail; but where joints are broken about one-third the length of the rail, good results usually follow.

Besides the channel bar joint illustrated above, there are devices in the market which combine the splice bar and bridge principles, some of which have given excellent service. Among these are the standard or girder joint illustrated in (Fig. 38). This consists of two side clamps of rolled steel, each a girder of great strength, and supporting a Tee bar on which the ends of the rails are seated and the whole clamped by nutlocked bolts above and below. The Tee bar or bridge may be extended so that its ends reach to the adjacent ties upon which it is supported by small two-bolt clamps, making what is termed a three-tie joint which is apparently stronger than the solid rail.

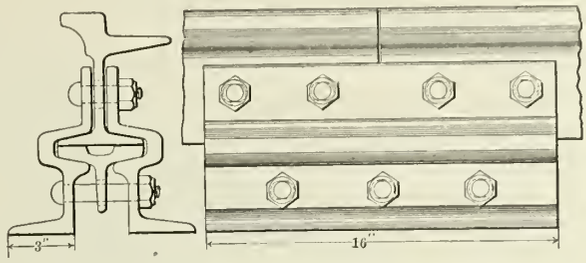


Fig. 38.—Standard Girder Joint for High Rail.

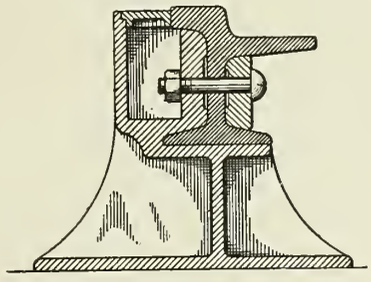


Fig. 37.—Combined Joint Box and Chair.

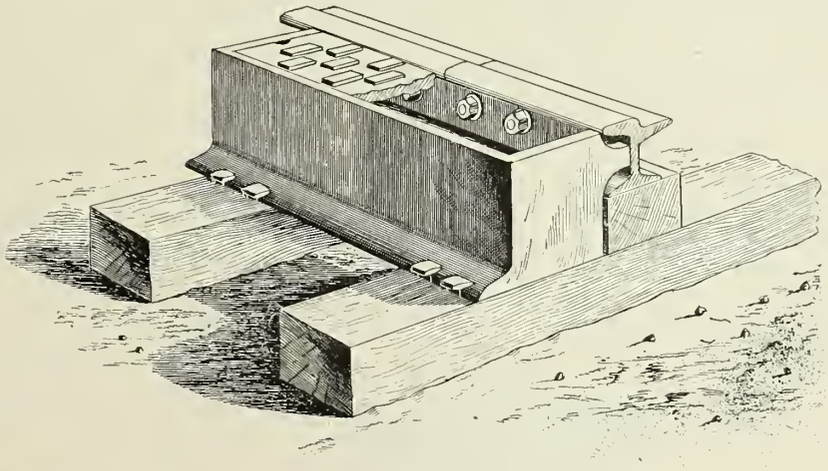


Fig. 36.—Joint Box.

A second joint, which has been designed for the same purpose and known as the Samson bridge joint chair, is illustrated in Fig. 39. It is made by casting steel chairs upon the ends of a three foot section of inverted Tee rail. In cooling, the metal shrinks upon the end of the rail,

The relative advantage of supported or suspended joints where wooden ties are employed need not be discussed. In treating on track construction for cable lines in the second chapter, we recommended supported joints, as the yokes are usually spaced quite a distance apart, but with ties laid closely, as shown in Figs. 13 and 14, no one can tell which is best. With the adjacent ties so placed that they come entirely under the ends of the channel bars, as shown in the last figure, the joints may be suspended, otherwise a tie should be placed immediately under the joint, except when some form of bridge joint is employed.

The position of joints with respect to each other is an important consideration. They should never be laid op-

forming a bridge chair in one piece so that nothing can work loose. The chairs are provided with brace portions having holes which provide for securing them firmly to the rail by means of bolts, which resist any tendency of the rail to cant over. Between the chairs the splice bars are adjusted to the rail in the ordinary manner.

A similar bridge joint is shown in Fig. 40, which consists of an inverted T rail, to the ends of which chairs are secured by means of clips. This arrangement also allows of the use of channel bars, the girder being entirely supplementary thereto.

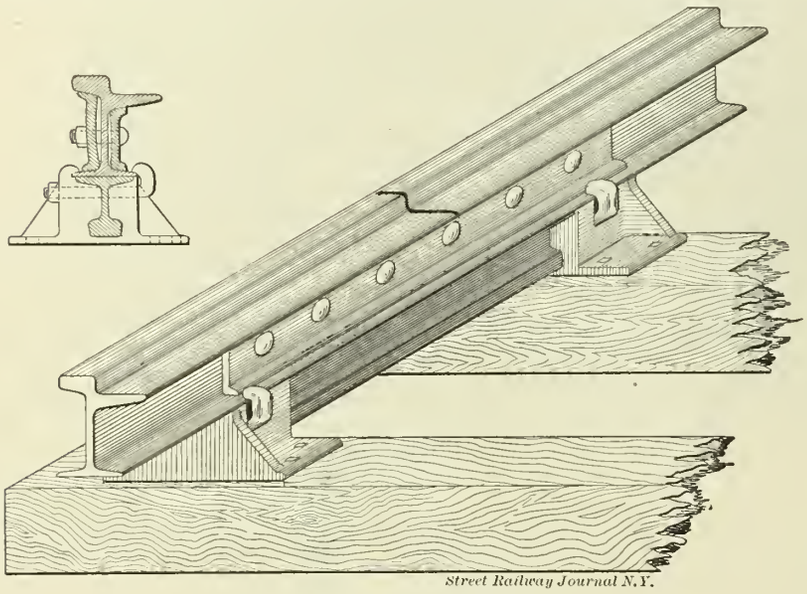


FIG. 40.—CLIP BRIDGE JOINT.

A long joint chair (Fig. 41) has also been designed for use with the box girder rail. This may be extended to cover two or more ties as desired. Its construction is clearly indicated in the engraving.— *To be Continued.*

New Elevated Road for Chicago.

The most promising plan ever formed for providing rapid transit for the residents of the West Side, Chicago, is that proposed by the Metropolitan West Side Elevated Railroad Co. The incorporation was mentioned in the last number of the STREET RAILWAY JOURNAL. The company are thoroughly sound financially, and those interested are substantially the same as the capitalists who have invested in the South Side L road. The company mean business, and while their plans have been before the public but a short time they have made very decided progress.

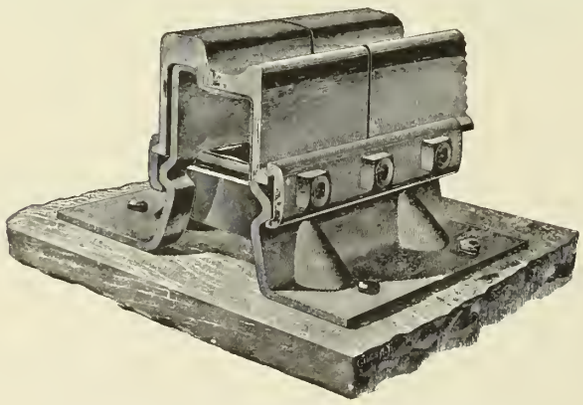


FIG. 41.—JOINT CHAIR FOR BOX GIRDER.

At the meeting of the City Council, April 7, a franchise to construct the road between Van Buren and Harrison Streets, with branches running Southwestward and Northwestward west of Ashland, was granted. The ordinance requires that eight miles of road be constructed within two years with double tracks, and the company are required to pay an annual license fee of $50 per car.

The Proposed Paris Underground Railway.

The underground railway projected by Mr. J. B. Berlier for the city of Paris has been several times referred to in this journal, and we present in the following article a summary of the latest report on the subject, prepared by Mr. P. Chevillard and published in the *Revue Industrielle*, from which the accompanying plans are taken. The road starts from the Porte de Vincennes, and passes through the Cours de Vincennes, Place de la Nation, Boulevard Diderot and Rue de Lyon to the Place de la Bastille, where it enters an open cutting as far as the Rue St. Antoine. There it again enters a tunnel which continues through the Rue de Rivoli, Place de la Concorde, Les Champs Elysées, Place de l'Etoile, Avenue Victor Hugo, Place Victor Hugo and Avenue Bugeaud to the Bois de Boulogne. As will be noted, this route passes through the most important sections of Paris in an easterly and westerly direction along the north bank of the river Seine.

The total length of the line is 36,852 ft., of which 31,844 ft. are tangents and the remainder curves of from 164 to 820 ft. radius. Of this length 6,604 ft. are level. The rails, weighing 40.3 lbs., are laid on wooden ties at a three foot gauge.

Two sections have been adopted for this railway. The first is a metal tunnel nineteen feet in exterior and 18.21 ft. in interior diameter provided with two tracks. The tunnel consists of cast iron rings formed of a series of segments bolted together in the same manner as on the now well known City & South London Electric Railway. The minimum radius where this section is employed is 328 ft., which will give a proper clearance between the cars and the side of the tunnel. A cross section of the tunnel showing method of ventilation is shown in Fig. 1.

When a greater radius is necessary, or where the grade approaches the level of the ground, a rectangular section has been adopted, consisting of two masonry walls and an iron or steel roof, the clear width being 2,297 ft. Of the whole line 30,935 ft. are to be circular in section, 1,287 ft. will be rectangular, and the remaining 4,630 ft. will be taken up by stations and sidings.

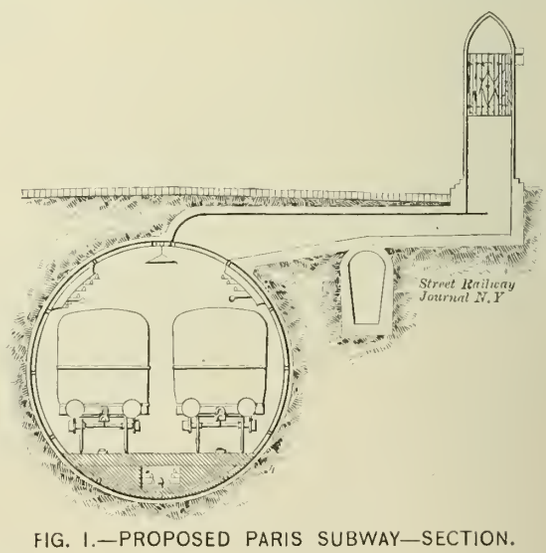


FIG. 1.—PROPOSED PARIS SUBWAY—SECTION.

The sewerage system of Paris naturally causes some inconvenience at places. Where the main Sebastopol sewer, or collector, is crossed, a bridge is thrown across the sewer at a sufficient height (5.9 ft.) to allow the workmen to pass along the banquettes on each side of the central drain, while the two water mains (3 ft. 7 ins. and 2 ft. 8 ins. in diameter) carried in the upper part of the sewer, are to be carried under the track by means of inverted syphons. See Fig. 2.

For operating purposes, the line will be divided into two sections, one about 1.86 miles and the other about

4.97 miles long. The current will be supplied at 450 volts by means of a central rail laid between the two rails of each track and carefully insulated, metallic brushes being used to take the current from this rail. The return current will pass through the ordinary rails and the metallic part of the tunnel. A central drain will collect whatever water may accumulate along the line and conduct it to the low points, where it will be removed by electric pumps.

The trains will be made up of four cars each, two provided with motors and two without. The cars will be

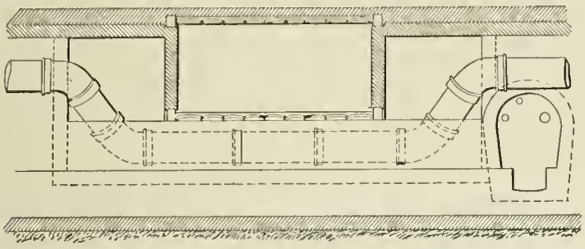


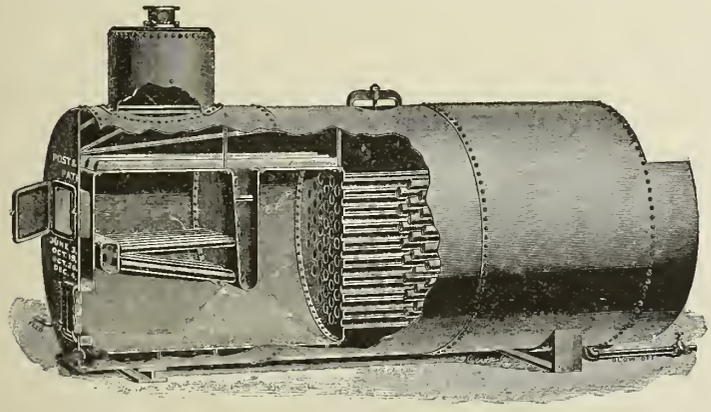
FIG. 2.—ARRANGEMENT OF SUBWAY AT SEBASTOPOL SEWER.

mounted on bogie trucks for greater ease in moving around the curves. The motor cars carry two motors of twenty-five H. P each, connected directly to the wheels and controlled by a rheostat, the change in direction being effected by a special commutator. The electric connections will be so planned that the motorman on the front platform of the train, controls all the electric apparatus, including that for locking the doors of the cars while they are in motion. The speed of the trains has been set at twelve and a half miles, rising to fifteen and half miles when necessary to make up time or for other reasons. The total cost of construction of the line is estimated at 41,000,000 francs or $8,200,000.

The Complete Combustion Boiler.

The problem how to best utilize the heat given off by coal in combustion for the generation of steam has taxed the ability of engineers ever since the invention of methods of utilizing steam for power purposes. The number of boilers which we have illustrated and described in these pages has been large, and below will be found a type of boiler which possesses a number of novel features.

As will be seen, the boiler is of the horizontal cylinder, multitubular type, and does not differ materially in design from the ordinary form of tubular boiler except in the furnace. At the back of the grate a hanging water leg of steel plates, riveted to the crown sheet of the furnace,



THE COMPLETE COMBUSTION BOILER.

extends downwards towards the ash pit. The grate is formed of water tubes entering the front side of this water leg at a moderate inclination from the horizontal and at the front of the furnace entering a gun metal box just below the furnace doors. Return tubes, also inclined, extend from this box back to the water leg and insure circulation of water through the shell and water leg through the grate tubes. Boilers with this type of grate have been in use for more than five years without requiring the outlay of one dollar for repairs.

The space below the grate, ordinarily the ash pit, is the combustion chamber, the air for combustion being admitted through the fire box above the grate and drawn down through the grate bars by the chimney draft, where it becomes highly heated during its combination with the hot gases of the coal. As the combustion chamber is completely surrounded by the water heating surfaces of the boiler, and as the heat after leaving the combustion chamber passes through the tubes which form a large absorbing area directly to the uptake chimney, it will be seen that the boiler will have a high efficiency.

Another valuable feature of the boiler is its strength and durability, since, having a tube let in its centre, stayed and strengthened by an adjacent water leg, both riveted to the fire box and the whole securely bolted to the outer shell, the boiler is especially strong.

So long as water in the boiler is kept above the upper ends of the grate bars it is impossible for them to burn off, and no necessity for renewal of grate during the life of the boiler is probable. If, however, through negligence or failure of pump or injector, the water should fall below the grate bars, the latter would soon burn off and the steam would quickly extinguish the fire, making the boiler automatically and perfectly safe. It has been practically demonstrated by complete combustion boilers that the passage of the gaseous elements of fuel down through a very hot fire solves the problem of burning smoke, or, in other words, prevents the formation of smoke. This not only is an economical feature of using all the fuel but prevents the formation of any soot in the tubes, a point whose advantages will be readily recognized. The circulation of water and steam in every direction is unimpeded and perfect and the steam obtained is very dry. The boiler can burn either hard or soft coal, wood, dry tan, shavings or any other kind of fuel which may be burned in any steam boiler.

No brick walls being required in the setting of the boiler, it is easy to install, and as no cold air is admitted in the interior of the boiler below and beyond the firebox, the chief cause of leakage in the tubes, extremes of expansion and contraction, are wholly avoided. It might also be added that as the heat generated in this boiler is drawn away from the fuel doors, the boiler is an easy one to fire, and the temperature of the boiler house is kept low. The latest designed boiler differs somewhat from that described and illustrated above. The water space about the firebox is of uniform space, three inches, and provision is made for steam by means of a large drum on the top of the boiler, with openings to admit free circulation of steam.

The following figures of some results of tests will illustrate a number of the points already referred to. At a test of a twenty-five H. P. boiler at Bishop Bros., East Somerville, Mass., by Francis A. Galloupe, the evaporation from and at 212 degs. was found to be equivalent to 11.53 lbs. of water for one pound of combustible. Another test of a seventy-five H. P. boiler made at Smith & Carleton's iron works, South Boston, by Geo. H. Reynolds, showed equivalent evaporation of 12.21 lbs. to one pound of combustible, the water evaporated from and at 212 degs. per square foot of heating surface per hour 2.85 lbs. Tests of three 100 H. P. boilers at the Chicago City Electric Light Plant, made by J. M. Stroder, gave equivalent evaporation per pound combustible from and at 212 degs. 11.75 lbs., and combustible consumed per H. P. 2.924 lbs. In all of these tests the horse power developed was considerably in excess of the rated horse power, and the temperature of the boiler room was remarkably low. We were present last month at a test made of this boiler, under ordinary working conditions, at the factory of McGuire & Clark, at 68 Madison Street, New York. The measurements were made by Peter Backus & Son, engineers of New York, and the results obtained by them were even better than those mentioned above.

The manufacture and sale of this boiler are controlled by the Central Complete Combustion Co., of 13 Park Row, New York.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
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The Plans for Electric Equipment in Brooklyn are so extensive and are being pushed forward so vigorously by the energetic men in charge of the different railway companies that in a short time Brooklyn will be hardly recognizable with its new equipment. It is owing to the fact that these improvements will soon be made that the article in another column on "Street Railways in Brooklyn" will have a special interest. It at once records the condition of the Brooklyn street railways in the spring of 1892, and outlines the way in which they will be equipped with electric power.

Attention is Called to the correspondence in this and the two numbers preceding relating to the taxing of street railway corporations by state and city authorities. The interest now awakened in the matter suggests a review of the papers entitled "Public and State Treatment of Corporations," which were presented at the last three meetings of the American Street Railway Association, by G. Hilton Scribner. If the statement, of our correspondent, J. B., prove correct, then the street railway companies of New York should unite and institute proceedings to recover the excess of taxes already paid, and prevent the assessment of too high a rate in the future.

The Municipal Management of Street Railways is frequently urged by writers of a socialistic turn of mind. We do not believe that any city ever cited as an example can run street cars as well as a private corporation. The socialists of Chicago recently demanded, in a set of resolutions, that the city solve the transportation problem by going into the street railway business. It is not necessary yet to argue the matter from the point of view of the political economist. As long as municipal authorities are wholly unable to grapple with so simple and easy a task as street cleaning, they can scarcely be trusted safely with the business of intramural transportation which requires for its satisfactory conduct talent of no mean order.

The State Department has performed a meritorious service in the collection of statistics upon foreign transit facilities, and an abstract of the principal points in a report recently published by this department upon this subject is given upon another page. We think that every one of our American readers will be satisfied after reading this report that the American system is the only one for our conditions, and if he has been abroad he will be more than ever of the opinion that the zone or graduated fare system, the plan limiting the number of passengers per car and other devices of our European cousins to nominally aid the general public, are in reality burdens on both the public and railway company, and cannot but result in a contraction of transit facilities.

The Street Railway Situation in Chicago is far more satisfactory to the residents of that city than it was a few months ago. The operating companies are increasing their mileage, and their extensions this year will probably aggregate over sixty miles. Several companies, recently granted franchises, promise to have cars in operation before snow flies again. There is a probability that the South Side elevated road will be carrying passengers within a few weeks at the outside. With such an increase in intramural transportation facilities, and with such an evident desire on the part of the companies to meet the demands made upon them, the problem which has seemed so serious to Chicagoans within the past few months should be very satisfactorily solved.

Of the Many Absurd Methods devised for taxing street railway companies, the most unreasonable and illogical is that of demanding a special tax or license fee for every car owned or operated by the railway company. Strangely enough this seems to be one of the most common methods adopted by city governments to raise money from street railway companies. But if we look at the result, we will see the absurdity of a law of this kind. It immediately puts a premium upon the running of a small number of cars by the railway company. If no such law exists, it often pays a street railway company to have a large number of reserve cars, which need only be run during the few morning and evening hours of greatest traffic. Impose a tax, however, on each of these extra cars, equal in amount to that paid by the all day cars, as is usually done, and the license fee paid to the city for the cars will more than counterbalance their slight additional earning capacity. The company will therefore prefer to add no more cars at these hours or during the day than is absolutely necessary, and will run with crowded cars. If a great deal of the energy expended in aldermanic and other circles over the advocacy of "no seat, no fare," and similar bills, intended to give every passenger a seat were devoted to lightening the burdens already carried by street railway companies, and the repeal of laws similar to the one mentioned here, we think that the consummation devoutly wished for would be sooner attained.

The High Rank which the street railway business of this country is taking in comparison with other pursuits is gratifying to all who are interested (and who is there that is not?) in the growth of this comparatively young industry. That it is becoming an exceptionally profitable and popular business is evidenced by the class of men who are now controlling large interests of this

kind in New York and other large cities. Among these are the names of persons who now hold, or until recently held, positions in the highest council of the nation. Their names are familiar to all and need not be mentioned in this connection, but the fact confirms one prediction repeatedly made during the last three years, that this business was likely to develop in the near future to proportions far beyond all preconceived notions regarding it, and that its *personnel* would improve accordingly. The prejudice is being overcome that formerly existed against the business, because of the peculiar manipulation of stocks that was practiced in some localities in the early history of the industry. There is no place for trickery in the street railway field and, fortunately, the number is growing less and less, and no one is more rejoiced at the fact than the veterans in the business. No one from the inside can survey the field without feeling an impulse of exultation, while at the same time he resolves to place his individual share of the business on a still higher plane towards perfection. We are proud to claim relationship to an industry that is vital to the well being of so great a mass of people and propose to do all that is in our power to assist in its further growth.

The Negotiable Value of a street railway franchise depends not only upon the earning capacity of the lines which are operating under it,but also upon its permanency. This fact is strikingly illustrated in the experience of the Union Railway Co. of Providence, R. I., in attempting to float its bonds in the leading money markets, and fully set forth in another column. Although the company has great financial strength, having done a profitable business for many years with its present appliances, yet its proposed bonds are unsalable because the franchise, which constitutes the essential element of security, is not perpetual, nor has it any fixed life, but it is dependent upon the pleasure of the City Council, upon a notice of ninety days. The company is justified, we think, in its action to secure from the legislature a modification of the objectionable features in its charter, and common justice demands that the measures receive favorable consideration. The history of the case will serve as a caution to new companies seeking franchises ; for while they may be willing to concede to the city authorities the right to order the rails out of the street whenever the service is unsatisfactory to the citizens or a majority of the City Government, and while the exercise of such right will be most improbable, yet the practical effect will be to deprive the company of any vested rights in the streets whatever. The lenders of large amounts of money require absolute security, and while it is not supposable that a city with society as it is now constituted, would take advantage of a railroad company and on short notice order them out of the streets, it is well known that there is a growing class in every community that would not hesitate, should it ever come into power, to cripple a company, or even to confiscate its plant ; hence the wise caution on the part of the moneyed investors, and the necessity of securing permanent and liberal concessions from city authorities.

Sharp Practice is Readily Detected by street railway companies, and those who resort to it are almost invariably the losers. This somewhat trite statement is suggested by the complaints of several operating companies who have recently been making heavy purchases for extensions of their systems. An officer of one of them relates that he ordered a number of armatures for his generators of a company who instead of supplying the materials honestly sent him armatures that had been condemned as unfit for use. The latter company subsequently had to redeem all the parts, pay the incidental expenses, and excuse themselves by a variety of elaborately prepared apologies. In another instance a lot of worthless poles were sent to a company who, of course, promptly rejected them and squarely refused to transact farther business with the dealer. Still another illustration was recently called to our attention when a manufacturer tried to palm off a lot of cheap car fixtures instead of those called for by specifications. But why enumerate instances? They are coming to light too often in these days of active demand in the street railway field. It would be interesting, however, to ascertain the motives which actuate those who endeavor to secure in this way a dishonest advantage of a railway company. It is certainly our opinion, based on rather extended observation, that street railway men are not less shrewd and wide awake than the smartest men in the community, and those who seek to take them in by such silly confidence games as substituting worthless for good material are bound to suffer in the transaction. The old saw about honesty is as fully in force to-day as ever. It would be manifestly unfair, however, to cite these instances of sharp practice without expressing at the same time our confident belief in the honesty and integrity of the vast majority of those engaged in selling supplies to railways. Facts are coming to light repeatedly to show that blunt honesty and fair dealing characterize all their dealings. Honesty has paid, and it retains for them their customers. The only curious fact is that some few seem to think they can outwit their customers and that they suffer no loss when detected in their game of misrepresentation.

The Cost of Operating Street Railways is not as easily ascertained as it should be. Figures are obtainable, to be sure, which purport to settle the question definitively ; but, unfortunately, they prove upon examination to be unsatisfactory ; in fact, statistics coming from different sources are comparatively so few and so conflicting, that after considering them one is utterly unable to form any sort of a consistent opinion. Those engaged in introducing the several systems of street car propulsion are certainly generous in the matter of data ; but from the very nature of the case their statements do not always inspire confidence. Every prospective purchaser discounts their statements, and in many instances figures are prepared with the knowledge that a margin must be allowed for the discount. It will always be true, however that any prediction, no matter how confident, regarding the operation of a certain machine will never be considered so reliable as the impartial statement of the man who carefully watches its daily performance. Tabulated statements of this kind are urgently needed in the street railway field at the present day. As many companies are contemplating extensive improvements and changes of motive power, the statistics are of peculiar value just now. Where shall we look for them? Here and there a street railway manager may be found willing to give us figures showing the cost of operation with his particular plant, but the great majority of those competent to furnish data guard them very jealously. The reasons that influence them in withholding the data are well known, but we believe that in almost every case the policy is a mistaken

one, and we incline very strongly to the belief that they should be less chary in furnishing the results of their experience, costly though it may have been. When data of the kind referred to are generally available it will be possible to dispose of questions which at the present time we cannot settle for the simple reason that facts are not forthcoming in a sufficient number of instances to warrant a general conclusion. Should the policy of withholding statistics be abandoned, companies generally would be the gainers, in our opinion, as in that event each one would be afforded the means of ascertaining by comparison whether they were securing proper returns for their expenditures.

The Report of the Boston Rapid Transit Commission, of which we publish an abstract in this issue, contains matter which will be read carefully by all interested in the rapid transit problem as it is presented in Boston. The system proposed by the Commission, instead of being designed to act as an auxiliary to the present transportation system, as was expected by some, is intended to take passengers directly from the main points of departure in the principal suburbs which are accessible to the system and to land them within a short distance of their destination in the business district, making the surface lines act as feeders to the transit system and largely reducing the surface tracks in the centre of the city. It was even proposed to recommend the entire discontinuance of surface cars in the district included within the proposed central circuit, but this was considered by the commissioners too radical to be incorporated in the final report, though recommended by the engineers. The disposal made of the steam railroad terminals in the city was no less summary, involving, as it does, the transfer of valuable properties from one company to another for the intended benefit of the general public. But it is a question whether the vested interests in both the steam and street railway directions can be arranged and satisfactory terms can be agreed upon for carrying out such important changes to say nothing of the question as to whether capitalists can be found who will carry out the extensive projects of the Commission, for it is very sensibly decided that such a scheme if carried out should at least be under the management of, if not built by the capital of private individuals. For this reason we think that many months will elapse before the plans proposed are consummated. Turning now to the engineering features of the proposed system, it is interesting to note that, contrary to the example of the corresponding body in New York, an elevated has been chosen in preference to an underground road. To be sure, a short section of the proposed Boston system is below the surface of the earth, but this, under the conditions, was unavoidable, and it is only a short link in an otherwise complete elevated system. The deep subway, such as in use in the City & South London railway, was rejected although it afforded the only method of reaching the extensive suburbs of East Boston and Chelsea, which are necessarily left without direct communication with the system selected. If both this and the New York system, as outlined in the reports of their Rapid Transit Commissions, be constructed there will be an opportunity for an interesting comparison between these different methods of urban railway construction. But neither, we think, will permanently reduce, still less eliminate, the demand for the present surface transit facilities, even on the routes covered by the more rapid transit systems.

The Magnitude of the Task that confronts the executive officers of a large street railway company when a change in motive power is contemplated is seldom fully realized at first by the parties interested, and *never* appreciated by the public. Only those who have grappled with the problem and have gone through to the finish, or are at present engaged in the work have any proper concept of the difficulties, the myriad of details and the petty annoyances which are inseparable from the undertaking. As no one is fit to be an officer in war who has not heroic blood in his veins, so no one should undertake to manage the business of installing a cable or electric plant, who has not a heart full of love for his profession combined with sufficient energy and enthusiasm to make him willing to confront all its responsibilities. It requires great courage, skill, patience, untiring industry and a fidelity to duty seldom called for in other lines of business. That these qualities are possessed to a large degree by the street railway fraternity in general is evidenced by the fact that very few, if any, have shrunk from the task when it was presented, and that success has generally crowned their efforts. The business at large appears to be in the hands of a class of valiant men who seem to have been raised up to steer the bark of mechanical progress, as are statesmen and skilled generals when the safety of the state is imperilled. In order to aid the public to appreciate somewhat the responsibilities that must be met by the few individuals that control the affairs of a street railway corporation we give in order the leading details. First, there is the work of renewing the franchise and securing from the local authorities and property owners the necessary permits. This settled, the securing of the necessary capital is a no less important question. A competent engineer must now be selected, and a choice of systems decided upon. The source of power and the relative merits of different types of engines, and other station equipment; the awarding of contracts; the design of cars and the placing of their construction in the hands of competent builders; the type of rail and character of the street construction; the selection of competent men to superintend the details; the disposition of old material and the training of employes so that they shall handle the new appliances skillfully. All this is to be done by the manager, and at the same time he must study the interests (often conflicting) of the moneyed investor and those of the public whom he is supposed to serve, while he listens to all the mean and buzzing grievances of offended patrons, and not infrequently bears the sneers and unrecognizing look of friends who fancy he is engaged in a scheme that will imperil the lives of themselves and families or affect unfavorably the value of their property. Others are so bound to custom that they oppose all progress, invoke the law and even attempt to make the truth lie for them. It will thus be seen that the position of executive officers at the head of a company engaged in making improvements of this kind is not an enviable one, and we cannot better express our admiration of their courage than by quoting the words of Hampden in his colloquy with Cromwell:

> "When I read o'er the bitter lives
> Of men whose eager hearts were quite too great
> To beat beneath the cramped mode of the day,
> And see them mocked at by the world they love,

Haggling with prejudice for pennyworths
Of that reform which their hard toil will make
The common birthright of the age to come,—
When I see this, spite of my faith in God,
I marvel how their hearts bear up so long."

An Extension of Time for one year has been granted to the Metropolitan Railroad Co. of Washington, D. C., by Congress, in which to complete the equipment of its lines for mechanical (storage battery) traction. The passage of this bill furnished an occasion for the enactment of two other measures; one, as is noted in another column, repeals the act prohibiting the use of overhead wires, and the other requires that the Metropolitan company shall not collect fare from passengers not provided with seats. The first is a wise measure, but the other is more unwise than the old law which the first repealed. The new law has not even the redeeming feature that is a part of the same practice on foreign lines which this law is supposed to copy, for on lines abroad where the "no seat no fare" practice is in vogue, the companies are prohibited from receiving more passengers than can be provided with seats. But under the Washington provision the company must receive all who come, while they are restrained from collecting fare from those standing. This requirement furnishes a good opportunity for unscrupulous persons to beat their way with the company, for they have only to wait at proper localities till a loaded car approaches, when they will board it and avoid the payment of fare. The repeal of the law relating to overhead wires confirms what we said at the time the measure was before Congress, that "when law making bodies assume to enact laws that are not called for by public demands or needs they are likely to be absurd and contradictory," and we think it is only a question of time when the measure relating to fare will be repealed. We are charitable enough to allow that it is because of ignorance regarding the situation that restrictions of the above nature are constantly being placed upon the street railways operating in the District of Columbia, and not until there is more enlightenment along these lines can anything better be expected. It is clearly the duty of street railways in all parts of the country to undertake to inform their local representatives regarding the fundamental principles of the street railway business, or to agree to look to it when nominations are being made that only men who have some practical knowledge of this business be put forward for the important position of a representative to Congress. In other words, use their political influence, which is not small when properly organized; for it is only a question of time when city authorities will be aping the action of the more prominent body and seek to introduce like measures in local requirements. If the individual congressman and the *personnel* of municipal authorities everywhere would learn something of the practical operation of street car lines, they would discover the many difficulties in the way and be more reasonable in their requirements. In connection with the above enactments we expected to see the few practical street railway men in the present Congress come to the defence of these interests in Washington, but so far as we are informed none of them raised their voices in debate either in favor of the one or in opposition to the other measure. It would seem that the enactment and subsequent repeal of such measures as that relating to the use of overhead wires would tend to teach the average legislator that he is not so much wiser than other people, and he would feel somewhat humiliated when the absurdity of such measures was fully demonstrated. Not so, however; they all seem to remain in the unintelligible state so peculiar to the average politician, which Lowell humorously portrayed in one of the Biglow Papers:

"Wal, sposin' we hed to gulp down our perfessions,
We were ready to come out next mornin' with fresh ones;
Besides, ef we did, 'twas our business alone,
Fer couldn't we du wut we would with our own?
An' ef a man can, wen provisions hev riz so,
Eat up his own words, it's a marcy it is so."

In this connection we take occasion to express our sympathy for the Washington companies that they are required to do business under the severe restrictions imposed upon them, while the burdens of the situation are aggravated by the constant fear of new and still more hostile regulations.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Car Builder vs. Car Buyer: What is the Proper Relation Between Them?

St. Louis, April 22, 1892.

Editors Street Railway Journal:—

The above question was suggested by the following quotation from a letter written by the general manager of a railroad company to a car builder, who had made a proposition to him for cars: "I am sorry to say that I cannot trade with you on the street cars, as your price is so much above others that I have received. I would not feel justifiable in giving you the order at the difference in figures."

As the majority of street railroads are controlled by men thoroughly conversant with the purchase of stocks and bonds of various kinds and the ways of Wall Street, perhaps it would be suggestive if they would in their imagination substitute bonds for cars, and so send out a proposition like this:

SPECIFICATIONS.

Office.

Messrs. .....

Bankers & Brokers.

We wish to purchase $500,000 in bonds of a street railroad. Bonds to be each for $1,000, payable in 20 years.

Interest 6 per cent., payable semi-annually. To be printed on finest paper and executed in highest style of the engraver's art.

We have no further specifications, but party offering bonds at lowest prices and on best terms will have preference.

You are respectfully requested to make a proposition.

Yours respectfully,

..... Bankers.

If, in reply to such request, they were offered $1,000 bonds ranging in price from $500 each, bearing 7 per cent. interest, principal and interest payable in gold, up to $1,200 each, bearing 5 per cent. interest, the probabilities are they would be able to discriminate to within one-tenth of one per cent. of the exact value of each respective offer, and get full value of their money in any case, *because they would know what they were buying*. On the other hand, it would be a dangerous thing for a novice to undertake to buy bonds under such specifications and be governed entirely by price. Such a proposition would strike the average banker or broker as being too silly and ridiculous to deserve serious comment, but is it, after all, more so than the every day efforts of some men to buy cars? For certain buyers look over the different offers, and having ascertained which is the lowest, give the order accordingly.

This being a common method of procedure, what is the result? Certain car builders reduce the price next

time, so as to be the lowest bidder, and in order to save themselves, make their cars to suit their price.

In the opinion of the writer, it is unfortunate for that car builder who has had the experience of many years, and who in that time has tried conscientiously to treat his customers fairly and to improve the quality of his work, that so many of his prospective patrons are so poorly posted about cars. It being conceded that some purchasers of cars are ignorant as to materials and those other details that are requisite to make a good car, the question naturally arises, Is there any way by which they can make an intelligent discrimination between different builders? I would say YES. By applying the same rules they would use in buying and selling bonds.

First.—What is the general reputation of the car builder? Is he a straightforward, upright man, or is he known to be shrewd, keen and given to sharp tricks in securing orders?

Second.—Has he had experience in the business? If so, how much?

Third—Is the concern owned and managed by men who are mechanics, and who have had long training in their business, is it a combination of capitalists (who are always the managers, and who can see only the money in the job)?

Having carefully investigated the character and reputation of the car builders it is proposed to buy from, the next step would be to select one or two good mechanics who have been employed by the railroad company long enough to know what is required for best service. Take them on a tour of the shops of the different bidders, care being taken not to express any preference, otherwise the mechanics will be prejudiced in their judgment in order to meet what they fancy to be their employer's ideas.

Other important points to be considered are: What are the elements that go to make up the cost of a car? How much for material? How much for labor? How much for profit? What is the difference in bids? Does this result from a difference in the labor or material of different builders? If so, to what extent in each case? Can one manufacturer get the same material for less money than another maker, or can he procure his labor for less? If so, does he get as good, or do you believe all mechanics are good and the work of one no better than that of another, or that it makes no difference whether a mechanic is good or not? Do you want less costly material used or a cheaper class of labor? Do you think it practicable for a manufacturer thoroughly versed in his business and who has an honest pride in his work to make a high class and low class of work with the same mechanics? If any manufacturer agrees to do this, look out for him.

In conclusion, the writer would suggest that the correct relation of car builder to car buyer is the same as that of employe and employer. In other words, you make up your mind to select a certain manufacturer who will engage to look after your interests in the building of your cars, allowing him so much for labor, so much for material, so much for profit for his compensation; then the question would arise, Can this manufacturer be trusted to do as he agrees, or will he at once go to work to see where he can take advantage by using material of an inferior grade, and skimping labor, to the end that his profit may be increased?

It is safe to say that when an order for cars is placed the buyer is at the mercy of the builder. If the former has been wise in the selection of the latter, all may be well; if not, advantage may be taken of ignorance, notwithstanding subsequent efforts to guard against it. B.

Street Railway Taxation.

March 25, 1892.

EDITORS STREET RAILWAY JOURNAL:—

In a careful examination of the three papers by Mr. G. Hilton Scribner, read before the last three meetings of the American Street Railway Association, the conviction is forced upon me that some of our street railways have been paying more taxes to the State of New York than the law calls for, and by inference, as the laws in the particulars to which we refer are somewhat similar in all the states of the Union, the idea is somewhat justified that street railways have been bled by somebody contrary to the spirit of corporation taxation. Mr. Scribner in his second paper said: "Now, one street railroad company owning but $344,000 of personal property all told, paid, besides its real estate tax, $38,000, which is a little more than 11 per cent. in one year upon its entire personal property, not estimated at a low valuation, but computed at cost, without any allowance for wear or depreciation. All other companies are paid at about the same rate without any deduction for indebtedness, bonded or otherwise."

If Mr. Scribner states the truth, and I do not doubt his word, the street railways of this state have largely overpaid their taxes; I say largely, but that word hardly meets the situation; they have overpaid what the laws call for by an excess of nearly 400 per cent. The street railway companies of this state cannot do better than look up this subject and put in a claim for rebates, if they have been paying taxes at the rate of 11 per cent. on the actual valuation of their plants. In truth, this assertion on Mr. Scribner's part, is so extraordinary that when explained to the tax office officials they derided it, saying, it was preposterous. The tax laws of this state, and nearly all other states, tax corporate property only once; and the New York laws put the figures at $16.86 on each $1,000 of the net valuation of the capital stock (less all stock securities on hand representing other corporations, in or out of the state, and less real estate and government bonds), for the municipality and county of New York, which tax is to be added to the state tax, an amount which brings the whole tax up in the neighborhood of $20.00 on the $1,000, for recent years. But that is only one-fifth of the sum which Mr. Scribner mentions as being paid right along by New York's street railways; yet why they pay a five-fold tax, he fails to explain. He accuses the law makers of gross injustice, in requiring street railways to pay such an exorbitant tax, and if his figures are correct, certainly he is justified in charging extortion somewhere.

The suspicion is reasonable that this overtaxation is a part of the method of making up the tax papers in the tax office, rather than any direct intent to overtax street railways. It is a habit of some of the clerks, when they do not know what amount is proper to put in an assessment, to put down almost anything, always putting it high enough, and trust the company taxed to rectify errors. Now, it may be that some of our street railways take the assessment literally just as it reaches them, and pay it without examining the law, or the justice of the assessment applied to their particular case. I have no other explanation of Mr. Scribner's statement, so long as such excessive overcharges have been the rule. If this is the true interpretation of the matter it may be money in the pockets of street railways if they hold a meeting on the subject to compare notes, and to learn exactly how much tax they have overpaid during past years. Besides that they could engage service to examine the tax laws for all concerned, as the laws are nearly the same for all cases, and such searchers could correct each tax assessment, if it contained errors, and see that a proper assessment is made out for each case. There is no double taxation in this state, except as before explained in these columns, in the case of real estate; in that instance real estate is taxed, as well as the mortgages upon it, the excuse being that the assessed valuation is, as a rule, so low that the mortgage only makes up the difference in value. But this excuse is not very good, for the great majority of real estate is mortgaged pretty well up to its auction, if to no other, value. Therefore, some real estate is, under the law, bearing a far heavier burden than street railway corporations, which Mr. Scribner energetically asserts are so outrageously overtaxed.

The real and personal tax laws of the different states are no easy matter to analyze; in the case of this state all personal property is taxable, no matter what its value may be with certain inconsiderable exceptions The assessor, however, exempts all small properties, such as house furniture and small accumulations of anything having a commercial value, but this is wholly voluntary

on his part. The law exempts nothing in the shape of property (less the above exception) and all household effects as well as any other property, are taxable. It is an extraordinary power thus wielded by the assessor, but I do not hear that he abuses it in the case of people in ordinary circumstances.

If street railways receive any tax assessment notices which in amount exceed 2 per cent., for this year, of the net value of their plant and resources, although the tax takes the form of a tax on the capital stock, they can take the assessment to the tax office, if promptly attended to, and have any excess of tax corrected. I do not understand why every street railway does not know this, and if they do, I do not understand how all of them—according to Mr. Scribner—have been paying so much more than they ought to pay. A corporation can deduct from the assessment of personal property all stocks representing other stock companies, which means in practice, curious as it may seem, that one corporation by investing its personal resources in another corporation, and that other corporation investing all of its personal resources in the first corporation, neither, under the law, is liable for any taxes; because by means of the mutual investments, there remain no taxable assets.

It may be that Mr. Scribner considers a corporation is taxed twice when it is taxed separately by city and county, then by the state; if he does, he should note that all other forms of taxation include the same three divisions of government. All personal taxation includes the three forms, as is likewise the case with real estate; only in the latter case, in this state, the three are united in one sum, while with some corporations they are divided into two, but the total amount comes to about the same thing. There is no double taxation except that described.

Since the above was written, before reading Mr. Scribner's kind criticism, published in the April issue of this journal, of my remarks made the month before, and because he makes specific charges against the New York State taxation law, which, if correct, wholly upsets my former argument, I placed all the papers before the attention of the proper authorities, with a view to have this subject carefully straightened out. And among these authorities I am particularly indebted to George S. Coleman, Esq., assistant corporation counsel of the city of New York, for most kindly aid.

Just as stated above, taking Mr. Scribner's figures of what some street railway companies have paid in taxes for granted, the existing laws require no such taxation; and so long as these taxes have been paid, the present investigation shows these overpayments are the result of errors somewhere, which ought to be rectified. The principle and aim contained in the present system of taxing street railway corporations is to tax a company's resources, that is, their capital or capital stock and surplus in excess of liabilities. And such taxation occurs only once on any part of such resources, that is, once each for the state, the city and the county. As we have repeatedly said, in the case of street railways there is no double taxation of the same thing under the law. There is, as Mr. Scribner says, $50 collected on each car as a license fee for doing business, but this is not a tax, as the word tax is used; it is a fee given by the company for its franchise; that is, the franchise has a value, and its owners sell it for the price named in the franchise. The street railway company also pays a small sum annually to defray the costs of the railroad commissioners; but this likewise is a part of the cost of the franchise, and not a tax for the purpose of defraying the expenses of the government; merely a cost which in the public estimation is for the general good. Whether right or wrong, it is not our purpose to discuss here. the point is enough in remembering that the public get no direct benefit from the expenditure of this money; it all goes for the proper management of the railway interests of the state.

Mr. Scribner says that only 75 per cent. of the value of any real estate is deducted from the assessment, and that the remaining 25 per cent. is taxed over and over again as personal estate. That statement is correct, except in the particular of repeated taxation of the 25 per cent. surplus of real estate. It makes no difference to the railway company what may be the assessed valuation of the real estate, whether it be 75 per cent. or 50 per cent. of its real valuation; for whatever the amount, it is only assessed once, and it matters nothing to the company if that once is on real estate or on personal estate, except in a secondary particular, which we will hereafter describe. If the 25 per cent. surplus value of real estate is not taxed as real estate it is taxed as personal, or *vice versa*, if taxed as real estate it is not taxed as personal. Mr. Scribner goes on: "The tracks are again assessed and taxed by themselves, although wholly included in the stock assessment." This statement is an error; the tracks are assessed in the different wards of the city as real estate, say, at the value of $10,000 per mile of double track, which is supposed to represent its market value. Being assessed as real estate it is deducted from the companies' personal estate, precisely like any real estate. So there is no double taxation here. If the tracks are worth more to the company than $10,000 per mile, whatever that excess is, is paid in the personal assessment and not in the real estate assessment.

Mr. Scribner continues: "The capital stock even, including as it must and always does the full value of the real and personal estate, is again assessed and taxed on the basis of the dividend it pays. Again, a heavy state tax is levied, based on gross earnings." As this statement reads it is entirely wrong; there is no such double or triple taxation of the same thing as is here implied; the two mentioned ways of taxation are either one or the other, and adopted by the state as its form of taxation, and a proper allowance in the official tax rate of each year is made to allow for one of these methods. In this way: For the year 1891, the tax levy on real and personal property was at the rate of 1.90 per cent., which amount embraced the taxation for the city, county and state; and the local tax levy on the personal estate of such corporations, joint stock companies or associations as are subject to direct state taxation was 1.686 per cent. This means, that the county and city of New York separated their tax from the state tax for such cases, which include street railways, and the state taxed them in one of the two ways Mr. Scribner describes. The reduction in the per cent. of taxation from 1.90 to 1.686, is an allowance for the state's taxation of these corporations. Not that the allowance is exactly equivalent to the separated state tax rate, but in the making up of the annual rates that allowance was made, and no part of the 1.686 per cent. goes to the state. It may thus be understood, that when the state assesses corporations in one of the two methods Mr. Scribner describes, it is not a double taxation as his words imply. Neither does the state tax street railways under both the methods he mentions, but it selects one of the two, as accords with certain provisions of the law which are too long to relate here.

In summary, we repeat what we have before said, that there is no double taxation of the resources of street railway corporations in this state, if the assessors themselves, and the counselors connected with them, know anything about the subject; and I know of no better authority. As I do not question Mr. Scribner's statements regarding the sums of money he says certain street railway companies have paid in taxes, I am only able to explain it by attributing the overpayments to errors. I above alluded to an exception of difference, which might prove a profit or loss to a street railway company, according to the amount of the surplus of real value in its real estate assessment; that surplus, in the form of personal estate, might be assessed less under the state tax than under the tax where the city, county and state were combined; or it might be more, according to what the state's independent tax might be. But this point has no connection with the question of a double taxation on the same thing. J. B.

IT is sometimes said that scientific men have never invented anything, but this is not true of Dr. Otto, who is known all over the civilized world as the inventor of the first economically and commercially successful gas engine.—*Exchange.*

Dissected Short Generator and Motor.

The accompanying engravings (Figs. 1 and 2) illustrate very clearly the shape and relation of the individual parts of the 150 H. P. generator and the gearless motor, as now manufactured by the Short Electric Railway Co., of Cleveland, O. This generator, which was fully described in our last September issue, has rapidly worked its way into popular favor.

Some of the interesting features of this machine are the field magnet frame, which weighs over 8,000 lbs.; the shape and position of the eight poles, which are provided with both shunt and series coils; the large ring armature, and method of mounting upon the shaft; the self centering and self oiling bearings, the oil rings being clearly shown; the unusually large commutator and the brush holder.

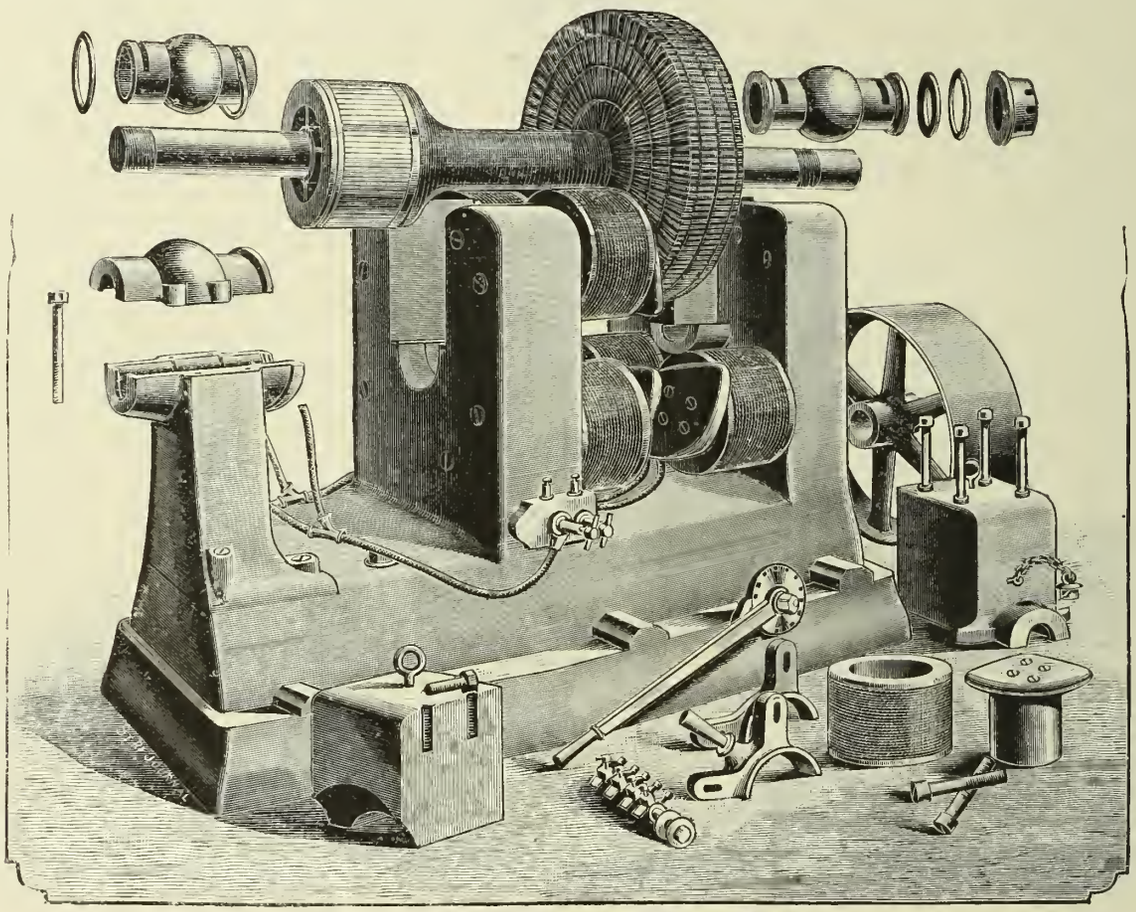


FIG. 1.—PARTS OF THE SHORT GENERATOR.

The gearless motor having been described previously, and again fully by the inventor in another column of this issue, does not require further notice in this connection.

Legal Intelligence.

CONSTRUCTION OF STREET RAILWAY—NEGLIGENCE—LIABILITY—CONTRACTOR—COMPANY. This action was brought by plaintiff for damages resulting by reason of personal injuries, against the defendant street railway company and the Thomson-Houston company, contractor, and had judgment against both defendants jointly. The defendants appealed.

Held, 1. That where a street railway company, having authority under its charter to construct a railway in the public street, does the work by an independent contractor, and an injury to a person passing along the street is caused by the negligence of a servant of the contractor, which negligence consisted in unnecessarily and improperly laying down loose iron rails in advance of the workmen engaged in constructing the track, the contractor is liable for the consequences of such negligence, but the railway company is not, the latter company not having reserved any control over the conduct of the former in executing the work.

2. That the evidence warranted the recovery against the contractor, and the judgment is affirmed to that extent, but reversed as to the railway company proper.

F. C. Street Ry. Co. et al v. *McConnell*, Georgia, S. C., Nov. 19, 1891.

STREET RAILWAY CO.—LIABILITY FOR PAVEMENT ORDERED BY CITY—VALIDITY OF ORDINANCE—CHARTER POWER OF CITY. In an action by plaintiff against defendant company to recover the expense of certain paving, wherein plaintiff had judgment and defendant appealed, it is

Held, 1. That under the laws of New York (c. 501, 1868), authorizing and directing the plaintiff (city) to grant permission to the street railway company (defendant) to construct a railroad upon certain streets, provided that the company should keep the surface of the streets within the rails, and for one foot outside thereof, and to the extent of the ties, "in good and proper order and repair," but, when the railroad had been operated for about eighteen years without any pavement between the rails, the city could not recover the cost of paving with asphalt that portion of the street, it not appearing on the trial that, at the time the city ordered the pavement, the space occupied by the railroad was not in good order and repair, or that the pavement was necessary.

2. That the enactment by the city of an ordinance requiring the pavement of the portion of the street occupied by the railroad was not presumptive evidence of the necessity for such improvement.

3. That the acceptance by the railroad company of the charter created an obligation in the nature of a contract, which could not be modified by the city without express provision therefor by statute.

4. That the city had no power by ordinance arbitrarily to determine what repairs or improvements were necessary. Judgment reversed.

City of Binghamton v. *Binghamton St. Ry. Co.*, N. Y. S. C., Nov. 1891.

Injuries at Crossing—Negligence—Evidence. 1. In a suit against the defendant street railway company for the death of plaintiff's husband, it was shown that he and plaintiff had stopped near defendant's south track at a street crossing to await the passing of a cable car on the north track, and that as soon as it had passed they attempted to cross, but were scarcely over the first rail of the south track when they were struck by a car thereon, which was almost upon them when they started, and the husband suffered injuries of which he died. The street was straight and well lighted, the night clear, and the car by which they were struck had a headlight with a reflector. The only evidence that the husband looked in the direction from which the car was approaching was given by plaintiff, who, however, only inferred that he did so, because it was the natural thing to do.

Held, that the accident was due solely to the negligence or misfortune of the deceased.

2. The fact that the gripman of the car that struck deceased was at the moment of the accident looking to one side, is not sufficient to show him guilty of negligence, when he had immediately before seen plaintiff and deceased standing by the side of the track, apparently engaged in conversation, and so had no reason to anticipate that they would attempt to cross in front of his car. Judgment for plaintiff reversed.

Scott v. *Third Ave. St. Ry. Co.*, N. Y. S. C., Nov. 13, 1891.

Injury to Passenger on Street Car—Contributory Negligence—Jury Question. 1, When the plaintiff was riding on the front platform of a street car, and, while passing around a curve was thrown from the car. He testified that the rear platform was crowded, and he had to get on the front; that he had to stay there because the car seemed full. There was evidence for defendant that there was ample room to stand inside the car.

Held, that an instruction was proper which authorized the jury to find plaintiff free from negligence in riding on the front platform if there was a reasonable necessity, real or apparent, for his doing so.

2. Where the evidence tended to show that riding on the front platform was not obviously dangerous, that the accident would not have happened if the defendant had used due care in operating the car; the question of plaintiff's negligence was for the jury, to be considered in connection with his knowledge of the curve in the street, and of defendant's rule against riding on the front platform. Judgment affirmed.

Highland Ave. & B. R. St. Ry. Co. v *Donovan*, Ala. S. C., Nov. 5, 1891.

Note: The many judgments rendered against street railway companies on account of accidental injuries to passengers while riding on platform has occasioned a serious agitation of the question of crowded cars. There appears but little doubt that a street railway company has the right to adopt rules prohibiting the riding on platform, but if there is slight negligence upon the part of the management, courts (especially the jury) generally hold it to be sufficient to support a finding in favor of the complainant. It has become so common for one to ride on the platform, of a car, sometimes by preference, but more often by necessary compulsion, that it is no longer considered negligence as a matter of law, for one to ride on the platform notwithstanding the well-known rule of prohibition. In this case (as in many others) the evidence tended to show that if the driver had exercised due care in swinging around the curve, the accident might have been averted. Interesting questions relative to the presumed danger of riding on the platform may be reviewed by reference to the following cases: Railway Co. v. Walling 2 Am. and Eng. cases, 20; Willis v. R. R. Co., 34 N. Y. 670; Nowland v. R. R. Co., 3 Am. and Eng., cas 463; R. R. Co. v. Miles, 13 Am. and Eng., R. R. cas. 10; R. R. Co. v. Worl., 21 Am. and Eng. cas., 429 and R. Ry. Co. v. May 5, Atl. Rep. 276.

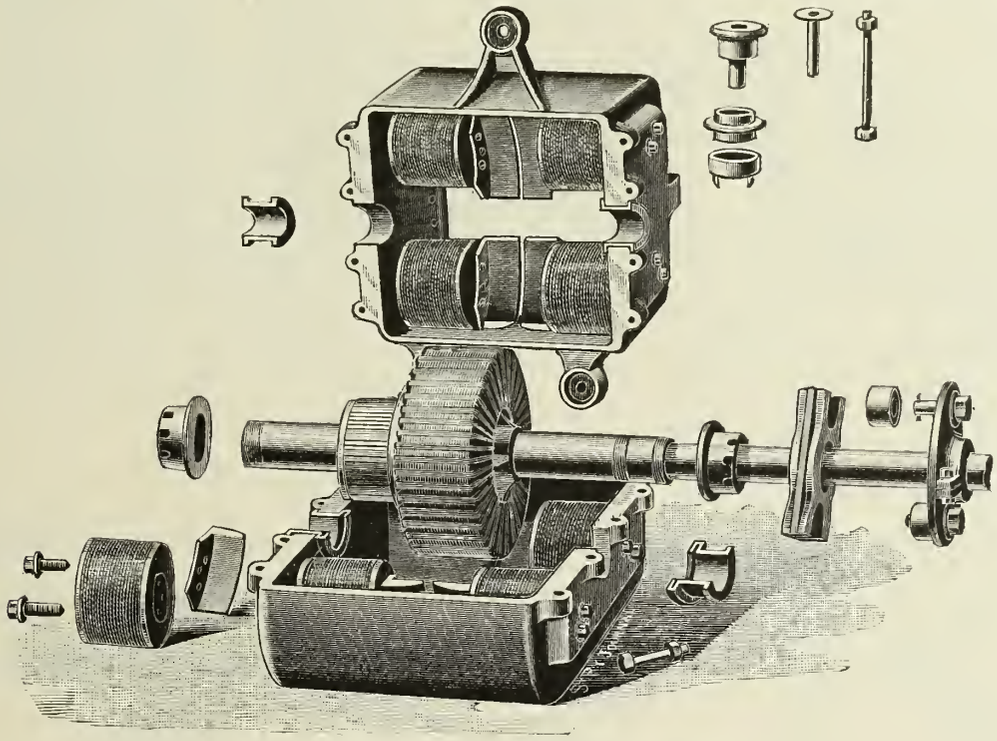


FIG. 2.—PARTS OF THE SHORT RAILWAY MOTOR.

Injury to Passenger—Boarding Moving Car—Contributory Negligence—Reversal. Where plaintiff boarded defendant's car while it was in motion, by getting on the sheet iron covering of the steps of the last platform, and maintained himself in that position by holding to the iron gate that barred entrance there until struck by a structure near the track and knocked into the street below.

1. *Held*, that he was negligent, as a matter of law.

2. *Held*, that a railway company is not liable for failure to take steps to avert injury from one who has placed himself in danger, where it has not omitted to discharge any duty towards such person.

3. When a passenger without the consent of the carrier selects a place to ride which is obviously not intended for that purpose, and is hurt by reason of hazards peculiar to that position, he has no cause of action.

Judgment reversed, new trial denied.

Carroll v. *Interstate Rapid Transit Co.*, Mo. S. C., December 7, 1891.

The Bates-Corliss Engine.

The engravings accompanying this article show front and rear views of the Bates-Corliss engine built by the Bates Machine Co., of Joliet, Ill.

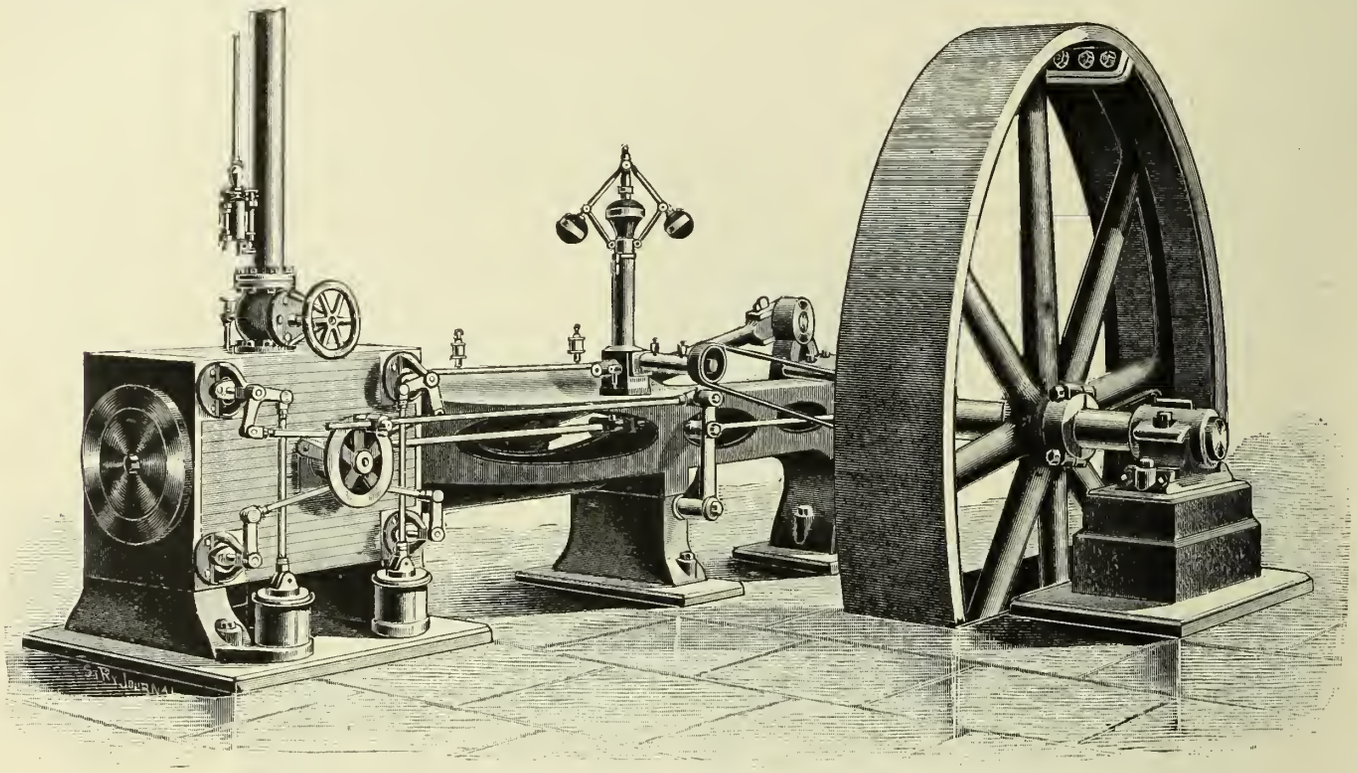


FIG 1.—BATES-CORLISS ENGINE—FRONT VIEW.

Some of the important features wherein these engines differ from the ordinary Corliss engine are the valves, governor, frame and proportions of the different parts. Besides the ordinary rotary valves, special flat side admission valves are provided to which the power is applied, parallel to and in line with the seats, obviating any tendency to rock or twist and consequent uneven wear, thus insuring a longer life than the rotary valves.

Tripping is done at the wrist plate, by means of which the mechanism of the valve gear is much simplified, the springs and small parts, in fact, all mechanism at valve stems being eliminated, the only loose pieces being the hooks on wrist plate. No springs of any description are used in connection with the valve gear or governor, neither does the governor require any water or oil pot to steady it. The governor, which is very sensitive, is of the flyball pattern and is provided with all necessary connections to automatically control the releasing gear; it is also provided with automatic stop motion. On extra large engines a separate eccentric is provided which enables the cut-off to take place at any position of the stroke, and is especially essential on engines that are required to operate under widely fluctuating loads.

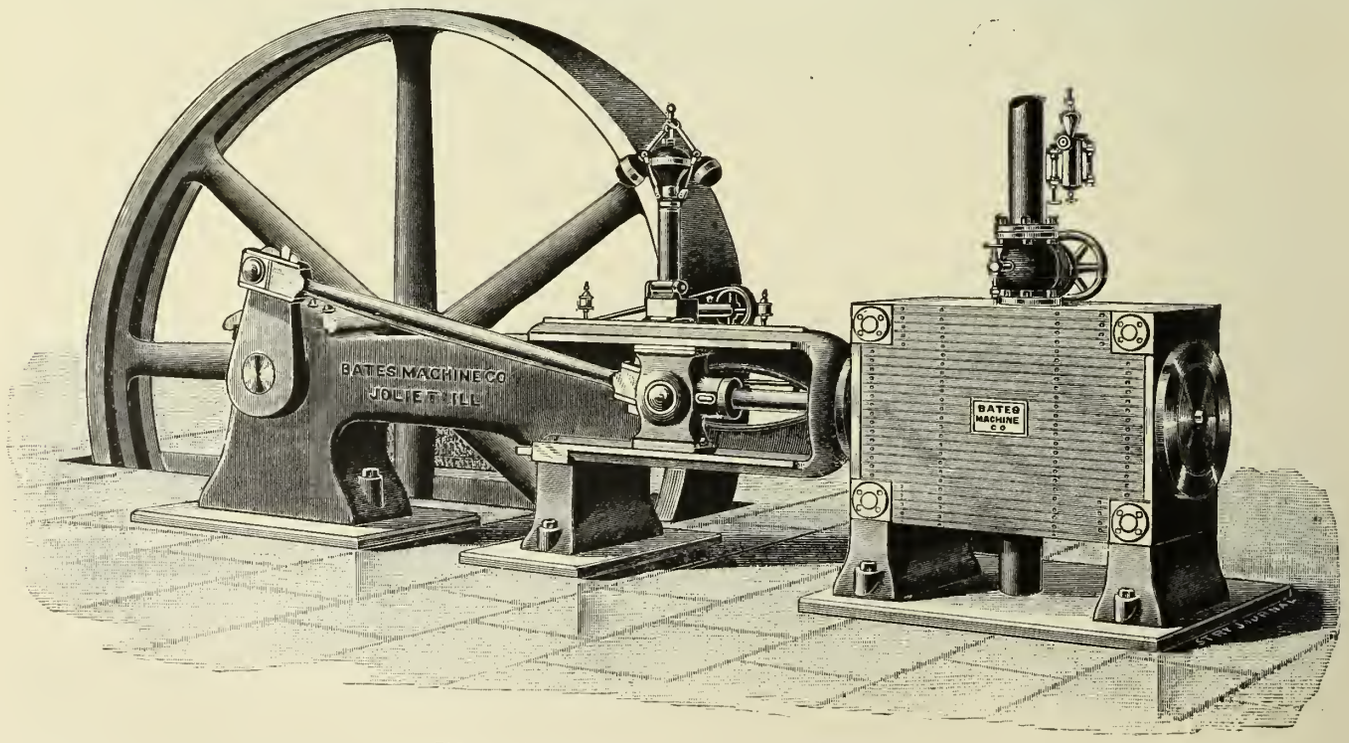


FIG. 2.—BATES-CORLISS ENGINE—REAR VIEW.

The frame is of the box girder form graceful in outline and contains an unusual amount of metal. The frame, main pillow block guides and centre leg which supports the guides are all cast in one piece, thus securing

great rigidity and stiffness. The main pillow block is provided with quarter boxes with large wearing surfaces, which are adjusted with wedges so that they may be removed without taking out the shaft. The out board pillow block is provided with a large cast iron adjustable sole plate.

The crosshead is of solid box form fitted with forged steel pin nearly one-half the diameter of the shaft. The shoes are adjustable with wedges and are provided with large wearing surfaces and filled with best babbit and scraped to fit guides.

The main shaft is of hammered wrought iron, one-half the diameter of cylinder, except in heavy duty engines where this proportion is increased.

The crank pin is of forged steel, one-half the diameter of the shaft. All bearings and journals are of ample proportion to insure the greatest strength and longest wear with the least possible friction.

Owing to the great demand for this type of engine, the capacity of the works has been doubled, which are now operated night and day, and with the present equipment are turning out on an average one engine a week. In addition to the manufacture of engines, the above firm make heavy flywheels, having facilities for casting and turning wheels thirty feet in diameter and any width of face. They give special attention to the equipping of electric light and railway stations with complete power appliances.

Cook's Patent Level.

We present in this issue illustrations of Cook's patent level which, as will be seen, differs from the ordinary level in many important particulars. Figs 1 and 2 show railway track levels and Fig. 3 a plumb and level.

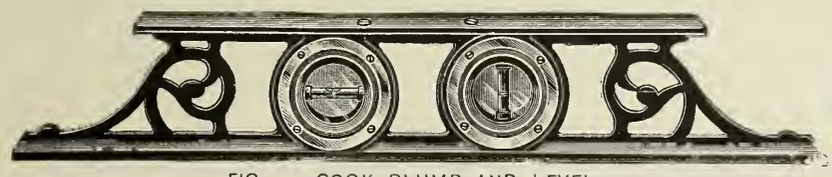


FIG. 3.—COOK PLUMB AND LEVEL.

The bulb tube carrying the bulb is set in a frame, which is faced on either side with glass, and can be seen from any position and from either side. The bulb tubes are also so arranged as to show their entire length, by which means the bulb can be seen from a distance, and overhead, which is not possible in the ordinary level.

The inside rings are made so as to revolve on their own centre for adjustment, and cannot get out of adjustment unless the set screws are moved. Nearly all styles are made in various sizes. The manufacturers are Davis & Cook, Watertown, N. Y.



FIG. 1.—COOK RAILWAY LEVEL.



FIG. 2.—COOK RAILWAY LEVEL.

"Round Top" Insulator and "Salem" Bell.

The object in the construction of the "round top" insulator shown in Fig. 1 was to produce a moulded mica insulator which should be entirely protected by a metal shell. The nub carrying the stem is entirely surrounded by the insulation which is formed into the shell at about sixty pounds pressure, the shell being turned over upon the edge, thus protecting the insulation against fracture from blows of the trolley wheel. The insulation is additionally anchored within the shell and by the peculiar method of manufacture attached to it, so as to be practically integral with the metal, giving, as will be seen, an insulator which is both strong and durable.

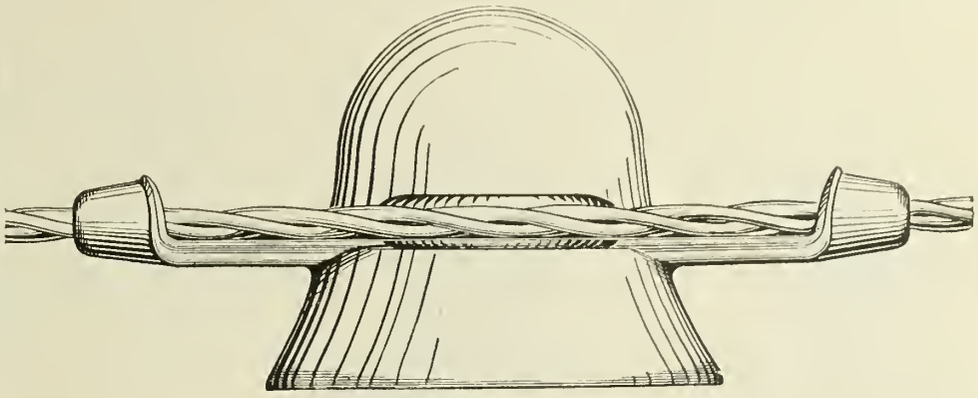


FIG. 1.—ROUND TOP INSULATOR.

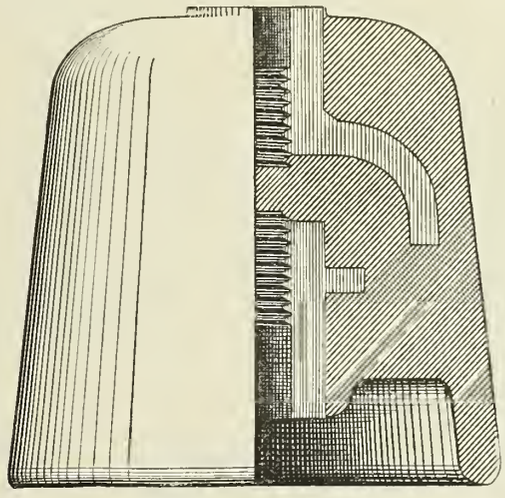


FIG. 2.—SALEM BELL.

The "Salem" bell shown in Fig. 2, needs little explanation. It is made of moulded mica with the brass nubs of extra weight and firmly anchored. The top nub is three inches counter-bore; the bottom nub five-eighths of an inch, and they carry one-half inch fittings. The weight of the bell is eighteen ounces.

The manufacturers of these insulators are the Johns-Pratt Co., of Hartford, Conn., and the mica insulation

used is the same as that which has been so long and favorably known in the different insulators manufactured by the Gould & Watson Co., of Boston. H. W. Johns Manufacturing Co., of New York, are the selling agents.

The Bryant Rail Saw.

A metal sawing machine especially adapted to cut rails is always a most convenient article in the work of

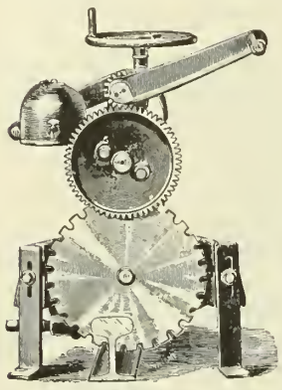


FIG. 1.

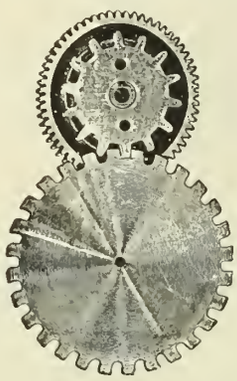


FIG. 2.

street railway track construction, and its use often saves a great deal of time and labor. Such an appliance is manufactured by the Q. & C. Co., Phœnix Building, Chicago, and is illustrated herewith.

Fig. 1 shows a portable Bryant rail saw manufactured by this company. This saw is adapted to be operated by two men, and will cut any rail in use on a street or steam railway in less than ten minutes. Records show

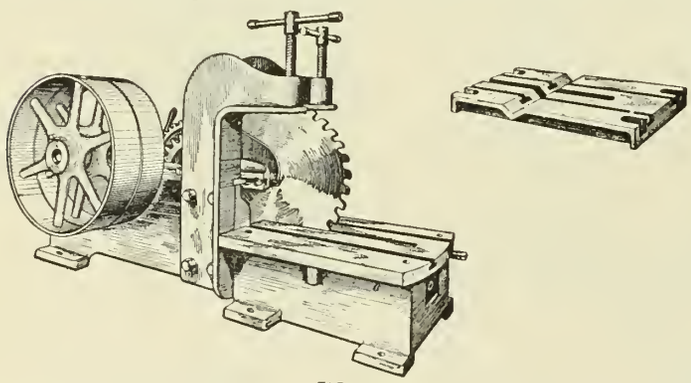


FIG. 3.

that by it a sixty pound rail, has been cut in three minutes, a ninety five pound in three minutes and twenty-five seconds, and a seventy-three pound rail, thirty-five degrees angle, in seven minutes. The machine requires a space of about 2 × 6 ft.

Fig. 2 shows the principle of transmitting power to the periphery of the saw blade, and, as will be seen, the arrangement is both simple and economical of power. The

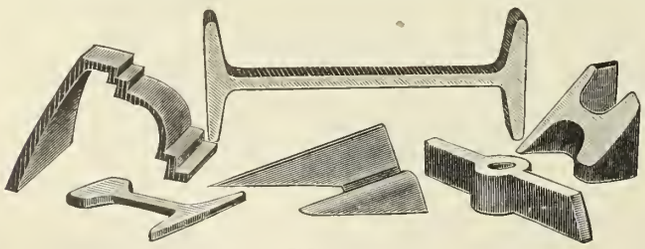


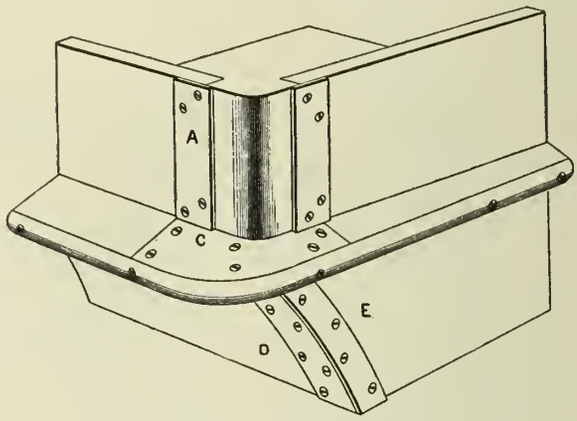
FIG. 4.

construction of the saw is such that each tooth acts as a planer cutter, leaving the work perfectly smooth and true and not disturbing the temper of the metal. As the machinery can be adapted for a mitre cut, mitred rails can be used very easily if desired.

Fig. 3 shows a larger type of machine for shop work, requiring, however, only about one H. P. for its operation; in fact it has been operated by a one-half H. P. electric motor. The saw is adapted for a large variety of work, and is provided with a movable table for clamping in position the rail or other metal to be cut. A view of some of the cuttings made with these machines is shown in Fig. 4.

Corner Stay for Cars.

The accompanying engraving shows a new and improved corner stay for street cars, the object of which is to simplify and improve the means of securing side and



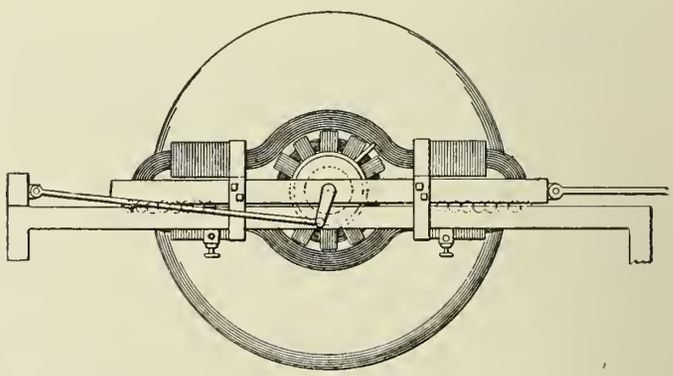
CORNER STAY FOR CARS.

end guard rails and panels to a corner post. The device is the invention of Henry Cochran, of Chester, Pa. As will be seen, the corner post is recessed to receive the two centre, side and end panels and the joints are covered by vertical plates, shown at A, secured to the panels by screws. The guard rails are also connected by a flat plate, C, arranged on their upper sides and secured in place by screws. This, together with a metal strap, which is placed on the edge of the guard rails, greatly increases their strength and durability.

The concave side panel and lower end panels D and E, are secured to the corner post below the guard rails and also have their ends covered by similar corner plates. This arrangement of plates makes a practically water tight corner, and is being used by the Lamokin Car Works, of Philadelphia, in the manufacture of their street cars.

Reciprocating Electric Motor.

A type of electric motor capable of giving a reciprocating motion has been recently patented by J. T. Wilson, of Tyrone, Pa., and is shown in section in the accompanying engraving. The field magnets of the motor are mounted on a longitudinal frame which is supported on balls resting in a groove of a second frame so that the

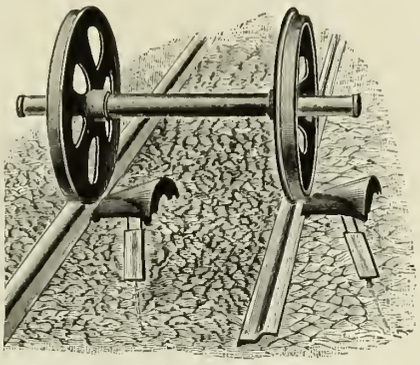


RECIPROCATING ELECTRIC MOTOR.

motor can reciprocate easily in a longitudinal direction. Mounted on the armature shaft, opposite that shown in the view, is a flywheel and a second crank secured by a rod to a fixed pivot, like the one shown. In street railway work the flywheel would be replaced by a small balance wheel. Rotation of the motor will then produce a horizontal motion equal in extent to the diameter of the circle described by the crank pin. The inventor claims the special adaptability of the device to operating street cars.

Tilden Street Car Replacers.

A replacing frog is coming to be regarded as an essential part of a street railway equipment. By the use of such a device as that shown in the illustration, a derailed motor or car will be replaced on girder rails by gravitation as soon as the wheels reach the altitude of the top of the rails. The frogs being double enders it is immaterial whether the cars be pulled ahead or backed. The dimensions have been developed by the most severe tests, and are now claimed to be practically perfect. They are self holding, and it is asserted that by their use rolling stock may be rerailed in one-quarter the time required when other devices of the kind are employed.



TILDEN STREET CAR REPLACERS.

The replacers can be used as hose bridges in case of fire when the hose is stretched across the track, by locating the frogs over the hose. As an electric switch is a part of each replacer and the circuit being connected by the location of the device on the ground, a motor car may be rerailed at any time under ordinary circumstances. Replacers of this style, but much larger, are now used with great success on the principal steam railroads of the country. They are manufactured by B. E. Tilden & Co. of the Monadnock Building, Chicago.

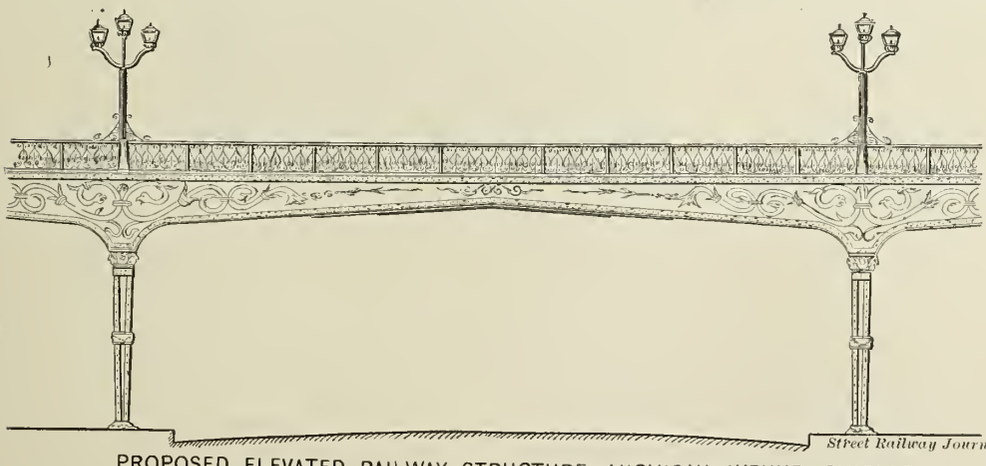
South Side Elevated Road, Chicago.

The way is now open for the Chicago & South Side Rapid Transit Co. to reach the World's Fair grounds at Jackson Park. The City Council, at a recent meeting, passed the ordinance giving the company a franchise on Sixty-third Street, and they now possess rights from Congress Street on the north to the entrance of Jackson Park. The franchise has been granted in time to insure the completion of the road before the opening of the fair, unless some extraordinary accident occurs.

It was expected that the road would be operated from Fortieth Street to Congress Street during May, but the company furnishing the structural iron failed to come to time, and it will be June before trains are in operation. The cars and locomotives are practically ready for use. The former are substantially the same as those used on the elevated roads in New York. They were built by the Jackson & Sharp Co. of Wilmington, Del. The engines are rather novel in that they are compound, and their performance will be watched with a great deal of interest. They were manufactured by the Baldwin Locomotive Works.

Speaking of the schedule, Chief Engineer Sloan recently said: "The number of trains we shall run will depend altogether on the amount of travel the public furnishes. The public seems to be taking kindly to the road, but the permanent revenue must come from the building up of the property along the line. When the New York L road started there were unoccupied miles of the street through which it passed, but in ten years solid business blocks lined the route. We expect the same thing here in Chicago. We can make the run from Congress to Fortieth Street in about fifteen minutes."

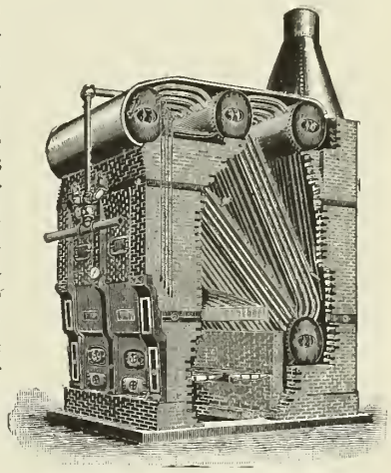
Where the road crosses Michigan Boulevard at Fortieth Street the Park Commissioners desired a more ornamental structure than the standard construction of the company, which, however, is extremely neat and substantial. The engineers of the company planned for this purpose the handsome structure which is shown in the illustration. There are three spans of this structure, the longitudinal trusses being six feet at the ends and arched to two feet at the centre. The columns are of wrought iron made up of angles and plates, and taper toward the base. Above the regular flooring is a solid iron floor made of buckle plates. On the latter is laid three inches of concrete upon which the ties are placed. The ornamental railing is of cast iron, and is bolted to the structure.



PROPOSED ELEVATED RAILWAY STRUCTURE—MICHIGAN AVENUE, CHICAGO.

The Stirling Water Tube Boiler.

The general arrangement of the water tubes and drums of the Stirling water tube boiler was shown in our March issue, but in the accompanying illustration a better idea can be obtained of its external appearance when ready for operation. As our readers know, this boiler consists of two or more upper wrought steel drums connected with each other and with a lower or mud drum, also of steel, by tubes expanded directly into the drums. The engraving shows three upper drums. Not an ounce of cast steel or cast iron is used in the construction of the boiler. As will be seen, this arrangement allows of an excellent circulation, since each water tube has a separate outlet equal to its own area.



STIRLING WATER TUBE BOILER.

By opening one manhole in each drum access is gained to every part of the interior of the steel plates and both ends of every tube. The exterior of plates and tubes is accessible at all points, so that the boiler is an easy one to clean, but it has been found that the tubes are practically clean on the outside as well as the inside, because they are set at such an angle that the solid matter inside and soot on the outside fall to the bottom of the furnace or into the mud drum, where it is blown off. The manufacturers of this boiler are the Stirling Co., of Pullman, Ill., and the New England agent is J. Bradford Sargent, 620 Atlantic Avenue, Boston, Mass.

THE treasurer's report of the Third Avenue (N. Y.) Employes' Relief Association for the year ending February 26, 1892, shows total receipts, including cash on hand, March, 1891, $9,086.80; disbursements, $5,888.85, the latter including sick benefits of $2,713, and death benefits, $1,500. The work which this Association is carrying on is of great value to employes of the company.

Papers at the Chicago Electric Club.

A number of interesting papers have recently been read before the Chicago Electric Club on matters pertaining to electric railways, and the electrical engineers of that city have had an excellent opportunity to judge of the present status of electric railway science and the advisability of the adoption of electric power on the streets of that city. We give below the papers of Prof. S. H. Short and Mr. Geo. K. Wheeler.

THE GEARLESS MOTOR; BY PROF. S. H. SHORT.

At first thought it does not seem necessary to place on the market a motor of new design which involves the abandonment of gear wheels for transmitting the power of the armature to the axle, but when we consider it carefully and examine all the advantages to be gained by so doing, we feel justified. If you recall the history of the steam locomotive you will remember that in the first machines the power was transmitted from engines through gear wheels to the axles. This was soon abandoned because of the wear on the gears, the noise, the breakage and the many things which rendered it impracticable, especially where high speeds were required. If you will look back over the history of the electric street car motor, you will remember that among the first experiments which were made, the high speed armature was geared down through a long train of gears to the axle. Finally, within the last two years, the practical operation of electric motor cars with two sets of gears, of a double reduction, has become quite general. It has now been found, however, that those gears are a great source of expense in the operation of electric street cars, and it has been the object of the manufacturer to reduce the number of gears in street car practice as far as possible, until we now have all of the well known electrical manufacturers offering a motor for street car service with but a single reduction, and we have already found in practice that this is immensely superior to the old double reduction type of two years ago. While this single reduction type of motor is undoubtedly eminently successful, I believe we can go a step further with great advantage, that we can connect the armature directly to the axle of the car without the intervention of armature, intermediate or other kind of gears. The abandonment of gears, or a gearless motor is undoubtedly absolutely necessary where high speed is required for driving trains of cars upon suburban or interurban lines– a thing which we shall undoubtedly be called upon to do within the near future. It will be well for us to inquire into the disadvantages of the spur gear, which is the form which has finally been adopted as the only successful method of reducing the armature to the axle speed. These gear wheels vary in efficiency of transmission of power, with the load and with the speed. They wear rapidly, especially when placed under a street car in the dirt, grit and mud. This wear of the gears has been a very serious thing for the electric railways during the last three or four years. The repairs upon street car motors have been mostly because of the use of gears, and the cost of maintaining an electric motor car has been due largely to this one thing. With the single reduction motor, of course, much more then half of the difficulty has been removed, but we believe that with the gearless motor, which does not contain any of those wearing parts, and without the armature and intermediate bearings and shafts, bolts and nuts, etc. we can get rid of all this source of cost in operating electric street cars. Those of you who have operated electric street car lines can appreciate what a serious thing it is for a tooth to break out of a gear in a car motor while it is in service. The car is loaded with passengers who have paid their fares. If one tooth breaks, the probability is that more will follow; finally the teeth of the gear do not mesh with the pinion and it either bends the armature shaft, or breaks the motor frame. Probably the wheels become locked and the car is unable to proceed on its journey. The passengers must be removed, and the car must be taken from the track, or dragged to the car house by another motor. This is calculated to make the patrons of the road dissatisfied with the electrical system, and it creates a feeling of distrust in the public mind about the certainty and regularity of the operation of the cars. Nothing could be more serious for a street railway management than a feeling of distrust among the patrons of the road. While this is not now as common an occurence as it was a year ago, because of the fewer gears in the single reduction motor and the fact that we are making our gears of steel which lasts longer and breaks less frequently, still the trouble is serious.

Again, it is a great source of loss to a street railway company when it is necessary to take a car out of service to replace worn out gear wheels. A car earns on an average in a good street car city, about $20.00 per day. If a car is taken off of the road for half a day, or a day, we not only lose the cost of repairs, but we lose the profit on the day's run.

The causes which disable cars should be reduced to the minimum, and it is to this end that we are advocating the use of no gears in a street car motor. It is very seldom now that we have trouble with armature bobbins and field magnet spools burning out. While we had some difficulty of this kind in the early days, we have learned how to insulate and protect the motors for street car service, so that electrically they are quite equal to the work they are required to do. We have therefore to look more carefully to the mechanical construction of a street car motor and perfect that part of the machine. We believe that we should make a street car motor with as few parts as possible, and especially should we endeavor to do away with the wearing parts.

If we can abandon the gears you can easily understand that we not only do away with them, but also with those wearing parts which accompany a train of gears, fast running shafts and their bearings, box caps, nuts and bolts, all of which need looking after.

We will now take up the matter of the power lost in spur gearing, and see what we can gain in that direction by abandoning gears. When we first took up the subject of a gearless motor, we set about to see how much could be gained in the efficiency of transmission of power by doing away with the gears. I made a very careful and thorough investigation of the losses between the armature pinion and the intermediate gear, and between the intermediate pinion and the axle gear of a double reduction motor. I first put a double reduction motor in good order, eliminating the armature bearing losses, as much as possible, by running the motor for a long time, to wear the bearings down to a good surface. I put my power brake for determining the horse power directly on the armature shaft and run my motor, delivering different horse powers all the way from no horse power to its full output—twenty H. P. At the same time we measured the electrical horse power which was being put into the motor, and from this we constructed a curve of efficiency of the motor at different loads, which curve is reproduced as the upper curve in Fig. 1. The greatest efficiency reached by this motor was about 70 per cent. at a load of from fourteen to sixteen H. P. The efficiency at small loads, say,

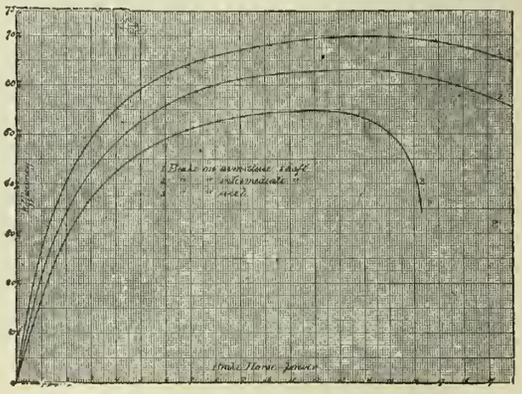


FIG. 1.

at two H. P. was something like 50 per cent; at four or five H. P. an efficiency of 65 to 70 per cent. We then took the brake from the armature shaft and replaced it with a well made armature pinion, allowing it to mesh with a well made intermediate gear, these gears being cut as nicely and as carefully as possible so that there would be the least possible loss between the two in making this test. Putting the brake on the other end of the intermediate shaft we again secured the number of readings of the horse power delivered, after being passed through this one pair of gears, the electrical horse power being indicated carefully at the same time. From the efficiency at different horse powers thus obtained we produced a second curve, which is shown in Fig. 1 as the middle curve on the diagram, and we find that the efficiency of this arrangement has fallen considerably. We once more removed the brake and placed the intermediate pinion on the intermediate shaft, allowing it to mesh with the axle gear. The brake was now placed on the axle itself and another set of measurements—the same as those before made—were secured and a curve of efficiency again plotted, which showed a large loss in these gears, the efficiency at the axle being less than that at the armature by an amount indicated by the two outer curves. The axle results showed that at fourteen H. P. delivered by the motor, we obtained an efficiency of 70 per cent. as a maximum when the brake was placed on the armature shaft. When the brake was placed on the intermediate shaft delivering fourteen H. P. the efficiency dropped to about 62 per cent. When placed on the axle, the efficiency dropped to a little less than 55 per cent., showing a loss in the gears of some fifteen per cent., when delivering fourteen H. P. You will find in going over these curves that the loads vary considerably with the speed. Making an efficiency curve of the gears alone at different speeds, you will find the efficiency is very low at heavy loads and slow speeds and rises to its highest at medium speeds and medium loads. It again falls when running up to higher speeds. For this reason it is more economical to run a geared motor not too fast or too slow, but at a medium speed. This fact has been established long since in the use of gears in other classes of machinery and in designing machines where power must be transmitted through gears. The best possible speed at which gears are to be run, and the relation between pinion and gear are carefully considered. In the single reduction motor we regain, we might say, more than half of this loss in efficiency, because the gears are run at a moderate speed. I think that this one feature of gear loss makes it desirable to abandon their use in street car motors if possible. If we can save in practice 15, or more nearly, 20 per cent. of the power consumed in operating a street car motor by using the gearless instead of the double reduction type, it is well worth while, as this means the consumption of less coal and the reduction of first cost in the power plant and accessories.

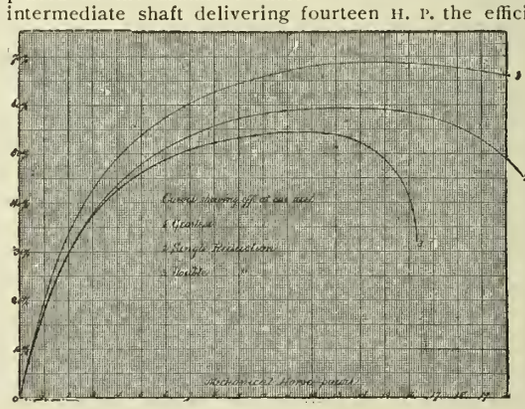


FIG. 2.

Fig. 2 represents another set of curves developed in the same way as those shown in Fig. 1. Three motors were used in this test, the double reduction, single reduction and the gearless. In each case the power

brake was placed on the car axle. The double reduction motor showing the efficiency at different horse powers is practically the same as the lowest curve in Fig. 1. The power brake placed on the axle of the single reduction motor shows the loss in but one pair of gears, and its axle efficiency is greater than that of the double reduction. In the gearless motor, however, there is no loss between the armature and the axle; therefore the curve shows the actual efficiency of the motor itself. In the single reduction motor the relation between the diameter of the pinion and the gear is greater than it is in the double reduction; therefore the loss is somewhat greater. If we had a still slower running motor armature on the single reduction, so that the pinion could be larger and the gear smaller, this loss would not be so great, and the efficiency at the axle would be greater. From these curves it is seen that the efficiency of the gearless motor at the axle when delivering 14 H. P. reached very nearly 70 per cent., or very nearly the same efficiency as the double reduction motor at the armature shaft. The single reduction motor, when delivering the same power through one pair of gears showed an efficiency of 60 per cent, while the double reduction shows a little over 50 per cent. These practical tests show that with the gearless motor we actually save from 15 to 20 per cent. in the power necessary to put into the car in order to get the same result at the axle.

We will now give you a description of the construction of our gearless motor. Gearless motors have heretofore, as you well know, been constructed and operated. The armature has been placed directly on the axle, and fairly good results have been obtained. The City & South London Railway in London is operating its road with gearless motors to-day. These motors are high speed, making the problem somewhat easier. It is, however, difficult to construct a small motor, not too large to be placed under an ordinary street car, the speed of which shall not be above 105 to 150 revolutions per minute. Because of the light construction of the roadbed in street railways, it is also necessary to avoid the heavy hammer blow which occurs at the rail joints from a motor partly or entirely carried on the axle. When the wheel of the car passes from one rail to another it falls, striking a very heavy blow. If we have a very heavy weight, directly attached and carried on the axle, without any intervening cushion or spring, we will have a very severe sledge-hammer blow on the rail at every joint. This will soon pound out and destroy the rails. You are all familiar with the difficulty which is experienced in keeping up the rail joints on an electric line. The reason for this is apparent, if we think a moment, as it is a new element which has appeared since the introduction of the electric motor. All geared motors are supported at one end directly on the axle by means of axle bearings. At the other end these motors are supported on springs; thus, one-half the weight of a geared motor is carried directly to the car axle without the intervention of any flexible material. Imagine, if you please, that we could cushion both ends of a geared motor and put a spring between the motor and the car axle at the axle end. We will relieve the heavy blow of the wheels at the joints, and the wheels would not do as much harm or as much damage to the track. The actual weight carried by a set of wheels on the rails does not seem to affect the joints materially. Old horse cars, even when carrying heavy loads of passengers, did not affect materially the rail joints. Cable cars do not destroy their tracks, no matter how great their loads. Therefore it must be that this heavy weight of the motor carried solidly on the axle is the thing that is breaking down the rail joints on electric lines. This heavy jarring also crystallizes the axles, and we have complaints from all over the country that axles on motor cars are breaking. When we come to examine these breaks we find that the iron has crystallized, and the manufacturers are now endeavoring to overcome this by increasing the size of the axles. With the gearless motor, as we now construct it, none of the weight is directly carried on the axle. By referring to Fig. 3, which shows a section through the axle of the gearless motor, it will be seen that the armature is mounted on a hollow shaft which surrounds the axle, leaving an air space of about an inch entirely around the axle. This hollow shaft is really the armature shaft of the motor, and is carried in its own independent bearings in the motor frame. The motor frame consists of a box made in two halves. These two halves are fastened together and contain the field magnets, and enclose the whole, protecting it from mud and dust, the only opening in the box being on the upper side, next to the car floor. This box, which makes the complete motor when assembled, is provided with three projections at right angles to the armature shaft. These projections are made to receive steel spiral springs, similar to car springs. These springs are supported on the cross girders of an ordinary truck, such as is commonly used for motor cars, and support the entire weight of the motor. The axle is passed through this hollow armature shaft and can move freely in any direction within it. At one end of the hollow armature shaft is placed the flexible driving device which communicates the motion of the armature directly to the axle. This driving device can be seen in Figs. 3 and 5, and in Fig. 4 an end elevation of the motor is shown, together with the spring mounting of the motor and a section of the axle in the centre of the hollow shaft. Fig. 5 shows a plan of the motor as you would look down through the trap doors in the floor of the car, the field magnets and armature, commutator and brushes, all being revealed, and the case with which you can get at the brushes and all the various parts of the motor is well shown. The axle also has a free end play of two inches through the motor and armature shaft. This is necessary in rounding curves and to ensure freedom for the movements of the truck.

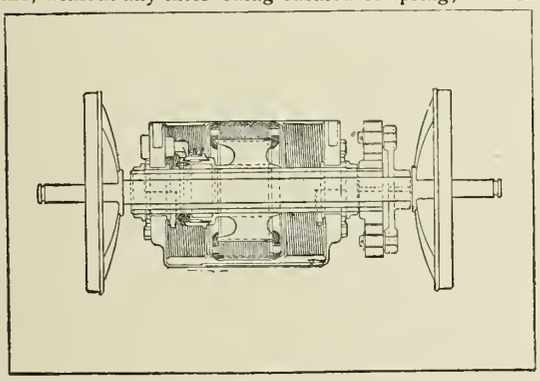


FIG. 3.

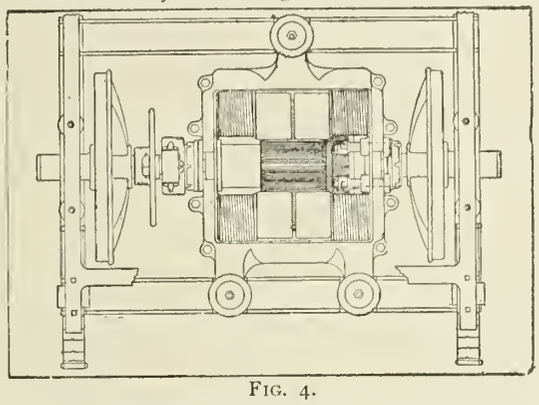


FIG. 4.

When the wheels drop from one end of a rail to another the motor does not immediately follow, its inertia being so great. The wheels not being very heavy do not make a heavy blow, but by the time they have reached another portion of the rail the motor falls down against its springs, distributing, as it were the blow over a considerable length of the rail, thereby preventing a serious damage to the rail joint.

The question is often asked, How do you obtain the necessary power or tendency to turn the wheels around without using an abnormal amount of current in so doing? It is contended that in a geared motor we have an enormous leverage through the gears. If we had a small armature, the same as is used in the geared motors on the axle, we would not, of course, be able to start the car, or to do the work necessary in moving a loaded car, but we have a large armature placed in a very strong magnetic field, and we have a great many more turns of the same current around the armature, thereby gaining in two ways a greater leverage because of a larger diameter of armature and a greater pull at the end of that lever, because of the increased number of turns of wire on the armature and the stronger magnetic field. It is something analogous to the steam engine. If we replace an electric motor with a steam engine, we can use a small engine under the car, with a small cylinder, and run it at high speed and gear down to the car axle, or, we can use a large engine connected directly to the axle, as is common now in locomotive practice, and run it slower and get the same power with, as has been demonstrated in steam motors, greater economy. You can make a similar comparison between the high speed engines of small size and the larger Corliss engines running at slow speed. We have the advantage in the slow running motor of practically doing away with the loss in Foucault currents set up in the armature ring. Air resistance we are liable to, the greater loss in the dead resistance of the motor, but by designing our motor with a very low resistance of the magnetic circuit, we are able to cut down the wire on the machine so that its resistance is quite low, being only about 2½ ohms. There is another advantage in this slow speed motor, which is not small—the wear on the commutator is very light and the heat produced by the friction of the brushes on the commutator is exceedingly small, making the motor run cool in all its parts. We are obliged, of course, to take advantage of everything that is possible in the construction of the gearless motor in order to make it small and light enough for street car service. We use the best wrought iron and steel in its construction, because of their superior magnetic qualities. We have to use the best copper of highest conductivity to reduce our resistance losses. This is, of course, in the end an advantage to the machine, because it makes it stronger and less liable to breakage.

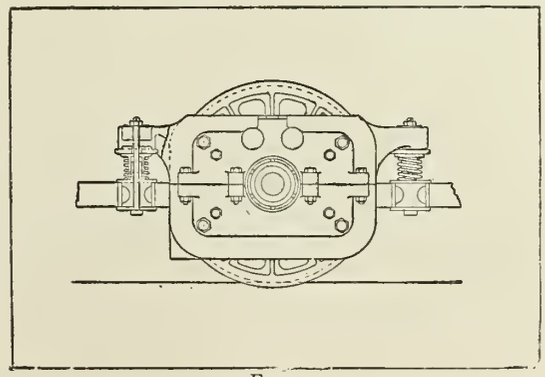


FIG. 5.

It has been urged by some that the gearless motor is more difficult to repair than a reduction motor, and that it is a serious thing to repair an armature bobbin which has been burned out, because the armature will have to be taken out of the machine and the wheels pulled off in order to get at it. By referring to the drawings of the gearless motor it is easy to see that by dropping the lower half of the casing into the pit, it leaves the upper half of the motor carried on the truck frame and by simply raising the car body, the armature can be rolled out from under the car without taking it off the axle or removing the wheels. In practice we should have one of these axles and wheels with the armature all ready attached, to roll back into the place of the damaged armature. Replace the lower casing of the machine and the car can be put immediately into service, and the damaged armature bobbin rewound in its place on the axle, there being no need of ever removing

the wheels from the axle, except when the wheels are worn out and have to be replaced with new ones. The gearless motor armature can be removed from the car by one man in as short a space of time as the geared motor armature cun be removed, and without so much danger to the armature, as it is well protected from abrasion and injury in handling.

To answer the question as to how much current is taken by the gearless motor in operating a car, we have prepared a copy of readings taken from a car in actual service, drawing a trail car. The current readings, also the pressure readings, were taken every half a minute, and from Fig. 6 a very good idea of the amount of current required can be gained. These readings were taken in August on the East Cleveland Railroad, Cleveland, O. On this road the traffic is very heavy, although the grades are light; but by comparing these results with those obtained from single and double reduction you will find that there is practically little or no difference between the current readings. The average readings, however, in the test run with the gearless motor will be considerably lower than those with the geared motor, owing to the fact that we have gotten rid of the gear friction. The gearless motor will coast so easily that on a very slight down grade a car equipped with gearless motor will run up to speed, without any current being used, and in making stops the current is shut off from a gearless car long before it is in a geared motor car. These intervals of the use of little or no current, as compared with the intervals in which there is little or no current used in a geared motor, are very considerable, and represent the extra loss in the gears.

Gearless motor trial — Aug 17th 91 — 2x regular service pulling Trail-car — Temp. 96° F

Time	Cur.	Volts	Remarks	Time	Cur.	Volts	Remarks	Time	Cur.	Volts	Remarks
2:20	33	448		2:44½	16	400		3:13	30	412	
	31	420			9	18	424		6	420	99 amps
	19	424				18	440		4 50	412	To start
	0	428			8	27	428		0	436	
	2 30	416				0	400	3:15	47	420	
	33	400			9	23	400		64	416	
	3 19	424				0	420		6 21	420	
	17	436		2 50	57	400	Start		19	420	
	4				20	380	Coast		7 16	420	
					60	360			16	436	
2 25	16	440			33	396			8 14	420	
	0	400			2 0	400			14	420	
	6 0	440			60	400	Start		9 15	420	
	7 16	448			3 20	420			16	424	
	7 21	441			0	420		3:20	30	436	
	17	444			4 0	360			0	440	
	8 15	424			19	416			1 35	440	
	15	424		2:55	59	334			27	428	
	9 0	420			44	436			2 25	420	
	0	444			6 32	380			0	420	
2 30	18	436			6	400			3 36	448	
	19	436			7 0	0			0	460	
	1 21	424			20	360			41	440	
	28	440			9 - 0	360			30	460	
	2 14	440			70	320		3:25	27	448	
	0	440			9 17	400			22	440	
	3 18	448							6 27	444	
	4 17	420		6:00					24	460	
	17	432							7 15	440	
2:35	17	440			1 27	368			14	448	
	0	440			27	380			8 22	440	
	20	440			2 0	380			27	440	
	6 70	440	Start		21	400			9 16	460	
	132	456			3 0	380			0	460	
	7 24	460			39	360		3:30	0	456	
	40	416			4 41	356			0	440	
	8 57	400			20	380			1 18	420	
	24	436		3:05	50	392			30	420	
	9 77	420	Start		34	360			2 40	420	
	85	420			6 0	426			16	430	
2:40	0	440			72	408			3 17	424	
	37	420			7 31	380			45	429	
	16	448			20	396			4 27	440	
	18	440			8 0	420	Not		14	420	
	2 24	424			50	392	Start	3:35	42	420	Start
	14	424			9 18	408			40	440	
	3 16	424			20	428			6 40	416	
	55	420	Start	3:10	38	400	Pumps		35	424	
	4 20	440			41	396	& Start		7 15	400	
	0	420			55	400			16	416	
2:45	0	420			31	420			8 31	420	
	0	436			2 27	428			35	424	
	6 34	430			70	380			9 0	440	

FIG. 6.

We have carefully tested double reduction, single reduction and gearless cars running on the same track on roads in Cleveland, Ohio, taking at the same time readings of current and pressure, and we have found that in some cases the single reduction would require the least amount of current — sometimes the double reduction and sometimes the gearless, depending upon the number of passengers hauled, stops made, and other things that might come in to consume more or less power; so it is difficult for us to say that there is any difference in actual power consumption between the three classes of machines. The gearless motor is capable of starting loads as quickly as the geared motor, and is capable of starting as heavy a load under similar conditions, and we have a curve shown in Fig. 7 which illustrates the actual horizontal pull of a 20 H. P. gearless motor mounted on 33 inch wheels. In examining this curve, it will be seen that the horizontal effort in pounds when the car is running 20 miles per hour is about 250. In ordinary street car practice we find that it requires about twenty pounds per ton to move a load on street car rails. This means that with a horizontal pull of 250 lbs. this single motor could move a car weighing twelve tons at the rate of twenty miles per hour, or, as the curve will show, that at fourteen miles per hour the motor has a horizontal pull of 700 lbs., or it will move a load of thirty-five tons at the rate of fourteen miles per hour on a level track. This curve is not falling off rapidly — certainly not as rapidly as it would with a geared motor, because the loss in the gears begins to increase very rapidly with the heavy loads.

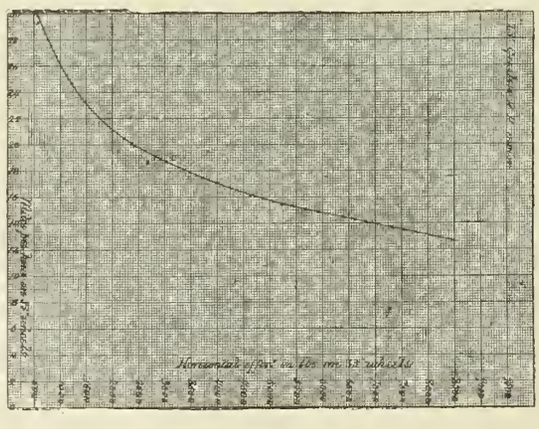


FIG. 7.

You can easily figure from this curve what the motor will do under any conditions of load, grade and speed. The tendency in street car practice is to increase the speed of the cars, and the gearless motor lends itself especially to this end, as we have found that with very rapid speed geared motors wear out the running parts more rapidly and become very much more expensive to maintain, while the gearless motor can operate with as great economy at the slow pace required in crowded streets; it is also capable of running at a very much higher speed in suburban traffic without the slightest fear of damage to the machine. In this respect it makes a very much more flexible motor than the geared machines. You can easily understand that this motor now makes it possible for us to develop large electric locomotives to be used in elevated railway service, and for pulling suburban trains in and out of large cities. From calculations and designs which we have made, we find that the size and weight of the motors required for 200 and 400 H. P. locomotives is not more than is necessary to produce the required adhesion to the rails needed for the required tractive pull to move these heavy trains. The motors are not large comparatively, and their economy will be very great. We believe that this branch of electric railroading will develop rapidly, and that within a few years gearless electric railway motors will be used in places for purposes and in numbers unthought of at the present time.

THE SINGLE REDUCTION MOTOR: BY GEORGE K. WHEELER.

All practical electric street railway men appreciate the necessity of having a motor that shall have the greatest possible degree of self-protection from outside injury. This necessity was evident by the number and severity of the storms of the last few years, and it has been the aim of electric manufacturers to design a motor that would meet the requirements of ordinary street railway service, and so constructed as to be perfectly protected within itself, and to reduce the number of wearing parts, reduce the weight of the motor, and construct a frame of such strength that breakage would be impossible, and to provide a more perfect magnetic circuit than that found in the double reduction motors. The important problems to be solved in making a successful single reduction motor, are as follows:

First, electrical and mechanical simplicity; second, slow speed and powerful torque; third, protection of field and armature from dust and water; fourth, accessibility of all parts of the motor so as to render it easy for repairs and adjustment; fifth, high commercial efficiency at all speeds and loads; sixth, reduction of weight per horse power, developed with a view of lightening the load that must be carried at all times; seventh, small expense of maintenance

There have been various types of single reduction motors placed upon the market during the past fifteenth months, and I must say that some of them have not fulfilled the above requirements. It is my opinion that much better results are obtained by a two pole single reduction motor than by the four pole, for the reason that it is much lighter, simpler in construction, has a smaller commutator, half the number of bobbins on the armature, also half the number of brushes. and is much more economical to maintain. One of the leading electrical manufacturers has produced a motor that, I think, meets all the requirements for ordinary street railway service. This motor is fifteen H. P., weighs about 2,000 lbs. complete, including gear, pinion and gear case. The motor frame is constructed of two castings of steel, clamped together by bolts at the front and back, the axle brasses being held between the two parts. The armature bearings are cast in one piece with the lower half of the frame, and are provided with caps so that the linings may be inspected or renewed without disturbing the other parts of the machine. The frame is hinged together at the axle end so that the upper half may be raised if desired. The lower half of the frame is so constructed that it is perfectly waterproof up to the centre line of armature and axle bearing. All the metal in the frame forms a part of the magnetic circuit, and dead weight is thereby avoided. The armature is a combination of the Gramme and Paccinotti type, and so constructed that it is entirely iron-clad. The iron core is a ring with projecting teeth solidly fastened to the shaft. The coils are wound between the teeth and firmly held in place by wooden wedges. It is not necessary with this form of armature to use the mica, insulating paper, canvas and German silver bands. The winding is continuous, and all joints are made by electric weldings, no solder being used in any part of the armature. The winding is such that there is no crossing of wires, and as it is below the surface of the iron core it is protected from any mechanical injury. This form of armature permits of much less clearance between the armature and pole pieces, and the smaller airgap materially decreases the magnetic resistance of the circuit. This certainly means less weight and less heating of the field spool, and that a smaller motor will perform more work on account of greater efficiency. The field coil (there being but one) is placed at the top of the motor, and in this position exerts upon the armature a solenoidal pull, so proportioned that under normal load the armature is lifted from its bearings. I have had an opportunity of inspecting a set of armature bearings that had been in use upon a motor of this type for several months, and the tool marks in the bearings had not been scored, with the exception of a small spot on the bottom and top of bearing, thus demonstrating that the wear on brasses is reduced to a minimum. The armature pinion and axle gear are made of steel of ample width of face and are run in an oiltight case in order to insure free and continuous lubrication and to exclude dust and grit. As to the exact life of gear and pinion thus enclosed, I am unable to state accurately, but I know of single reduction motors that have been in operation since May 1, '91, so enclosed and running in a light weight of grease, which up to the present time do not show a wear of more than .005 of an inch. It would certainly seem by this that the expense of maintaining the gear and pinion for two motors per car could not exceed $10 per year. The tendency of modern improvement in railway motors is to diminish the gearing, and I do not think that any

thing is to be gained over the double reduction motor by placing two sets of gears and pinions one on each side of a single reduction motor, as it not only increases the friction losses, but adds an additional weight to the motor, and if the motor frame and armature shaft are properly constructed there is no liability of straining or breaking either by reason of placing the gear and pinion on one side only. It is stated by a number of competent electrical engineers that the placing of one motor on a truck is ample for all ordinary street car service. By experience I have found that with a truck having but one motor attached to one axle, the wheels on the axle to which the motor is attached do not brake as quickly as the free wheel, and flats are thus formed on the free wheels on this account; also that it is a difficult matter to ascend grades over 3 per cent., and that it is next to an impossibility to operate a car so equipped, during the winter months. It is also advocated that the proper method is to gear a single motor to both axles; this, in my opinion, is open to serious objections. In gearing a single motor to two axles of a truck, it is almost impossible to keep wheels perfectly true; that is, one set of wheels will perhaps wear more than the other on account of the variation in the quality of the iron, and as soon as one set of wheels is in the slightest way different from the others a bad action takes place between the driving gear and wheel, for the reason that one wheel is trying to run faster than the others, which, of course, naturally will cause one set of wheels to be dragged along until that distance has been overcome, and when the wheels start anew, the gears are in a short time thrown out of mesh with each other. It will be understood that in order to make a successful gear driven by a single motor, it is necessary that both sets of wheels travel exactly with the same speed over the rails, and that the truck on which the motor is mounted must be perfectly rigid, so that the gears will at all times mesh with each other. In practice this has been found almost impossible, especially where heavy work is required and a large number of curves are to be found, and also where the track is in bad condition, excepting possibly when the wheels on the truck are perfectly new, and the track in good shape and the curves very liberal, but it will be found if one set of gearing is disconnected, that it will require from 15 to 20 per cent. less power to operate. It is for these reasons that I believe the best results are obtainable by connecting a single motor to each axle of a truck. It may be argued that there is twice the liability for trouble where two motors are used, but experience proves that this is not exactly so, for by this method you obtain the proper traction and benefit of all wheels, and in case of extra load you have ample power to operate the car under all conditions of service, and in case of injury to any part of one motor, it can be disconnected and the car operated until an opportunity offers to make the necessary repairs.

A single reduction motor should be so constructed as to give the greatest possible distance between the bottom of motor and top of rail. With the best form of motors which have, up to the present time, been constructed, the greatest distance obtainable between a 15 H. P. motor and top of rail is 2½ ins. when placed on a wheel 30 ins. in diameter. I strongly recommend the use of larger wheels, either 33 or 36 ins. in diameter. With a motor mounted on 36 inch wheels, this will give a clearance of 7½ ins., which is more than ample to clear ordinary track obstructions, and if the motor is thoroughly protected in its frame, it will not be necessary to use motor pans, which have been a necessary evil in connection with double reduction motors. It may be stated that a car equipped with 36-inch wheels requires an excessive amount of current to operate, but this is not a fact. On a test which I made more than a year ago on a car equipped with 36-inch wheels and a car equipped with 30-inch wheels, the same motor equipment and car of same length and weight, operated over same length of road on same day and by same man, total length of line being 16 miles, it was found that the car equipped with 36-inch wheels required about three-quarters of one H. P. more on an average than the car equipped with 30-inch wheels, although the 36-inch wheel car required more current in starting and climbing grades, but it would run longer on the level by momentum, and thus average up the current consumption.

With the present form of single reduction motors I think that the 33-inch wheel is of ample size.

On tests which have been made with the best types of single reduction motors, they have been found to be from 8 to 10 per cent. more efficient than the double reduction, and are capable of retaining a much higher speed under various conditions of service. On a recent test which I made on an over-country road, which was some 11⅛ miles in length, the car being 34 ft. in length, and with 25 passengers, the total weight of the car being 23,700 lbs., the car equipped with double trucks having two 25 H. P. single reduction motors to each car, the maximum speed attained was 32 miles per hour, this car climbing grades of 4 and 5 per cent. at the rate of 17 miles per hour, and on a car 16 ft. in length, equipped with one 15 H. P. single reduction motor, the maximum speed attained was 25 miles per hour, on the level, and the car in climbing grades of 4 and 5 per cent. would not attain a speed of over 5 miles per hour.

By the use of single reduction motors the cost of maintenance and operation will be greatly reduced on any road so equipped for the reason that the number of parts has been greatly reduced from that of the double reduction, and its efficiency greatly increased. I am of the opinion that the single reduction has come to stay and will continue to force its way to the front, and eventually supersede the double reduction motors with which the earliest roads were equipped.

Following these papers on April 11 was a debate on the resolution "*That the Trolley System should be used in Chicago.*"

The affirmative was supported by Alex. Dow and Frank L. Perry, and the negative by St. John V. Day and E. E. Keller. F. W. Parker acted as judge.

The arguments both *pro* and *con* were well given, and the points made on each side were appreciated, though the sentiment of the audience was evidently with the affirmative. One of the advocates on this side showed by the stereopticon a view of Indiana Avenue at present, and as it would appear equipped with trolley poles, as evidence that the latter are no disfigurement to the street. Mr. Parker as judge, decided that both the affirmative and negative of the question were proved, and that the trolley system was the best adapted for some of the streets of Chicago, while on some streets another system was preferable.

At the same meeting resolutions were also passed expressing the appreciation by the club of the work done in electrical science by the late Charles J. Van Depoele, and their sympathy with his bereaved family.

Methods of Electrically Controlling Street Car Motors.*

BY H. F. PARSHALL.

While in many respects the controlling apparatus for street car motors and the general requirements of the same do not differ greatly from some other cases, there are some features that demand the closest attention if the car is to be handled either efficiently or comfortably so far as the passengers are concerned. While the number of methods proposed and tried in times past has been great, at the present time there seems to be sufficient agreement between the principal designers and sufficient data at hand to warrant the writing of a fairly comprehensive paper on the subject.

The problem of controlling the motors is probably the most difficult one in the whole range of street car work, and in no small degree determines the electrical design of the motors, or, to be more specific, to start a car under any given conditions of track a certain torque is required. Beyond a certain limit, fixed largely by the convenience of passengers, this torque cannot be exceeded. The smaller the current with which the motor is able to develop this torque, the smaller the rheostat or other starting devices may be and the more efficient the car equipment. Should the motor, therefore, be incapable of developing a comparatively powerful torque per ampere, the amount of energy dissipated either in the magnetic windings, armature windings, or rheostat becomes excessive, the results being the more or less rapid deterioration of these parts.

It may not be out or order here to discuss the design of the motor with reference to getting this torque most efficiently. The average horse power exerted by a street car motor at the car wheel probably does not exceed 20 per cent. of the maximum it is expected to do in starting the car under the various conditions encountered. Now, to get the highest efficiency from a motor run under these conditions, it is necessary to get the highest possible efficiency at that horse power at which the greatest amount of work is to be done, and inasmuch as the loss in the conductors for this horse power is necessarily low (otherwise the motors would burn out in doing the maximum work to which they are subjected), the question does not resolve itself into how to get the least possible motor resistance of armature and magnets, but rather, how to minimize the constant loss of hysteresis, eddy currents and friction. While all of these losses vary somewhat with the speed in series wound motors, the variation of these losses is not great, since for an increased speed there is in general a diminished intensity of magnetization and pressure. To render these losses a minimum, and at the same time to get the requisite torque to handle the car efficiently, there is but one solution; that is, to put the maximum number of turns on the armature compatible with good running as to heating and sparking.

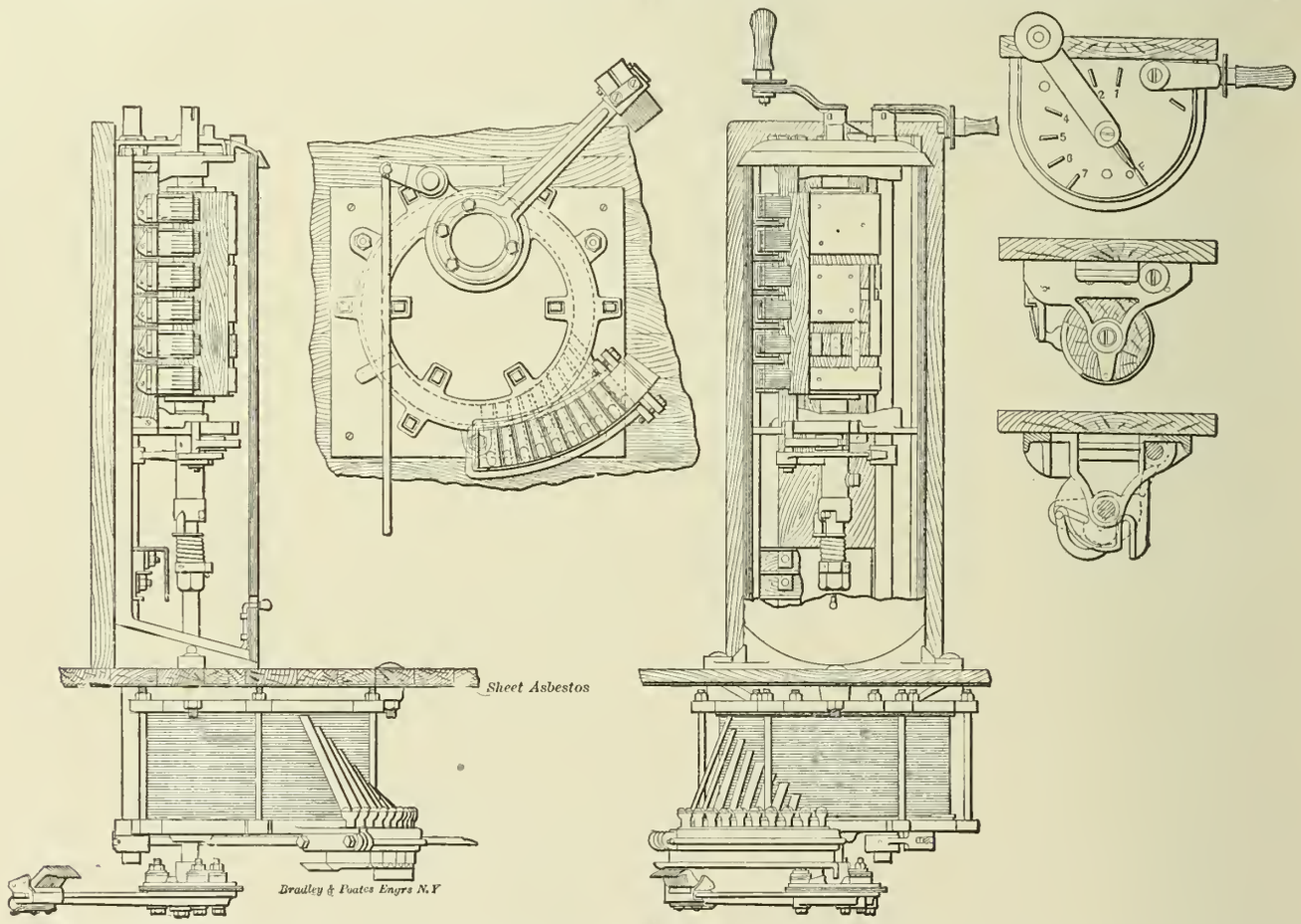
The particular advantages of the commutated field method are, that with a limited number of pounds of copper, or, in the case of street car motors, with the limited space available for field magnet windings, it is possible to adjust the magnetizing force of the field coils so that the rate of doing work of the motors may be made to correspond with the rate this work is required by the car for the various speeds and conditions of track. This adjustment may be made for any size of motor with any required degree of precision by varying the number of magnetic coils. To increase the range or precision it is only necessary to increase the number of coils. In practice it has been found that this number could not be very great, otherwise the car wiring becomes too complicated and too expensive. This same holds true of the controlling switch. Three magnet coils, or sets of magnet coils, seem to be the practical limit, since there is a general agreement between street railway managers that the present number of magnet connections (six) should not be increased, and even with this number there is occasional trouble with broken wires or terminals. With a fifteen H. P. motor it is possible with three sets of coils to run under most conditions met with in practice without employing external resistance. It is occasionally necessary, however, when the car is to be run at two or three miles an hour, to make use of the resistance coil that is ordinarily used only when starting. With twenty-five H. P. motors it is necessary, with three sets of magnet windings, to make use of this resistance coil very considerably in ordinary practice, since without this it is not possible to get a speed of less than one-third of the maximum speed of the car, which is generally taken to be about eighteen miles an hour.

A method that is receiving a great deal of attention now is that known as the "Series Parallel Method." While it has not yet been introduced very largely in practice, numerous experiments have indicated the desirability of doing this as soon as some of the troublesome features of the switch have been overcome. The method of operating is as follows:

*Abstract of a paper read at the sixty-sixth meeting of the American Institute of Electrical Engineers, New York, April 19th, 1892.

In starting, a rheostat of from eight to twenty ohms is used, according to circumstances, in series with the motors, which are in series with each other. After this resistance is thrown out of circuit the magnet coils of one of the motors are short circuited, a section at a time. To make the start smooth, three or four coils at least are required. The magnet coils being short circuited, the armature is then short-circuited, and the magnet coils thrown in circuit simultaneously with the armatures being thrown in parallel. It is just at this point where the difficulty with the switch has been encountered, since either the switch has to be operated with great rapidity or the contacts act in perfect unison, otherwise unpleasant results as to short-circuiting occur.

The advantages of the method are that a very wide range of speeds is obtainable at a comparatively high efficiency, and that the energy required to be dissipated by the rheostat is small for the low speeds frequently required in city practice. This lessening the duty of the rheostat is a very important point, since as yet it has been found exceedingly difficult to construct a cheap rheostat that could be placed under the car in the small space available and dissipate so large an amount of energy as is required when the car is to be run for a considerable time at a speed as low as two or three miles an hour. Any method of control that has lessened the energy to be dissipated in the rheostat has in general been considered with favor, since there has been a corresponding diminution of trouble in each case that the energy to be dissipated has been lessened.



Having now given a general discussion of the problem a brief description of some of the apparatus recently devised may prove of interest.

The cut shows the general design and arrangement of an improved form of platform switch, which combines both the "field commutation" and the "series resistance" methods of starting cars. To start the car, the switch handle is turned from the position marked "off" with a counter clockwise movement; this movement carries the arm of the rheostat, which is placed under the switch, around and over the contact segments, so that the resistance is gradually cut out of circuit. After the contact arm has been carried around to 135 degs. and all the resistance has been cut out, it is released from the cylinder shaft and left locked in this position. A further movement of the switch handle then affects only the cylinder, and commutates the sectional windings of the field magnets of the motor from series to parallel in the usual way. In stopping the car the field coils are turned from parallel to series, the resistance coil is then again put into circuit and the circuit broken when the contact lever leaves the lest segment of the resistance coil, and not, as hitherto, upon the cylinder contacts. The only caution to be observed in stopping is to see that the switch handle shall be turned to the position marked "off," for the motors are reversed by means of a separate reversing switch placed under the car and operated by a lever connecting with a separate shaft in the controlling switch case. The shaft of the platform switch interlocks with this reversing shaft in such a manner that it is impossible to reverse the motors until the cylinder is in the "off" position. The use of this separate controling switch has been objected to, but to combine both the advantages of the rheostat and commutated fields the switch mechanism becomes too complicated and the switch too large to have the reversing performed by a reverse movement of the controlling switch handle.

It is to be noted that the general design of this rheostat is such that those parts having mechanical functions and energy dissipating functions have been separated as much as possible. Of course the mechanical functions of a rheostat are more or less limited; it is evident, however, this effort is in the right direction. It is with respect to this particular point that the rheostat has a decided advantage over any form of mechanical clutch in starting a car. The clutch, of course, has its advantage in starting quickly bodies that have a great amount of inertia. In ordinary practice, however, the amount of energy dissipated in a clutch is approximately equal to that necessary to dissipate in a rheostat, but the clutch has, in addition to its energy dissipating function, a very exact mechanical function, and these two functions are interdependent on the same wearing parts. For this reason, if no other, clutches have not yet been made to compete favorably with rheostats.

An important point that has been attended to in this switch is the breaking of the circuit on a separate switch instead of on the cylinder. A snap switch, of the knife blade pattern, is employed to break the circuit at four points. It operates in connection with the cylinder shaft to which it is connected with a special locking and releasing gear of similar design to that shown in the cut. The first movement of the cylinder shaft closes the snap switch and completes the circuit through the coil. Further movement then disengages the snap switch from the shaft (leaving it closed) and the different commutations are affected. When breaking the circuit the snap switch is again brought into action.

When this form of car controlling switch is used, the platform lever is fitted at its lower end with a bevel gear wheel meshing into another gear wheel placed on the cylinder shaft. When necessary, an extension shaft fitted with one or more universal joints, makes connection between the platform lever and the cylinder shaft. When this switch is placed in the middle of the car, the amount of car wiring is materially lessened and the car inspection made more easy.

THE Short Electric Railway Co., of Cleveland, have made a change in the location of their New York office. Having found their somewhat limited quarters in the *World* Building too small for their purposes they have opened an office in the Mills Building, 15 Wall Street. At this office will be found, hereafter, the same genial and gentlemanly representatives of this enterprising electric railway company, Messrs. E. J. Wessels, manager of the office, and Mr. C. C. Curtiss, confidential agent of the company, who have represented them before and who are rapidly making themselves a power in the street railway fraternity of New York and New England.

Short Electric Railway Notes.

The New York special agent of the Short Electric Railway Co., Mr. E. J. Wessels, has recently returned from a business trip throughout New England, and reports much interest in apparatus manufactured by the Short Electric Railway Co. in that section. As a practical result of his trip he returned to New York with orders representing no less than fifty-two motors, the first, we believe, of the kind which will be installed in New England. The New Haven & West Haven Street Railway Co, of New Haven, Conn., head the list with an order for nineteen single equipments of twenty-five H. P. single reduction motors and seven double equipments of the same type. This railway company have long been anxious to install electric motors, but have only just received the requisite permission from the municipal authorities. Work has been begun and the road will be equipped as rapidly as possible. The order for the engines and generators has been placed with Westinghouse, Church, Kerr & Co., who will supply three of their large size direct connected engine and generator units. The power station will be at about the middle of the line on West River.

Next on the list appears the name of the Norwich Street Railway Co., who have ordered fifteen twenty-five H. P. single reduction motors, and this road will be changed from a horse to an electric line as rapidly as possible. The power station will be located at Taftsville. The third name on the list which Mr. Wessels brought back with him is that of the Natick (Mass.) Street Railway Co., who have requested the Short Electric Railway Co. to supply them with four twenty-five H. P. single reduction motors. Mr. Wessels says that the outlook in the street railway line in New England is very bright, and expects to do a large business in this territory.

For these three orders, aggregating fifty-two motors, the Short company promise prompt delivery, and it is expected that all three roads will be using their summer apparatus early in June.

The Short Electric Railway Co. also announce recent sales to the Braddock Electric Railway Co., Braddock, Pa.; the Union Passenger Railway Co., Chester, Pa.; the Ft. Wayne Electric Railway Co., Ft. Wayne, Ind., and the Schuylkil Electric Railway Co., Pottsville, Pa.

The Short Electric Railway Co. are now shipping to Siam the entire installation of the first electric tramway in that country. The name of the company who are the purchasers is the Bangkok Tramways Co., and the road, which is six miles in length, is practically level and most interesting throughout its entire length, crossing fourteen of the many canal bridges in Bangkok. Teakwood poles will be used in construction throughout—in fact, all wood used in construction with the installation will be teakwood. Included in the equipment are generators, two steam plants complete, six car equipments and extra parts. The order is the outcome of the visit to this country of Mr. Aage Westenholz, who made a thorough examination of electric railway apparatus, both in Europe and in this country, visiting all the large manufacturing companies and the most successful of their plants.

The Fort Wayne Electric Railway Co., of Fort Wayne, Ind., is one of the most recent corporations to adopt Short motors, and their decision to install electric power is all the more interesting because the principal owners are also largely interested in the cable railway at Cleveland. The order for apparatus includes twelve car equipments complete, comprising fourteen twenty H. P. single reduction Short motors, and ten miles of overhead construction. Shipment of apparatus is already begun, and from the vigorous manner in which the Robisons are pushing the construction work, it is expected that the road will be completed and in operation by June 1.

One of the most successful railways ever installed is that operating between East Liverpool and Wellsville, O. It will be remembered that this road, which consists of eight miles of overhead construction and operates eight cars, was completed in exactly three months from the day when the ground was broken. Mr. Al. Johnson, an indomitable worker, personally superintended the installation, and the road, as might be expected, is furnished throughout by the Johnson Rail Co. A full description of this road was given in our January issue just after trial trips had been made.

The success of the road from the start was assured, and the company, consisting of Mr. Al. Johnson, Mr. S. H. Short and Mr. C. E. Grover, all of Cleveland, have been obliged to double the equipment in order to accommodate the summer travel. The J. G. Brill Co. are just completing eight fine open cars, somewhat unusual in the fact that they are eight instead of seven bench cars, and for these cars the Short Electric Railway Co. of Cleveland, O., will furnish sixteen 20 H. P. single reduction motors and two additional 133 H. P. generators.

E. H. Jones & Co. of Cleveland, who put in the first steam plant, are also doubling their part of the equipment.

It is a curious fact, to be explained only by the character of the manufactories in Wellsville and East Liverpool, that these towns, the total population of which is 16,000 people, can support a street railway system larger than that to be found in some cities of 40,000 and 50,000 inhabitants.

Refunding Street Car Fares.

A suit of more than usual interest to street railway companies, although the amount involved was extremely small, was brought against the North Side Railroad Co., Chicago, in a justice's court. There were seven complainants. They had boarded a Clark Street car bound south. At Chicago Avenue the cable broke, and the passengers were offered transfers good on the Wells Street cable line two blocks distant. The seven men who figured in the suit refused the transfers, and demanded the return of the fares which they had paid the conductor. Naturally, the latter refused to refund the money, but offered the transfers. Suits were then brought, and each complainant wanted, in addition to five cents, the sum of $2.00 to pay for wear and tear of shoe leather and the injury wrought to his feelings. Attorney Johnson who represented the company asserted that when the company accepted a nickel from a passenger that fact did not oblige the company to carry the passenger on that particular car only. That in the event of a breakdown, transfers on other lines were given. Neither was there any contract, according to Mr. Johnson, to land a passenger at any particular point by any particular car unless the latter insisted upon such an agreement when he entered the car.

Justice Wallace decided that the company must refund the nickels and pay $3.75 into the court as costs in one case. In the other cases the complainants failed to appear, or the complaints were thrown out on technicalities. An appeal was taken.

The University of Wisconsin, at Madison, Wis., has just issued a circular of its engineering school, containing an outline of the courses open to students there. We are pleased to notice that in the electrical engineering department, which is in charge of Prof. D. C. Jackson, considerable attention is devoted to the study of the special conditions arising in electric railway engineering and that this institution recognizes the call for trained experts in this branch of electrical work.

The electric railway company of Lexington, Ky., seem to be prolific of novel ideas. In a recent issue mention was made of the company's plan of interesting the public in taking care of fare receipts. Since that time it has been decided to carry weather signals on the cars.

The Thomson-Houston Electric Co. have received an order for fifty car equipments from the New Orleans & Carrollton Railway Co. The construction will be done by J. G. White, of New York.

Obituary.

STEPHEN T. POPE.

The death of Stephen T. Pope, superintendent of the Chicago City Railway Co., is announced. Mr. Pope was born in Dorchester, Mass., and was graduated by the Massachusetts Institute of Technology in Boston. For many years he was superintendent of the Chicago Division of the Chicago, Burlington & Quincy road. Mr. Pope was appointed to the superintendency of the Chicago City Railway Co. about a year ago, but for a short time only performed the duties of the position. Failure of health necessitated a trip to California, and his death occurred in that state.

COL. CALVIN GODDARD.

Col. Calvin Goddard, president and manager of the Chicago & South Side Rapid Transit Co., died April 4, at San Francisco. About a month previous to that time he had left Chicago for a rest, as he was entirely broken down by overwork. Col. Goddard was fifty-five years of age at the time of his death. He was born at Norwich, Conn. He entered on his business career in Chicago, and was assistant cashier of a bank in that city when the war broke out. He immediately volunteered his services and went on the staff of the governor of Ohio as adjutant. While in West Virginia he met Gen. Rosecranz and joined his staff, soon becoming adjutant-general of the Army of the Cumberland, being the youngest man to hold that position in the national forces. He was with Rosecranz both at Vicksburg and Chattanooga. After the war he accepted the position of treasurer for the Wells, Fargo & Co. express, and later held a similar office with the New York & New England railroad company. He was connected with the first Edison company. He was the president from the time of the organization of the Chicago & South End Rapid Transit Co. Until two years ago he had resided, since the war, in New York, but then he moved to Chicago.

A Valueless Franchise.

The Union Railway Co., of Providence, R. I., which controls all the street railway business of the city, being desirous of equipping its lines for electric traction, recently tried to negotiate $3,000,000 of bonds upon its property and franchise, but found that no financial institution in the country would have anything to do with them, owing to a clause in the charter, which reserves to the City Council the right, on giving ninety days notice of its intention so to do, to annul, amend or alter the terms and conditions upon which the company is authorized to operate its lines of road, and to order the rails or any part to be taken up and the streets restored to their original condition.

In order to secure an amendment to the charter and give it value, the company has petitioned the legislature for an extension of time to twenty years, and while the objectionable clause is allowed to remain, it is supplemented with the provision that an equivalent location be provided in another street.

The history of the case is fully set forth in the following communication recently presented to the City Council of Providence by the Union Railroad Co. The communication is not only interesting in the features relating to the franchise, but also for the endorsement given to the value of electric traction :

"Your honorable body is familiar with the urgent needs of this community in the matter of improved facilities for the rapid transit of passengers. It is universally conceded that the future growth and prosperity of the city depend in a very great measure upon the early and successful solution of this question.

"This company, after a careful study of the situation, in the summer of 1890, applied to your honorable body for permission to use electricity as a motive power under the trolley system on all its lines. After prolonged discussion permission was granted it to inaugurate that system on the Broad Street route, where it has now been in successful operation for a number of months. The opposition to it entertained by many good citizens prior to its introduction *has now substantially disappeared in the light of practical every day experience of it in our midst.* One has only to take a trip over Broad Street to see the marvelous improvements already called into being by that line. Similar results will undoubtedly be produced by other lines in other parts of the city. The great mass of our citizens are awake to this fact, and this company is now in almost daily receipt of applications and requests to extend the electric service in other directions.

"We are desirous now, as in the past, of giving to the public a street car service as good as the best in the land.

"One thing we have learned by experience, however, is that to replace horses with electricity means, in effect to throw out our entire present plant and replace it with a new one; the roadbed must be rebuilt and relaid with heavier rails; larger, heavier cars of different construction must be provided and new car houses built to meet their requirements. Besides this there is the matter of electric construction and power.

"A conservative estimate shows that it will cost this company not less than $2,000,000 to equip its system for operating by electricity. It is obvious that the only way to raise this large sum of money is on bond and mortgage. Such bonds would have to be sold in the great financial centres of the country.

"Negotiations have been had with bankers and institutions, both here and elsewhere, with a view to placing the first mortgage bonds of this company, with the uniform result that the gentlemen applied to have declined to entertain the matter."

Their reasons for this are set forth in a number of letters, two of which are quoted as a fair sample of all :

NEW YORK, April 12, 1892.

"JESSE METCALF, Esq., President Union Railroad Company, Providence, R. I.

"DEAR SIR :—We are in receipt of your favor of the 11th inst., with enclosures as stated. While the bonds of such companies as yours would undoubtedly otherwise be considered a good investment, it is proper for us to state that the clause of the charter empowering the City Council in giving ninety days notice of its intention so to do, to annul, amend or alter the terms and conditions upon which your company is authorized to operate its lines of road and to order the rails or any part to be taken up and the streets restored to their original condition, etc., would naturally make any conservative person hesitate to purchase them. Under existing conditions we beg to say, frankly, that we shall not ourselves care to undertake their negotiation.

"Regretting that we are not able to make you a more satisfactory answer, we remain, yours truly,

MORTON, BLISS & Co.,

NEW YORK, April 12, 1892.

"JESSE METCALF, ESQ., President Union Railroad Company, Providence, R. I.

"DEAR SIR: We are in receipt of your letter of the 11th inst., enclosing balance sheet and synopsis of charter of your company and the city ordinances controlling it.

"We can understand how, with local ownership of capital stock, your company can have grown up under the extraordinary conditions of city control which appear in the rules and regulations of which you give an abstract, but we say without hesitation that it would be entirely impracticable to place in this market the proposed new mortgage or any considerable part of it, excepting under such concession from the city as will give assurance of permanent occupation of the existing and proposed lines, without the reserved right to the charging City Council to practically destroy the value of the property at any moment it pleases.

"Capitalists always regard with timidity securities, the existence of which depends largely upon the judgment or caprice of politicians, and it is certain that the ordinances which you quote place in the hands of the city authorities a measure of power which practically prohibits the creation of a mortgage good enough to recommend to investors.

"We regret to have to send you this adverse opinion, but we feel sure that an essential modification of the franchise will be necessary to enable you to make a good bond. Yours truly,

"H. C. FAHNESTOCK, Vice-President."
First National Bank.

"In order to obtain the money necessary to carry out the improvements which are demanded in the immediate future by the citizens, this company finds itself, therefore, under the necessity of applying to the General Assembly for such legislation as shall be required to do away with the features objected to. It is believed that the objectionable clauses are of theoretical rather than real value to the city. To order up the rails of the street car lines out of the streets would create a revolution in the entire life of the people. The citizens would not tolerate it. The right to order up the rails can be of value to the citizens only in exceptional cases where owing to changing conditions, the rails are no longer desirable in some particular locality. This must have been the intention in framing the law as it now stands. A reservation of a right to order up the rails in a street, provided an equivalent location be given elsewhere; would not be objectionable to bondholders, and would answer all the requirements of the city."

"We beg herewith to give notice to the city of our intention to make this application to the Legislature at once, and to request your Honorable Body to co-operate with us in obtaining the needed legislation, which will so manifestly inure to the benefit of the city as well as of this company.

"In order to prevent any possible misunderstanding, we will add that it is not our purpose to ask for any legislation that will in any way interfere with the entire control by the city over the speed and running of the cars and other police regulations in the streets as at present; nor with the right and power of taxation by the city; nor with the right, and power of the city to grant franchises and impose payment therefor under the provisions of the "Franchise act," so called. Respectfully submitted,

Union Railroad Co.,
JESSE METCALF, President."

Annual Report of the Thomson-Houston Electric Co.

The annual meeting of this company was held at Middletown, Conn. during the past month. The old board of directors was re-elected and the report of the company's finances and business for the year ending February 1, 1892, was presented by Vice-President Coffin.

The following board of directors was elected: H. A Pevear, C. A. Coffin, J. I. Smith, B. S. Spinney, C. H. Newhall, S. A. Barton, E. Griffin, S. E. Peabody and T. J. Coolidge, all of Boston.

The report contains many interesting figures regarding the business of the past year. Owing to the extremely depressed and precarious condition of the commercial interests of the country at the opening of the year an essential decrease in the business of the company was experienced during the first few months of the year, particularly in that portion derived from the local lighting organizations operating from central stations.

The number of street railway companies operating and under contract, reported January 1, 1891. was 145; added during the year, 59; total, January 1, 1892, 204, employing altogether nearly 3,000 cars, with an aggregate mileage of about 2,500 miles.

The annual report shows the income for the year ending January 30, 1892, after deducting dividends paid, to be $1,524,414.25 and the total surplus account $7,546,947.96.

Street Railway News.

General.

Brooklyn, N. Y.—Last month a fire broke out in the Atlantic Avenue Railroad Co.'s stables and did damage estimated at $7,000.

Chester, Pa.—The Union Railway Co. have awarded the contract for building ten new cars for the trolley system to the J. G. Brill Co., of Philadelphia. The contract for building the two engines and boilers for the operation of the plant has been awarded to Robert Wetherill & Co., of Chester. The company will probably give the rail contract to the Johnson Co., of Johnstown. The electrical equipment is to be put in by the Short Electric Railway Co., of Cleveland, O.

Chicago, Ill.—The cable cars of the North Side system were delayed recently by an unusual accident. A horse in some way caught his shoe in the slot, and so tightly was it wedged that it was found necessary to pry off the slot rail in order to release the animal.

THE Lake Street Elevated Railroad Co., of Chicago, have filed a certificate stating that the capital stock has been increased from $3,000,000 to $5,000,000. The money is to be used in extending the system. It is assumed that the increase in capital stock means that the negotiations by New York capitalists for the purchase of the road are now abandoned. The representative of the New York syndicate objected to the road for several reasons, the chief of which consisted in the fact that the terminus of the road was on the West Side and not within several blocks of the heart of the city.

Detroit, Mich.—The Supreme Court has recently handed down a decision which is of interest to street car companies. A suit was brought by Clara L. Rosher against the East Detroit & Grosse Pointe Railway Co. While the plaintiff was driving in a buggy on the tracks of the defendant the vehicle was struck by a car. She was injured, and claimed damages to which the Appellate Court finds she is entitled. The court holds that she was not negligent in driving upon the track, nor was a trespasser. The question whether, being on the track, the plaintiff used reasonable diligence and ordinary care to prevent a collision, was one for the jury to determine. Street cars have precedence necessarily in the portion of the way designated for their use. This superior right must be exercised, however, with proper caution and due regard for the rights of others, and the fact that it has a prescribed route does not alter the duty of the company to the public who have a right to travel upon its track until met or overtaken by its cars.

THE Board of Public Works, in a communication to the Detroit Citizens' Street Railway Co., refuse to sanction the overhead electrical system. The company, however, will make the attempt to equip their Jefferson Avenue line so that if rapid transit is not adopted it will not be their fault.

Elmira, N. Y.—A syndicate composed of the mayor and a number of bankers and capitalists of this city, have just obtained control of the Elmira Water Works, the Elmira Electric Light Works, the Electric Street Railway system of thirty-three miles and the Inter-State Fair Association, which will be put under one management as the Elmira Municipal Improvement Co.

Hamilton, Ont.—The street railway injunction has been dissolved and the street railway company have awarded their contracts for electrical equipment. The Eastern Electrical Supply Co. will furnish the poles, etc., the Edison General Electric Co. the feed wire, John A. Roebling's Sons Co. the bare copper wire, J. Cooper & Co. the iron wire, the Westinghouse Electric & Manufacturing Co. the motors and generators, and Ahearn & Soper the labor and work of construction.

Lynn, Mass.—The Lynn & Boston Railroad Co. are erecting a handsome brick power station on lower Washington Street. By June 1 it is hoped to have it equipped with three 350 H. P. Watts-Campbell engines and Babcock & Wilcox boilers, also three 350 H. P. multipolar generators of the Thomson-Houston type. As soon as this plant is in operation several additional lines in Lynn, now running with horses, but equipped for electricity, will be furnished with electric cars.

New Bedford, Mass.—James Irvine of the New York Equipment Co., has purchased a controlling interest in the Union Street Railway Co.

New York, N. Y.—A big street railway deal has been brought about by the Widener-Elkins-Lamont syndicate, by which seven New York City railroads are consolidated under one management, the title being the Metropolitan Traction Co. and the president John D. Crimmins, the contractor. The combination at present consists of the Broadway Cable Road, Broadway & Seventh Avenue Line, Chambers and Twenty-third Street Crosstown lines, Ninth Avenue, Sixth Avenue and the Auenue C lines, but it is the intention of the new company to obtain control of the entire surface car system of this city, overtures with that end in view having been made. President Crimmins will have as his associate officers Henry Thompson, vice-president; Daniel S. Lamont, secretary; Thomas F. Ryan and Daniel B. Hasbrouck, treasurers.

Pittsburgh, Pa.—The Duquesne Traction Co. are making a car wheel which, they think, competes favorably with anything in the market. If successful, the wheel will probably be adopted for all their cars. Mr. George Rice has now no connection with this company.

San Diego, Cal.—The San Diego Electric Railway Co. have commenced work on the electric equipment of their road. This company take the place of the old San Diego Street Car Co., which went into the hands of a receiver some time ago, and whose property was sold to A. B. Spreckels of San Francisco last October. Joseph A. Flint, who has acted as receiver for the old company, is secretary and treasurer of the new company.

San Francisco, Cal.—A very quick piece of cable construction was performed recently on the Sacramento Street branch of the Ferries & Cliff House Railway. The length of line was 2,800 ft. of single track with concrete roadbed, and the entire work was completed in seventy days from the time of commencement. The work was under the charge of Mr. Howard C. Holmes.

Toronto, Ont.—A deputation of aldermen have been inspecting the various electric systems in the United States in order to determine on the one most suitable for Toronto. The City Engineer has reported in favor of the trolley, but the Council wanted more information in regard to the storage battery. Detroit, Cleveland, Pittsburgh, Washington and other cities were visited.

THE company will have thirty new open cars ready to go out by May 1, and have twenty box cars now in course of construction and it is proposed to give a better summer service than ever before. Though the snowfall has been considerable during the past winter, no difficulty has been experienced in operation and the receipts have shown good gains over the previous year, the increase for the month of March being $8,638.97. The average earnings per car mile for the same month was 14.5 cents, the total car miles being 413,434. The company has over 1,400 horses at present, but they will soon have to give place to the electric motor.

Extensions and Improvements.

Atlanta, Ga.—THE Consolidated Street Railway Co. have asked permission to operate a double track electric line on Peachtree Street.

Brockton, Mass.—The East Side Street Railway Co. have petitioned for authority to extend their tracks from Centre Street at Quincy Street, to the Abington line.

THE Industrial Improvement Co., of Boston, expect to extend their street railway here to Holbrook, and will then build a line from Holbrook to Braintree to the Boston & Quincy line, which practically connects with the West End Street Railway of Boston.

Buffalo, N. Y.—Franchises lately put up for sale were all bought by the Buffalo Railway Co., the only bidder. The bid put in by Manager H. H. Littell was on the percentage plan, approved by the citizens' special committee and adopted for the whole system: 2 per cent. of annual gross earnings upon less than $1,500,000; 2½ per cent. when under $2,000,000 and over $1,500,000, and 3 per cent. when over $2,000,000. The company promise to conform to the various conditions of the general agreement.

Cambridge, Mass.—The West End Street Railway Co. have applied for the right to operate their electric system on Harvard Bridge and its approaches.

Charlottesville, Va.—Since the opening of the street railway in June, 1887, this city has doubled its population and area. The building on the line and at either end has been remarkable, and the undertaking of the street railway (which was considered by many a foolish thing) has proven to be one of the best investments, and increasing in value each year. The cars only run six days in the week, and yet the company have been offered four times its cost for the road. George Perkins has recently been elected secretary. The company expect to extend their line in May, and will want two cheap second hand, open, one horse cars.

Chester, Pa.—Media and Chester will be connected by a trolley railroad this summer. Samuel A. Dyer, president of the Union Railway Co., appeared before the Borough Council last month and asked for concessions, which were promptly granted, and he has signed a contract for the construction of the road.

Chicago, Ill.—The Calumet Electric Street Railroad Co. will extend their line from the terminus of the Cottage Grove cable line at Seventy-second Street to Burnside, at Ninety-third Street. This will be a distance of about three miles.

THE Calumet Electric Street Railroad have begun the extension of their lines from the terminus of the South Side cable system at College Grove Avenue and 72d Street. The road will build extensions

aggregating eighteen miles during the present year. The three miles of line on which the company are now at work will, when completed, give communication up South Chicago Avenue to Jackson Park, between Chicago and South Chicago, Pullman, Grand Crossing, Burnside and Dauphin Park.

The West & South Towns Street Railway Co. have asked for a permit to lay tracks on Twenty-second and May Streets and on Lawndale Avenue, making six miles of road. The application states that the company have decided upon using the overhead system of electricity, and will use, if permitted, an eighty pound girder rail.

Covington, Ky.—The new management of the Cleveland syndicate, who have purchased the street railway system, will at once begin the work of repairing the road. The iron rails are to be changed and the lines extended to Latonia, Ludlow, Milldale and to all the flourishing suburbs of Newport and Covington.

Denver, Colo.—The Tramway Co. expect to convert the Broadway and Colfax Avenue lines into electric lines.

Fort Wayne, Ind.—More double tracks are wanted by the Fort Wayne Street Railway Co., for their new electric system. An ordinance has been presented to the Council, to permit the company to extend their system.

Grand Rapids, Mich.—The Township Board has granted the Consolidated Street Railway Co. a new franchise to Reed's Lake from the city limits.

Jersey City, N. J.—The Jersey City & Bergen Railroad will extend the Newark Avenue horse car line from the Five Corners to the Hackensack River.

Kansas City, Mo.—The Northeast street railway have made a contract with the American Car Co. of St. Louis to build six eight-seat open cars for summer travel. They will be put on the road early in June. The tracks on Independence Avenue from Grand Avenue to Highland Avenue, will all be rebuilt. Steel curves and switches will be put on all parts of the road, and some of the tracks in Pendleton Heights will be relaid.

La Crosse, Wis.—An ordinance now being considered by the Council grants to the La Crosse City Railway Co. the exclusive right to construct and operate electric railways upon all their lines now operated with animal power, and in all streets which the Common Council may designate. This right to continue until June 1, 1927, a period of thirty-five years.

Lansing, Mich.—The Lansing City Railway Co. are about to build a new power house, and have asked for bids.

Marlboro, Mass.—A bill has been reported by the Legislative Committee authorizing the Marlboro Street Railway Co. to extend their tracks to Hudson and Westboro, or either of them. It requires the company to use the overhead electric system.

Memphis, Tenn.—The Citizens' Street Railway Co. will this summer extend their lines to the grounds of the Memphis Fair and Exposition.

THE City & Suburban Railway Co. are having four elegant open motor cars made, and they will be received and put on the lines by May 15. They will seat about forty people each. Work is being pushed on the Raleigh electric road and it will be completed some time in June. The East End dummy line are contemplating some great improvements this summer. It is understood that work will shortly commence on equipping the line with electricity.

Milwaukee, Wis.—The Villard syndicate will extend the National Avenue line this summer. This is the line that it is expected will be extended to the State Fair grounds.

Montreal, Que.—A syndicate, which includes H. E. Everett, who controls the Toronto street railways, has acquired a controlling interest in the Montreal street railway, and purposes to introduce an electric system

New Bedford, Mass.—The Union Street Railway Co. are making an extension of about three-fourths of a mile to their line and are laying a fifty-six pound T rail.

New Orleans, La.—Lately Comptroller Thoman sold a franchise at public auction to Mr. Judah Hart for the right of way for a street car service, for twenty-five years, over a number of streets. The work of construction is to begin within two weeks from the signing of the contract, and to be completed within a year from the same date. A bond of $50,000 is exacted.

Newark, N. J.—The New Jersey Traction Co. have asked for the privilege of laying double tracks on Bank Street and Central and Fifteenth Avenues. This company intend to connect Elizabeth and Newark by electric cars before the summer is over.

Newton, Mass.—Two petitions were received recently by the aldermen from residents in Newton Centre and Newton Highlands asking that a franchise be granted to the Newton & Boston street railway to extend their route from the Centre to the Highlands.

North Woburn, Mass.—The North Woburn Street Railroad Co. will equip their line with electric power. The company have about seven miles of track, with termini at North Woburn and Medford.

Oakland, Cal.—An ordinance has been introduced in the Council supplementing the permission heretofore granted to the Consolidated Piedmont Cable Co. to construct, maintain and operate a street railroad on Washington Street and to provide for and require the running of a continuous line of street cars thereon from First to Fourteenth Streets.

THE Oakland Consolidated Street Railway Co. have asked for a franchise to run cars to Mountain View Cemetery.

Peoria, Ill.—The Fort Clark and the Peoria Rapid Transit railroad companies will, it is said, shortly equip with electricity.

Pittsburgh, Pa.—A number of improvements in the way of increased facilities for carrying passengers will be made during the coming months by the Pittsburgh and Duquesne traction companies. Two new lines will be opened this spring. One will be an extension of the Lincoln Avenue branch out Deary Street and Larimer Avenue and across the Larimer Avenue bridge. The other branch will start at the junction of Fifth and Penn Avenues, go out Fifth Avenue under the Pennsylvania Railroad out Hamilton Avenue. Thirty new summer cars will be placed on the Duquesne line. They will be four feet longer than the present cars, with closed front and back, and with the seats back to back. On the Fifth Avenue line a double deck car will be tried.

H. SELLERS MCKEE has awarded the contracts for the Homestead extension of the Birmingham road. It will be a five mile double track road.

A SYNDICATE of property owners, among whom are J. B. Dewhurst, Sullivan Johnston, E. T. Earle, Fred. Schwitter and James Breen, have organized for the extension of the Perrysville electric line from the city line at Jacob Born's tavern to Perrysville, a distance of two and a half miles. The intention is to have the Federal Street & Pleasant Valley Co operate the new road, or to effect some traffic arrangement by which the cars of the new line will have the use of the Pleasant Valley tracks.

Reading, Pa.—The Reading & Southwestern Railway Co, want the privilege to extend their tracks from Third and Penn Streets over a number of streets to North Reading.

St. Louis, Mo.—Bills for the extension of the Citizens' and Northern Central roads and change of motive power to electricity for the latter road and the Cass Avenue and Union lines have been signed by Mayor Noonan. The reconstruction of the three last named roads will begin at once and will be operated by a 2,000 H. P. plant to be erected on the site of the Northern Central Railroad stables.

San Francisco, Cal.—The Ferries & Cliff House Railway Co. have purchased the franchise known as the Eisner & Reinstein franchise, which was granted about two years ago with the privelege that cable or electric motors might be used on D Street. Work on the proposed branch will be commenced immediately. In due time it will be extended to the beach.

Sandusky, O.—The People's Electric Railway Co., the opening of whose line is fixed for May 1, contemplate extending it twelve miles to Milan.

Steinway, N. Y.—At a meeting lately of the directors of the Steinway & Hunter's Point Street Railroad it was decided to change the name of the road to the Steinway Street Railroad. George A. Steinway was elected president, Henry Ziegler vice president and Harry De Low secretary and treasurer. It was resolved to extend the railroad from Long Island City to Flushing, and that the trolley system of electric cars should be substituted for the present horse car system. The building of the electric road from the car stable in Steinway to Ninety-second Street ferry will be commenced immediately. The company have been capitalized in the sum of $2,500,000.

Stoneham, Mass.—The East Middlesex Street Railway Co. have petitioned for a right to operate the electric system in the town.

Washington, D. C.—The Washington & Georgetown Railroad Co. have been authorized and required to ex end their tracks from High Street, in the city of Georgetown, and west along M Street to Aqueduct Bridge. The changes are to be made and cars operated on the extension of the line by December 1, 1892.

SENATOR MANDERSON has introduced a bill to change the name of the Capitol, North O Street & South Washington Railway Co. to that of the "Belt Railway Co.," and to authorize the extension of the company's tracks over various streets to the company's present line on Seventh Street. To construct this extension the company are authorized to increase their capital stock in a sum not greater than $100,000.

Waterbury, Conn.—The Waterbury Horse Railroad Co. are making preparations for more rapid car service on the South Main Street line in anticipation of the summer travel.

Worcester, Mass.—The City Council lately gave a hearing on the petition of the Worcester Consolidated Street Railway Co. for location of electric railway tracks in Summer Street. This brought out the fact that four other companies want the location.

New Roads.

Atlanta, Ga.—The North Atlanta Electric Car Co. have received permission to build a line from the Kimball House along Pryor Street to Church, on Church to Williams, on Williams to Spring and thence to the city limits.

Austin, Tex.—The Austin & Suburban Railroad Co. have been chartered. The directors are Seyes Hanlenback, of Chicago, R. Vanslyke, of Dallas, Geo. P. Warner and Chas. P. Schrivinor, of Austin and J. W. Hoyt, of New York. The capital stock is $70,000.

Baltimore, Md.—The bill incorporating the Baltimore & Washington Turnpike & Tramway Co. has been introduced in the legislature. Its design is to develop property between Baltimore and Washington. The capital stock is fixed at $150,000, with authority to increase to $300,000 and to mortgage at a rate not exceeding $500,000 per mile. The plan is to make a turnpike road between the two cities, and authority is given to build a tramway for cars to be propelled by electricity or other motive power.

THE ordinance authorizing the construction of tracks on certain streets in the city by the Baltimore, Canton & Point Brecze Railway Co. was passed by both branches of the City Council without discussion.

The Baltimore, East Baltimore & North Point Railway, with Frank Morrison and others as incorporators, have been incorporated, with a capital stock of $50,000, with the privilege of increasing it to $500,000 The company are authorized to construct a double or single track road, with horse traction or electricity, for the carrying of passengers or freight.

Bridgeton, N. J.—The Bridgeton Street Railway Co. have been organized here with Dr. H. K. Trask, president; William S. Scull, vice-president; Alexander R. Fithian, secretary and G. G. Browning, treasurer. Over $20,000 is subscribed. It is intended to cover five miles of streets in Bridgeton and the company in the near future will continue the road to Carmel and Millville.

Brookwood, Pa.—A. B. Hamilton, N. Hamilton, C. W. Lynch, J. E. Fox and others have applied for a charter for the incorporation of an electric line, to be called the Brookwood Traction Co., to operate, lease and maintain railways in Dauphin, Lebanon and Cumberland counties. It seems that the intended corporation desire to connect the small towns in the lower end of this county by an electric railway.

Buffalo, N. Y.—Another suburban street railroad out of Buffalo will be built by the Buffalo & Hamburg Railway Co. which filed a certificate of incorporation lately. The new road will run from the city to Hamburg, and will be operated by electricity or cable. The capital stock of the company is $150,000, and the directors named are: Cyrus J. Wheeler, J. H. Meech, Benjamin B. Hamilton, Joseph A. Oaks, Daniel O'Grady of Buffalo, and others. The principal office of the company will be in Hamburg.

THE certificate of the Buffalo, North Main Street & Tonawanda Electric Railroad Co. has been filed. The line of the new road will be from the end of Main Street along the town line road to Eggertsville and to Tonawanda. The capital stock is $60,000. L. F. W. Arend is president; A. W. Fancher, vice-president; Edward Rutherford Secretary; C. C. Mead treasurer. Work will be commenced about May 1 and finished July 1 five cars will be installed at first.

Chattanooga, Tenn.—A meeting has been held at Sherman Heights to consider the question of an electric railroad. The Electric Railway Co. are willing to extend the North Dobbs Avenue line, but the Heights' residents object to the roundabout route and want a direct route by way of Harrison Avenue.

Chicago, Ill.—The Grand Crossing & Windsor Park Railway Co. are a new company, with a capital of $40,000; incorporators, Belton Halley, Andrew J. Toolan and Frank H. Clark.

ARTICLES of incorporation for the Chicago Union Elevated Railway Co. were filed last month. The capital stock is $17,000,000. The incorporators and first board of directors are John Tyler, Thos. F. O'Malley, Wm. Bell, G. E. Scott and Geo. M. Rekels.

THE Calumet Belt Railroad Co. has been formed. The railroad which it is proposed to construct will extend from a point on the South Chicago Railroad intersection of Erie Avenue and South Chicago Avenue, running in a southerly or southeasterly direction to a point on the Illinois-Indiana State line, with a branch extending westerly to a point on the Illinois Central road between Kensington and Harvey.

A FIFTY year franchise was granted to the Metropolitan West Side Elevated Railroad Co. at the Council meeting recently. The ordinance requires that at least eight miles of two tracks shall be laid down and operated within two years, and the remainder within three years from the time of the acceptance of the ordinance; that $100,000 in cash or Chicago City bonds shall be deposited in the city treasury to secure the completion of five miles of track in two years and become the property of the city if they are not completed, and that a further bond of $100,000, to secure the city from damages, be filed.

THE Western Dummy Railroad Co., have been organized to operate a dummy railroad on the World's Fair grounds; capital stock, $500,000; incorporators, Eugene H. Dupee, Lockwood Honore and Arthur A. Bliss.

A PROJECT for building an electric road along the North Shore, connecting with the proposed Chicago & Evanston electric road has been talked of. The new line would extend as far north from Evanston as might be considered desirable.

THE Grand Crossing & Windsor Park Railway Co., of Chicago, have been incorporated to operate a street railway; capital stock, $40,000; incorporators, Belton Halley, Andrew J. Toolen and Frank H. Clark.

Coraopolis, Pa.—The people of Neville Island and Coraopolis are about to build an electric line, as follows: Beginning at Thorne Street in Coraopolis and running along Fourth Avenue to Ferry Street to Montour Junction, thence to Neville Island, and from there to McKees Rocks and connect with the Pittsburgh & West End line. The capital stock is $50,000. J. W. Arras is president, J. I. Shanks, treasurer and M. D. Rowland, secretary of the company.

Dallastown, Pa.—There was an enthusiastic meeting held here in the interest of the proposed motor line railway to York. Mr. V. Shatto, of the firm of M. V. Shatto & Son, presided. The probable cost of the eight miles of line, which it is proposed to build, was stated upon estimates of Mr. S. Page, of Steelton, to be about $80,000.

Dedham, Mass.—A movement is on foot in Dedham looking to the introduction of a street railway into the town. Articles of association have already been drawn for the formation of a company which is entitled the Suburban Street Railway Co. The proposed railway is to commence at or near the court house, thence through the town of Hyde Park and the city of Boston, to a point at or near the Forest Hill depot, its terminus, a length of six and half miles. The capital stock of said company is $65,000. Amongst the directors are Thomas T. Robinson, of Dedham, James D. McAvoy and John T. Robinson, of Hyde Park, and W. B. Ferguson, of Malden.

Denver, Colo.—An ordinance has been introduced in the board of supervisors granting the right of way to the Circuit Railway over certain streets. The road is to be operated by electricity, gas or compressed air.

Des Moines, Ia.—A bill has been passed which provides for authorizing electric street railway companies to operate on public highways in the country. The bill is designed to allow the building of the proposed electric road between Des Moines and Indianola.

Detroit, Mich.—It is stated that a number of prominent Detroit men have filed articles of association with the secretary of state for the incorporation of the Detroit Transit Railway Co. The purpose of the company is a gigantic one, contemplating the construction of an elevated double track line of railway completely encircling the city of Detroit, accessible to all the present lines of railway and all that may be constructed in the future, for freight traffic as well as affording a system of rapid transit for passengers. Charles H. Ellis is the projector of the enterprise.

Fishkill, N. Y.—On April 12, the board of directors of the new electric street railway held a special session and a new company was formed, who purchased the stock of the old company. Among the new members are John T. Smith, Willard H. Mase and Samuel Phillips; $30,000 was raised and paid in, a contract drawn up but not given out, which called for the completion of the road by July 1.

Freeland, Pa.—Negotiations are now on foot for the incorporation of an electric light and railway company. The capital stock is to be $100,000.

Fresno, Cal.—An ordinance has been asked for granting the Fresno Electric Railway Co. the right to construct and maintain an electric street railway system for the period of fifty years. The company are required to expend at least $25,000 on the work within the period of one year from the passage of the ordinance, the work to be commenced within three months from the granting of the franchise.

Fultonville, N. Y.—The Fulton & Montgomery County Electric Railroad Co. was incorporated recently, with a capital of $75,000, to build and operate an electric railroad from here through the village of Fonda and the village of Johnstown to the city of Gloversville. The road will be about seven miles long. The company's office will be in Johnstown. The following are the directors: Robert Wemple, Fultonville; M. B. Northrup, Johnstown; Jere S. Sitterly, Fonda; Ezra Nare, Gloversville and J. W. Schroeder, New Brunswick.

Gettysburg, Pa.—E. M. Hoffer, of Hummelstown, will build an electric line which will start from the square in the town and take in all of the important and historical points of the entire second and third days' fight. The length of the road will cover eight miles and the cost will be about $170,000. Stations will be erected at most of the important points. Mr. Hoffer expects to have the road completed and in running order by June 1.

Grand Island, N. Y.—A new company, the Grand Island Electric Belt-line Bridge & Ferry Co. are to be organized. The company's plan is to build a belt line around the island with bridges at each end connecting with the mainland. A ferry is also proposed. Among those interested are Messrs. John H. Meech, of Buffalo; Ossian Bedell, of Grand Island, E. N. Stone, of Batavia and George H. Ahrens, of Jamestown.

Hammond, Ind.—A franchise for the Hammond Electrical Railway Co. has been granted. By December 15 the company are to complete and operate a line from Ridge Road to Gostlin Street on Hohman; on Gostlin from Hohman to Ft. Wayne depot; on Indiana Street from Howard Avenue to Hohman Street.

Huntingdon, Pa.—A new company called the Huntingdon Street Railway Co. has been formed here, with a capital of $18,000. The road will be three miles long. It will extend from Huntingdon to Alexandria. Three of the directors are Samuel E. Henry, George A Port and Alex. Denny.

Independence, Ia.—A franchise has been granted C. W. Williams to build three miles of electric street railway, extending from the Illinois Central depot south to Main Street, thence west past the Burlington, past Rush Park and South to the Iowa Hospital for insane. The cost of the project will be $40,000, and will be completed by July 4.

Jeffersonville, Ind.—The Jeffersonville City Railway Co. have filed articles of incorporation. Among the incorporators are Dennis Long of Louisville, John Zuluaf and John Read, Jr. of Jeffersonville. The company have purchased of Samuel Miller the plant and franchise of the defunct Ohio Falls Street Railway Co. bought by him at the foreclosure sale on March 19, for $16,000 and have put the road in operation. The officers are Ed. J. Howard, president Geo. J. Long vice-president; John C. Zulanf, secretary and treasures.

Kennebunk, Me.—A meeting of the Kennebunk Board of Trade was lately held for the purpose of considering the advisability of constructing an electric railway between Kennebunk and Sanford. R. W. Lord, S. T. Fuller, Ivory Littlefield, Jos. A. Titcomb and Wm. F. Moody are actively interested in the matter.

Kingston, N. Y.--The Kingston City Electric Railway Co. was incorporated recently to operate an electric street railroad for a distance of three miles. The directors are : Edward T. Stelle and others of Kingston, and Jansen Hasbrouck of Rondout.

La Crosse, Wis.—Common report has it that Messrs. Powell, Mosher, Neumeister and Zeisler, are about to form a company to operate a line of electric railway.

Lancaster, Pa.—An electric railway from Lancaster to Columbia is projected. The Lancaster City Railway Co. are said to be pushing the scheme.

Lansdale, Pa.—Citizens here are taking steps to build an electric railway from Lansdale to Skippackville, by way of Kulpsville and Harleysville. The length of the road will be about ten miles, and its estimated cost is about $100,000.

Leadville, Colo.—Dr. John Law and Colonel Goodell, of this city, in conjunction with Eastern capitalists, are to build and operate in this city an electric street car line, and operations will probably commence about May 1. The company will invest $400,000 and build about eight miles of track. The main line will start near the Denver & Rio Grande depot and from the city limits will reach to Evergreen Lakes along the Malta road. The road will be operated with the trolley system, and a gigantic reservoir will be built in Lake Park to supply power.

Lewiston, Me.—There is a plan on foot to build an electric railroad from Lewiston to Augusta. Gen. C. W. Tilden and others are interested in the scheme.

Lewistown, Pa.—The Lewistown & Reedsville Electric Co. have been incorporated, with a capital stock of $25,000.

Marshallton, Pa.—The committee of citizens of the Marshallton, who have in charge the matter of an electric railway from Unionville to West Chester via Glen Hall and Marshallton have reported considerable encouragement. Thomas Pennypacker, George March, Harry Hall and Emmor B. Cope are active in the movement.

A LARGE meeting of citizens has been held here to further the project of building an electric line between WestChester and Oxford by way of Marshallton. A committee consisting of George March, Harry Hall, Wilson Loller, Thomas Pennypacker and Emmor B. Cope were appointed to look after the matter.

Martins Ferry, O.—The Wheeling & Belmont Railway Co. have been organized to operate a street railway. The capital stock is $500,000. John S. Cochran is interested in the project.

Massillon, O.—Articles have been drawn up for the incorporation of the Massillon Street Railway Co., capital stock $50,000. The incorporators are W. A. Lynch, J. W. McClymonds, C. A. Gates, C. M. Russell and W. E. Russell.

A CHARTER has been applied for for the Canton-Massillon Electric Railway Co. with headquarters in the two cities named. Eventually the Canton-Massillon Electric Railway Co. will purchase the Massillon and the Canton street railways. Construction has begun on the Canton-Massillon line. In the city, lines will be built this spring from the West Side railroad stations to the city limits ; and from the base ball park to Main Street, on Erie. Extensions will be then pushed as rapidly as convenient, over all the other streets named in the ordinance. For the Massillon city lines five cars have been ordered. For the cross country line the car order includes one extra long car, two cars thirty feet long and two street cars. In addition to these there will be trailers and also a baggage and mail car. It is designed to have hourly mails between the two cities. The Westinghouse system will be used throughout.

New Haven, Conn.—A new company, the New Haven & Morris Cove Railroad Co. have received permission to construct an electric line from here to Morris Cove, a seaside resort. James N. Townsend is president, and George H. Townsend is treasurer. The capital stock is $100,000. Construction will begin soon.

New London, Conn.—The Connecticut Tramway Co. have been organized here, with a capital of $20,000, all paid in. The business of the company is to build and construct railroads. The incorporators are Dwight Townsend, of New York ; Tracy Waller and Charles A. Gallup, of New London.

IT seems probable that the attempt to start an electric street railroad has been abandoned, it being the opinion of competent judges that the town is too small to make such a road profitable. The chances, however, for a horse railroad to be built this summer are considered good, and should one be built, doubtless, heavy rails will be laid in view of the possible change to electricity as a motive power later on.

New Orleans, La.—AN ordinance has been introduced in the City Council granting to Adolph Schreiber, his associates and assigns, the right to construct and operate a belt railroad in the city of New Orleans.

Oakland, Cal.—The Oakland, San Leandro & Haywards Electric Railway Co. have filed a petition with the City Council asking for a franchise to construct and operate an electric street railroad on certain streets. They ask that the franchise may be granted for a term of fifty years.

A FRANCHISE has been granted to San Jose parties for a continuation of the road from Haywards to San Jose, but they have been unable to obtain a franchise permitting the laying of tracks into that city, and operations upon that portion of the line are not likely to be commenced yet.

Parkersburgh, W. Va.—Captain Shaw has asked for franchises to build a street car line over certain streets. His idea is to make it an electric line if possible.

Pekin Ill.—W. P. Craig, president of the Palatka & Heights Street Railway, proposes to spend $10,000 in extending and improving his line along the Heights, making a belt line, and use motor power as a means of transit.

Petaluma, Cal.—The project of connecting this place with Santa Rosa by an electric railway is being talked of. It is said that Wilfrid Page, a large property owner, has offered the right of way through his land.

Philadelphia, Pa.—A charter has been granted to the Boulevard Passenger Railway Co. of Philadelphia, a corporation organized with Edward J. Moore of 5,017 Wayne Avenue, Germantown, as president. The new company propose to construct and operate a street car line over the proposed boulevard from the City Hall to Fairmount Park, providing the city grants the right of way.

Phœnix, Ariz.—A franchise has been granted for an electric street railway, to Henry L. Wharton for a period of fifty years.

Pinckneyville, Ill.—The Pinckneyville Street Railway Co. have been incorporated, with a capital of $5,000. The incorporators are George W. Clark, John B. Davis and Charles D. Kane.

Pittsburgh, Pa.—The ordinance granting the Millvale, Etna & Sharpsburg Traction Co. the right of way through Millvale was presented at the meeting of the Borough Council last month. George B. Hill and other representatives of the company were present and assured the Councils that the road would be built as soon as the ordinance was passed.

Plainfield, N. J.—The Council has granted to the Plainfield Street Railway Co. a franchise to construct and operate a street railway on the overhead trolley through West Sixth Street, Plainfield Avenue, West Seventh Street, Monroe Avenue, West Fourth Street, Grant Avenue, East Front Street and Somerset Street. The road is to be completed within six months.

Providence, R. I.—A petition for the incorporation of the Point Judith Electric Railroad Co. has been presented to the Legislature. The incorporators are Jeremiah P. Robinson, Isaac R. Robinson, William G. Roelker, Frank D. Sturgess and Mark W. Maclay, all of New York. The intention is to construct a railroad, commencing at some point near the Providence & Stonington railroad, or the Narragansett Pier railroad, and thence to the Atlantic Ocean at the extremity of Point Judith.

Red Bank, N. J.—The Red Bank & Sea Bright Street Railway Co. have been organized, with a capital of $150,000, to build a six mile street railway. The officers of the company are W. B. Price, Newark, president ; James A. Turnbull, Newark, treasurer ; Thomas Davis, Jr., Red Bank, secretary. The road will be commenced about May 1, and the officers hope to have it in operation early in July.

Salem, Ore.—A charter has been issued to the Salem Motor Railway Co. The incorporators are: E. F. Parkhurst, F. A. Turner, F. N. Derby, William England and H. W. Cottle ; capital stock $100,000. They wish to use steam, electric or other power.

San Francisco, Cal.—A petition for a street railway franchise has been presented by W. B. Wilshire, *et al*, along and upon certain streets. The petitioners are willing to expend $40,000 in the construction of the road within a year after the granting of the franchise, and to pay 2 per cent. of the gross income of the company every year into the city treasury. They desire the privilege of using cables, horses or electric motors, and agree to purchase all the material for the construction of the road, as far as possible, in this state. The petition was referred to the Street Committee.

THE City Front Railway Co. have been incorporated to maintain a street railway along the water front and to operate cars for passenger traffic upon the rails of the Belt Railroad. The capital stock is $100,000. The directors are C. A. Spreckels, R. J. Huffacker, P. L. Wooster, H. C. McPike, and Rudolph Spreckels. For the use of the Belt Railroad the company are to pay for the first six months $100 a month, for the second six months $150 a month, and thereafter $200 a month. The term of the franchise is six years.

ANOTHER street railway franchise has been asked for by Robert Sherwood, H. Epstein, Charles Goodall, James L. Byrnes and W. S. Keyes. The route proposed is from Market and East Street to Broadway, thence to Devisadero, to Fell and to Stanyan.

GUSTAV SUTRO has also applied for a street railway franchise on many streets of the city.

Seattle, Wash.—The Duwamish Construction Co. were recently incorporated by Angus Mackintosh and others, to build suburban electric railway lines on which trains will be capable of making forty miles an hour.

Sing Sing, N. Y.—The Ossining Electric Railroad Co. is a new company to operate an electric railroad in Sing Sing. The executive officers are as follows : President, Col. Edwin A. McAlpin ; vice-president, John V. Cockcroft; treasurer, A. S. Underhill ; secretary, F. D. Arthur. The capital stock is placed at $50,000. The proposed route is from the railroad station to the camp meeting grouuds. A branch will strike off south from Main Street down Spring Street to the south line of the village.

St. Paul, Minn.—The St. Paul & White Bear Railroad Co. have contracted, it is said, with the Northwest Thomson-Houston Electric Co. to build an electric line from North St. Paul to Mahotmedi, on White Bear Lake. The electric plant for the line will be located at North St. Paul, and will consist of two 100 H. P. dynamos, with two steel boilers made by Babcock & Wilcox and two compound, ondensing engines.

Tiffin, O.—This city will have an electric street railway during the present season. Meshech Frost, Judge J. F. Bunn and Frank Bloom, all of this city, and F. W. Brightman of Fall River, Mass., having organized a company for that purpose. They will begin work as soon as the right of way and franchise can be secured.

Vacaville, Cal.—The preliminary survey for an electric railway running through the centre of Vaca Valley has just been completed. As laid out it will be a little over ten miles in length. The cost is estimated at $100,000.

Warren, O.—The ordinance granting the Trumbull Electric Railroad Co. the right to construct and operate an electric street railroad in certain streets in the city, passed June 3, 1891, has been amended in certain particulars and the time limit in which the road is to be completed extended to December 3, 1893.

Washington, D. C.—A new electric railroad known as the Washington, Alexandria & Mount Vernon Railway is to be built here. The cars will be run by the overhead system. The company have rented the building at No. 140 South Fairfax Street as headquarters.

West Chester, Pa.—The Board of Trade are deeply interested in the proposed construction of an electric railway through Chester County between West Chester and Oxford. Charles W. Roberts, Frank P. Darlington, A. D. Sharpless and others are actively interested.

Westport, Wash.—The owners of Westport are preparing to build a motor line from the wharf in the harbor, through the town of Westport and the bathing resort of Cobassett, a distance of three miles. It is said also that they will extend the road to North Cove, on the Willapa harbor if they meet with encouragement.

Williamsport, Pa.—Two new companies have been incorporated here, entitled, respectively, the South Side Passenger Railway Co., capital, $15,000 ; and the Vallamont Passenger Railway Co., capital $10,000. The directors include Henry C. McCormick, J. Henry Cochran, Eugene R. Payne, James B. Kranse, Fletcher Coleman and E. B. Westfall.

Worcester, Mass.—The Worcester & Millbury Electric Street Railway Co. are a new company, with $150,000 capital. The road is to be running by midsummer.

A Tax Decision in Pennsylvania.

An important decision was recently given by Judge Reeder, of the Pennsylvania State Supreme Court in the case of Northampton County *vs.* the Easton, South Easton & West End Passenger Railway Co. The action arose on a case stated and raised the question whether the railway company was liable for local tax assessed upon its horses and stables. The case stated described the property as being "necessary, appurtenant and indispensable" to the exercise of the franchise, and the Supreme Court decides that they are therefore exempt.

As every passenger railway company can clearly establish, by competent testimony, that their horses and stables are necessary and indispensable to the enjoyment of their corporate rights, the practical effect and meaning of the decision is that all such property is exempt from local taxation.

The decision is of great importance to the passenger railway companies of the state, and will save them, for all time, the yearly payment of large sums to the local tax gatherer.

Personal.

Mr. A. P. Smith of the American Supply Co., of Kansas City, and Mr. C. E. Cook, of New Bedford, Mass., called at our office last month.

Mr. Charles T. Yerkes president of the North Chicago and West Chicago railroad companies, has been elected a director of the World's Columbia Exposition.

Mr. R. Walters, who for several years has been connected with the firm of A. L. Ide & Co. of Springfield, Ill., has been appointed superintendent of the mechanical department of the National Electric Manufacturing Co. of Eau Claire, Wis.

Mr. G. M. Angier, who has been connected with the Knapp Electric Works of Chicago, has accepted a position with the Mather Electric Co. of Manchester Conn.

Mr. J. A. McLure, the street railway contractor who went to Colima, Mexico, last fall to build a surface road, has completed it, and sails from there for home on April 21. He will be kindly greeted by his friends in New York City on his arrival.

Mr. M. K. Bowen, for some time assistant superintendent of the Chicago City Railway Co., was on the first of April promoted to be full superintendent in place of Mr. S. T. Pope, recently deceased. Mr. Bowen comes well qualified to his new position, as he was formerly superintendent of the Kansas City Cable Railway, a position which he held for four years. We congratulate Mr. Bowen on his promotion, and congratulate the company that have been able to secure the services of so competent a man.

Mr. Frank H. Monks, who for the past three years has been general manager of the West End Street Railway Co. of Boston, resigned that position on April 19, and will engage in private business. The Board of Directors on accepting his resignation passed complimentary resolutions respecting his faithful services during his connection with the company. Mr. Monks has contemplated this action for more than a year, and it was not, therefore, a surprise to his intimate friends. Before engaging with the West End company Mr. Monks had been connected with other street railway enterprises, and he has the pleasure of a large acquaintance with street railway men throughout the country. The duties of general manager will for the present be divided by President H. M. Whitney and C. S. Sargeant, second vice-president.

Mr. Thos. H. McLean, late general manager of the Twenty-third Street Railway Co., has recently been appointed general manager of the seven New York lines now controlled by the Metropolitan Traction Co., of which company John D. Crimmins is president, Henry Thomson, vice-president, Daniel T. Lamont, secretary, and Thomas H. Ryan and Daniel Hasbrouck, treasurers. Mr. McLean has been connected with the Twenty-third Street company in various capacities since 1877, and previous to this was interested in the operation of the Albany day line of steamers, so that he is well qualified for the duties of this new position. The JOURNAL has many good wishes for all of the above named officers, and trusts that abundant success will crown their labors in the broader field to which they are called.

New Publications.

Vulcabeston and Moulded Mica is the title of a pamphlet which the H. W. Johns Manufacturing Co., Maiden Lane, New York, have recently published. It contains illustrations and descriptions of the various insulators, sockets and other insulation appliances sold by this company as well as of their well known asbestos and Vulcan packing, indurated vulcabeston for steam, weather and waterproof work, etc.

Illustrated Catalogue, No. 7, published by the Interior Conduit & Insulation Co., of New York. Another handsome catalogue, No. 7 of the series published by the Interior Conduit & Insulation Co., and similar in appearance to those already issued, has been received by us. The catalogue is mainly devoted to the electrical fittings and tube system of this company, of which it gives illustrations and prices, but also shows the other apparatus manufactured by the company, of which the Johnson switches of various sizes and the deadbeat ampere meters are examples.

Comparative Boiler Tests at the Rochester Railway Co., published by the Heine Safety Boiler Co., of St. Louis, Mo. Under this title the Heine Safety Boiler Co. have published in pamphlet form a statement in regard to the recent test of boilers at the power house of the Rochester Electric Railway which was described in our last issue. The statement is interesting and consists in large part of the letter from Mr. Charles F. Foster, which was published in our last issue.

Electrical Progress and Development. A New England electrical journal, R. F. Ross, editor and proprietor, 146 Franklin Street, Boston, Mass. We are in receipt of a publication bearing the above name, which, in the editor's salutatory, is announced as the successor to *Modern Light and Heat* Mr. Ross is well known among the electrical fraternity, has a wide experience in electric journalism, and is well fitted for the task of publishing a journal devoted to electrical interests. *Electrical Progress and Development* will be published at the end of each month, and in the main will be devoted to New England electrical and kindred interests, although at the same time chronicling important electrical events elsewhere. The first number is well printed, contains, exclusive of cover, twenty-eight pages, and affords much interesting reading matter.

Record of Scientific Progress for the year 1891, by Robert Grimshaw, M.E., Ph. D., published by Cassell Publishing Co., New York. The plan of this work, as its name indicates, is to give in brief compass a statement of the most important discoveries and improvements made during the past year in all branches of scientific work. These improvements have been mentioned at probably greater length and with more detail in different periodicals throughout the world, but as these more extended records are so scattered as to be all practically inaccessible to most readers, the value of such a compilation is readily seen. Mr. Grimshaw is well fitted as an author of such a work, and has arranged the facts in a systematic manner under various headings, so that a record made in each branch of science is by itself. The book contains 372 pages, and is carefully indexed.

A Swindler Caught.

We are told that a man calling himself C. H. Lawrence and representing himself as an agent of the United States Railway Equipment & Construction Co., of Chicago and New York, has been obtaining money under false pretenses from a number of street railway companies and individuals interested in street railways. His method of operation has been to offer to build electric railways provided a few thousand dollars in cash was advanced, agreeing to accept his pay in bonds for the constructon work. After obtaining the cash he would suddenly leave without carrying out his part of the contract. Latest reports state that he has been apprehended in Memphis at the instance of several Lockport, N. Y., parties.

Equipment Notes.

Alfred F. Moore, of Philadelphia, reports that prospects for general trade in wires, cables, etc., are exceedingly promising.

The Stearns Manufacturing Co., of Erie, Pa., will establish a branch office in Chicago, on May 1. The office, which will be in charge of Mr. A. S. Griswold, will be located at 1120 The Rookery.

The Beacon Vacuum Pump & Electric Co. of Boston, Mass., have sent us two blotters upon which are printed the advantages claimed for the incandescent lamp manufactured by them. One blotter is cut in the form of a lamp.

The Crossley Friction Car Brake Co., of Cleveland, O., are equipping the cars of the Brooklyn Street Railway line of Cleveland, O., with their car brakes which have already been illustrated and described in these columns.

The United States Steam & Street Railway Advertising Co., Carleton & Kissam, proprietors, have recently closed a lease for the advertising privileges in all the cars of the Elizabeth Street Railway Co., Elizabeth, N. J., and the Paterson Railway Co., Paterson, N. J.

The Tripp Manufacturing Co., of Boston, have just closed contracts to furnish trucks to the following street railroads: The Olympia & Tumwater Railway Co., Olympia, Wash.; San Diego Electric Railway, San Diego, Cal.; Central Electric Railway Co., Sacramento, Cal., San Jose & Santa Clara Railway Co., San Jose, Cal.

The Falls Rivet & Machinery Co. of Cuyahoga Falls, O., are doing a heavy business at the present time. E. L. Babcock, president of the company, who was in Chicago recently, stated that the works were crowded with orders, and that a large number came from electrical companies requiring heavy transmission machinery.

The Germania Electric Co., of Boston, have removed their manufacturing department from Cambridgeport to their new factory at Marlboro, Mass., and ask us to give notice that any shipments to their account should be made to them at Marlboro, Mass., while all correspondence should be addressed to their office as heretofore, Room 505 Exchange Building, Boston.

Mark & Sterling, of Cleveland, O., report this month some very good orders, and prospects for many more. The joint problem seems to bother the street railway people as much as anything that they have to deal with and this problem, Mark & Sterling say, they can solve effectually by their patent joint bridge. This firm also do a large business in rails, crossings, ties, spikes, etc.

Albert & J. M. Anderson, have recently had some tests made of their electric railway insulators with the view of learning their actual resistance. The voltage used during the tests was 1,100, and one minute electrification of the insulator was allowed in each case, with results which show a resistance of 156,000 megohms. The tests were made by the Massachusetts Electrical Engineer Co., of Boston.

The R. D. Nuttall Co., of Pittsburgh, Pa., manufacture a wide range of electric supplies many of which were mentioned in our last issue. Their factory is pushed to its fullest capacity to supply the many orders which this company are receiving, and their apparatus is giving good satisfaction, if the large amount of business which they enjoy and testimonials from patrons are any evidence.

The Wenstrom Consolidated Dynamo & Motor Co., of Baltimore have sent us word that the receivers of the company, by virtue of a decree of the Circuit Court, of Baltimore City, have ordered all the real estate, building, tools, patent rights, plants, stock on hand, etc., belonging to the company, to be sold at auction on May 2, 1892. Full information in regard to the terms of the sale can be had of the receivers.

The Engineering Equipment Co., of New York, are sending out a general circular stating that the business of equipping electric roads is their specialty, and requesting the privilege of estimating upon the equipment of any railway with electric power. This company have had wide experience in the equipment of electric railways, and have on hand poles, wire trolleys and all other construction materials needed.

The Hill Clutch Works, of Cleveland, O., through their New York agent, Mr. J. E. Irwin, have closed a contract with the Hartford Light & Power Co., Hartford, Conn., for 130 ft. of seven inch shafting and clutch pulleys for thirteen dynamos and two engines, aggregating about 1,000 H. P. They have also received an order from the Richmond Railway & Electric Co. for forty-five feet of shafting and clutches for six eighty-light Wood dynamos.

The National Pipe Bending Co., of New Haven, are meeting with a large demand for their feed water heaters for steam plants. Among their recent orders from street railway companies they mention two heaters of 400 H. P. each for the Coney Island & Brooklyn Railway and an order to supply all the heaters required for the power station of the New Haven & West Haven Street Railway Co. whose cars are to be equipped with Short electric motors.

The Rochester Car Wheel Works are making remarkable progress in the introduction of street car wheels made in the Barr contracting chill, with which our readers are familiar. The additional orders given by roads after a thorough trial is the best possible recommendation of the good qualities of this method of wheel manufacture. Mr. F. D. Russell, who is in charge of the street railway department, is to be congratulated on the success of his efforts.

The Goubert Manufacturing Co., of New York, are having a large business in the sale of their feed water heaters, and tell us that among street railway companies especially their heaters seem to be meeting with great favor. As mentioned in another portion of this issue, they have recently received the order for three heaters of 1,000 H. P. each for the Broadway (New York) cable railway. They will also supply six feed water heaters to the Third Avenue Railway Co. for use in their new cable power station.

The Peckham Motor Truck & Wheel Co., have closed a contract with the Atlantic Avenue Street Railroad Co., of Brooklyn, N. Y., for fifty of their radial geared non-oscillating trucks. These trucks will be equipped with Westinghouse motors, the car bodies being furnished by the St. Louis Car Co., of St. Louis, Mo. The Peckham company have also contracted with the Harlem Bridge, Morrisania & Fordham Street Railway for sixty standard trucks, and with the Coney Island & Brooklyn Street Railway for twenty trucks.

The Ball Engine Co., of Erie, Pa., have sent us the copy of a letter recently received by them from the Warrenton Electric Co., Warrenton, Mo., in which they say: "We started the engine purchased from you for our electric plant, last night, and the way it moved off was beautiful to behold. It is certainly a very fine and powerful piece of machinery. No vibration, no noise, in fact and in short, it is perfect in every part and way. The satisfaction it gives is a pleasure to us, and it must be gratifying to you." The letter is signed by C. E. Peers, president of the company.

The John Stephenson Co., Limited, of New York, are busy on the completion of many orders at their factory, and their works present to the visitor an appearance of great activity. Especially prominent among the cars which they have just finished are twenty motor cars destined for the Rochester Electric Railway of Rochester, N. Y. These all have a sixteen foot body with no vestibules. The company are also building cars for Paterson, N. J., Baltimore, Md., Asheville, N. C., Pittsburgh, Pa., and have recently shipped cars to Washington, D. C., Salt Lake City, Utah, and Bridgeport, Conn.

George H. Hollingsworth of Beaver Brook, Waltham, Mass., has secured the contract for the entire car equipment of the Newton & Boston Street Railway Co., which will build at once about five miles of track, connecting Newton Centre, Newton Highlands and Newton Upper Falls with Newtonville. This equipment will consist of five open and five closed cars which will be models of elegance and luxury, and will be fitted with all the latest improvements Mr. Hollingsworth is also the builder of a new combination car, which has a number of novel points and has attracted considerable attention.

The Fulton Foundry Co., of Cleveland, O., are kept busy filling the many orders for their electric trucks which seem to be regarded with much favor. They say that they have received a large number of letters from different patrons, all speaking in the highest terms of these trucks, and coming as they do, unsolicited, they are very gratifying. They also inform us that the other departments of their works, such as the axle and wheel fitting and wheel making departments, are worked to their utmost capacity. Their departments for turning out switches, turnouts and special track work are also very busy.

The Reliable Manufacturing Co. of Boston, continue to ship their Reliable sand box and Collett ratchet brake handle to many street railway companies and car builders. Some large orders have been filled during the past month by them for the Newburyport Car Manufacturing Co., Ellis Car Co., Briggs Carriage Co., Lamokin Car Works, J. G. Brill Co. and other car builders; for the Brooklyn City Street Railway Co., Worcester, Leicester & Spencer Street Railway Co., Newburyport & Amesbury Street Railway Co., New York & Harlem Railroad Co., Merrimack Valley Horse Railroad Co., and many other successful street railway companies.

F. P. Little & Co., of Buffalo, have recently closed a contract with the Connecting Terminal Railroad Co., of Buffalo, for the installation of a plant consisting of one 500-light Thomson-Houston dynamo, one thirty-eight H. P. engine of the John T. Noye Manufacturing Co.'s make, and twenty-four 200 C. P. (Mosher) arc lamps and twenty-five sixteen C. P. incandescent lamps. They have also closed a contract for wiring the Columbia Bank Building, of Buffalo, and are at work wiring a number of other buildings in that city, including the city elevator and the American Bell Telephone Co's. building They announce business as very brisk.

The Lamokin Car Works of Philadelphia have closed a large number of contracts for street railways during the last month. Among others they mention one for the City Passenger Railway Co., of Altoona, Pa., for three open, eight seat, trail cars, the second order from this company, and one from the Harrisburgh Street Railway Co. of Harrisburgh, Pa., for sixteen thirty-three foot car bodies, These bodies will be mounted on Robinson radial trucks. Four will be for early delivery and twelve for August and September delivery. A new corner stay for cars, Cochran's patent, is being used by this company, and is illustrated in this issue.

The Fourth Avenue Railway Co. of New York, have decided to lay considerably more of the Duplex track after having given it a trial since December. The Duplex company have made contracts for their rail with the Atlantic Avenue Railway Co. of Brooklyn, N. Y.; the Rochester Railway Co., Rochester, N. Y.; the Camden Horse Railway Co., Camden, N. J. They have also made a contract for the track to be used on the new electric railway at Kansas City, Mo.; the Lakeside Electric Railway at Fort Wayne, Ind.; and the Steinway & Hunters Point Railway at Long Island City, N. Y.; also the New Orleans & Carrollton Street Railway at New Orleans, La.

The Wightman Electric Manufacturing Co., of Scranton, Pa., have met with the most flattering success in the introduction of their electric railway system during the year and a half that it has been in operation, and it is now in practical service on the following roads: The People's Street Railway, Scranton, Pa.; the Pennsylvania Motor Co's. road at Easton, Pa.; the Citizens' Passenger Railway, Altoona, Pa.: DuBois Traction Passenger Railway, DuBois, Pa.; Auburn City Railway, Auburn, N. Y.; Wheeling Railway, Wheeling, W. Va.; the People's Street Railway, St. Joseph, Mo.; the East Cleveland Railroad, Cleveland, O.; Brooklyn City Railroad, Cleveland, O.

The Underwood Manufacturing Co., of Tolland, Conn., have just furnished the Chicago City Railway Co. two endless belts, 62

ins. wide, and 400 ft. long. This belting was ordered something over a year ago, and is being placed in the cable power house at Twentieth and State Streets, Chicago. These belts when in operation will transmit about 2,500 H. P. They weigh 4,940 lbs. and contain about 2,050 sq. ft. The company have had two belts, 48 ins. wide, 350 feet long, in operation at the station at Fifty-fifth and State Streets for about five years, running night and day 5,200 ft. per minute, and driving about 700 H. P. each. These belts drive the fast lines of cable from Thirty-ninth to Sixty-third Street.

The Fitchburgh Steam Engine Co. of Fitchburg, Mass., announce their removal into their new quarters. For several years there has been an increasing demand for their engines until they were unable to keep up with their contracts, although running nights for some time. Their new factory is fitted throughout with all the best modern tools and facilities for handling large work, such as traveling cranes, etc., and is more than twice the size of their old plant. Their facilities for shipping are the best, as they can load directly from their erecting room on to the cars. They are now in shape to fill all orders promptly, for either large or small, vertical or horizontal, high speed, slow speed or compound condensing engines.

Chas. A. Schieren & Co. of New York, manufacturers of tanned oak leather belting and lace leather, number many street railway companies among their customers, and tell us that this branch of their extensive business is constantly increasing. As evidence of the popularity of their belts for electric work the following list of orders received by them during ten days in April will be interesting : Six twenty-four inch double belts for Trenton, N. J.; two thirty-six inch double belts and five fifteen inch double, perforated, electric belts for Salem, Mass.: two twenty-four inch double, perforated, electric belts for Asbury Park, N. J.; one twenty-eight inch double belt for Perth Amboy, N. J., besides many other smaller belts for generator works.

Pepper & Register, of Philadelphia, have secured the order to build and equip the Delaware Bay & Cape May Electric Railway, a six and a half mile road, with ten car equipments, generator to be 150 H. P., and cars to be equipped with thirty H. P. single reduction motors, both of the Westinghouse Electric & Manufacturing Co.'s manufacture. The Ball engine, Coatesville boiler and stack and Schieren's belts will be employed in the station, and on the outside work the company will employ Morris, Tasker & Co.'s brackets for pole construction and Washburn & Moen's trolley wire. The road is to be in operation complete by June 1. They have also secured an order to build complete the municipal electric lighting plant for Doylestown, Pa., and several isolated plants, work on which will begin at once.

Mr. Granville T. Woods, of New York, inventor of the multiple distributing electric railway system in operation on the Coney Island & Brooklyn Street Railway, has severed his connection with the American Engineering Co., and says that he is ready to give estimates for the equipment of street railways with this system. He tells us that he has the support of a syndicate of financiers, and is ready to guarantee the legality of his claims to exclusive use of the system. Mr. Woods has recently been engaged in litigation with the American Engineering Co. as to the right of the latter company to use certain details of the multiple distributing system and says that in a recent case before Justice Connolly in Brooklyn, in which the exclusive ownership in certain patents relating to the system was brought in question, a decision was promptly given in his favor.

The Berlin Iron Bridge Co. of East Berlin, Conn., have received a recent order from the Henry R. Worthington Hydraulic Works of South Brooklyn, N. Y., for a new machine shop to be built of iron. The building will be 200 ft. long by fifty feet wide, will be equipped with a twenty ton Sellers traveling crane, and will be made from the designs of the Berlin company who furnish it complete, including the foundations and brick work. This company have also taken the contract to build a producer building for the Solvay Process Co., of Syracuse, N. Y. The building will be 30 ft. wide × 100 ft. long and three stories high, built entirely of iron, even the floors being made of plate iron in order that there may be no wood work about the building to take fire. J. H. Horne & Sons Co., have also decided to build a new machine shop 64 ft. wide × 107 ft. long and have placed the contract for it with the Berlin Iron Bridge Co., of East Berlin, Conn.

The Westinghouse Electric & Manufacturing Co., of Pittsburgh, Pa., have met with large demand for their motors in all parts of the country. Their New England agent, Mr. R. S. Brown, of Boston, tells us that he has closed a large number of orders in that section. Among the companies who have recently placed orders with him for apparatus are the Waterville, (Me.) & Fairville Street Railway Co., who will use six gearless motors, and one 150 H. P. generator ; the Fitchburg, (Mass.) Street Railway Co., who wish eight single reduction motors and one 115 H. P. generator ; the Worcester, (Mass.) Consolidated Street Railways Co., six twenty-five H. P. single reduction equipments and one 250 H. P. generator ; Springfield, (Mass.) Street Railway Co., two twenty H. P. single reduction motors for their palace car ; Amesbury, (Mass.) Street Railway Co., ten single reduction equipments ; Gloucester, (Mass.) one twenty H. P. single reduction equipment.

The Stearns Manufacturing Co. of Erie, Pa., have now acquired, by purchase, the remaining franchises of Woodbury, Booth & Pryor and the Woodbury Engine Co. of Rochester, N. Y., including all patterns, patents, special tools, trade marks, good will, etc. This puts into the hands of the Stearns company not only the sole ownership of the Woodbury high speed, automatic engine, which they previously purchased, but also the world renowned Woodbury medium speed automatic engines, and the means of producing both. The name "Woodbury" has been for forty years synonymous with good steam engines, and with something over 3,000 of the two classes here named, all bearing the "Woodbury" earmarks to point and refer to, the Stearns company ought to be satisfied they have made no mistake in adding the medium speed, automatic Woodbury to the Woodbury high speed they have already pushed to the front rank of its class.

John Wood, Jr., of the Schuylkill Foundry & Machine Works, Conshohocken, Pa., reports an active business in his patent water tube boiler at the main works and also at branch works at East Saginaw, Mich., and Zanesville, O. Recent shipments are as follows : 1,000 H. P. to Duncannon Iron Co., Pa.; 600 H. P. Windsor Locks Steel Co., Conn. ; 200 H. P. New Haven Rolling Mill Co., Conn. ; 1,000 H. P. to J. Wood & Bros. Co., Conshohocken, Pa. ; 400 H. P. Hughes & Patterson, Philadelphia ; 600 H. P. Chester Pipe & Tube Co., Thurlow, Pa ; 500 H. P. John & James Dobson, Philadelphia ; 500 H. P. Alex. Kerr Bro. & Co., Salt Works, New York ; 100 H. P. Pottstown Iron and 150 H. P. Pottsville Iron & Steel Co., Pottstown, Pa. The greater number of orders now in hand are for electric light and railway purposes for which these boilers are specially adapted. The increasing demand for these boilers will necessitate the establishment of other works in connection with those now in operation.

The Pennsylvania Iron Works Co. of Philadelphia, have recently purchased the compression ice machine business formerly belonging to David Boyle, of Chicago, and owing to this and to their increased business in the manufacture of cable railroad, winding and driving machinery, etc., it has become necessary for the company to enlarge their plant. They have, therefore, lately contracted for the erection of a new machine shop, about 300 ft. long × 75 ft. wide, which will be equipped with the most improved tools, capable of turning out the heaviest class of machinery manufactured in this country ; it will also contain a thirty ton electrical crane, and one ninety foot pit lathe capable of turning wheels forty feet in diameter, ten feet face, and weighing from 100 to 125 tons each, as well as the latest adopted machinery for the purpose of speedily turning out compression ice machines, which they are manufacturing. When this shop is completed, the plant will be one of the largest of its kind in the United States. They have also just moved into their new office building, at the corner of Fiftieth Street and Lancaster Avenue, which is 100 ft. long × 50 ft. wide, vacating the space in the main building, which is now occupied by the engineering department.

E. H. Wilson & Co., of Philadelphia, proprietors of the Lamokin Car Works, write us that they number among their orders, in April, for electric cars, eight sixteen-foot, closed car bodies to be mounted upon Robinson motor trucks, made in Altoona, Pa., and two eight seat, open car bodies to be mounted on the same trucks, for the Richmond & Manchester Railway Co., Manchester, Va. ; for the Zanesville (O.) Electric Railway Co., they are building four nine seat, closed end, open car bodies, May delivery, this being the second order from this company. These car bodies will have the roofs sunk in the centre to allow the trolley base to pass under low bridges ; for the Cape May (N. J.) & Sewells Point Electric Railway Co., eight eight-seat, open cars complete with the Robinson motor truck, palace finish, May delivery ; for the Milwaukee (Wis.) Street Railway Co., one eighteen foot, closed car complete, with Robinson motor truck, also one open car with same truck ; for the Derby (Conn.) Street Railway Co., one open car body and for the Richmond (Va.) & Manchester Railway Co., eight sixteen-foot closed car bodies with Robinson motor trucks, of Altoona, also two eight seat, reversible, open car bodies with same truck ; for the Rock Creek Railway Co., Washington, D. C., they are building the following order : Six eight-seat, reversible, open cars, Cochran's patent malleable seat panels, palace finished ; six sixteen foot, closed, palace finished car bodies mounted upon Peckham motor trucks, and six twenty-six-foot, closed car bodies, length over all, thirty-three feet ; these will be finished in quartered oak, with hand carved panels, and brackets with pendent acorns, will have ceilings of oak decorated, three combination centre lamps ; the seats and backs will be spring, upholstered and covered with best Wilton carpet ; the cars will have nine windows on each side of twenty-six ounce English glass. Solid bronze trimmings and deck glass of handsome crushed ruby will complete the equipment. These cars are built under Cochran's patent, and tied at corners by steel guard rail stays. The car bodies are to be mounted upon the Robinson radial trucks, and are in every way model cars.

The Morton Safety Heating Co. of Baltimore Md., have quite a large business in the street railway field, in addition to the extensive business in heating steam railway cars with their safety heater. This company have received many testimonials from officials of both steam and street railways on which their heaters have been adopted, all speaking in the highest terms of their desirability for heating purposes, and have sent us copies of a number of such letters recently received by them, which furnish very interesting reading. One of these is from W. R. Crumpton, general manager of the Baltimore & Lehigh Railway Co., and from it we make the following extract, showing the effectiveness of the Morton heater : "The heater, with which you this winter equipped our train running between Baltimore, Md., and York, Pa., has given us perfect satisfaction. On February 6, 1892, the coldest day of the season, the thermometer at 2 A. M. was at zero and at 7:30 A. M. seven degrees above zero. The train was heated in thirty minutes to seventy-two degrees above zero. The train was in service eleven hours, during which time only twenty-two minutes of additional steam was applied, making fifty-two minutes during the entire day. In actual practice we have found it necessary to apply steam only while the train is standing at station, or while the engine is taking water, thus consuming steam which would otherwise probably be lost through the safety valve. This, of course, reduces to a minimum the cost of heating. I think it an absolute storage system ; it is also simple in construction, easy to manage, safe and cleanly." Among other

letters received by the Morton company are some which must be of an extremely gratifying nature to the recipients, testifying as they do to the safety in cases of accident, as well as to the efficiency, of the heater. One of these is from David Evans of Philadelphia, who was injured in an accident on the Baltimore & Lehigh railroad occurring March 3, 1892. Mr. Evans writes that the car in which he was at the time was heated by the Morton safety heater, and was precipitated down a steep bluff from a height of fifty feet, and he attributes his escape from death by fire to the fact of the use of the Morton heater. Another car of the the train which was heated by a stove caught fire from being overturned. The Morton Co. have received a similar letter from the legal agent of the Baltimore & Ohio Railroad Co., in Baltimore, Mr. McCahan, who also attributes the fact that he escaped with his life to the use of the Morton heater on the train. Among other recommendations recently received by this company, are one from D. F. Henry, president of the Federal Street & Pleasant Valley Railway Co., Pittsburgh, Pa., and one from H. W. Burgett of the Consolidated Light & Power Co., Dover, N. H. Mr. Henry writes that the Morton heaters have been in use upon his cars during the entire winter with excellent results, and Mr. Burgett reports the use of the heaters during two winters in which time they have met all the requirements of that road satisfactorily.

WESTERN NOTES.

The American Car Co., of St. Louis, now have over 250 cars in the various stages of construction in their extensive works. The management claim that this beats the record.

The Standard Railway Supply Co., Garson Myers, manager, are now located at 1,117 Monadnock Building, Chicago, Ill. The company manufacture and handle street railway specialties.

Kohler Bros., of Chicago, representatives of the Eddy Electric Manufacturing Co., report a most active demand for generators and motors. They state that they can sell machines a great deal faster than the company can manufacture them. The office is to be removed from the Rookery to the Monadnock Building.

The Metropolitan Electrical Corporation is the title of a new company organized to do general electrical engineering business, with headquarters at the Whitney Building, Kansas City, Mo. They will furnish plans, specifications and supervisions for complete steam and electrical installations, and request the privilege of estimating upon the installation of electric railway equipments.

B. E. Tilden & Co., dealers in railway supplies and motor replacers, have decided to discontinue their Cleveland office, and have established their general office in the Monadnock Building corner of Jackson and Dearborn Streets, Chicago. The change has been made to accommodate the growing business of the firm, and they have now better facilities for shipping the goods which they manufacture.

The Central Electric Co., of Chicago, are sending out a handsome circular descriptive of tested fuse wire and terminal fuses. The circular containing an article on fuse wire was read before the Chicago Electric Club December 7, 1891, by Elmer A. Sperry, and which gives valuable information on this subject. The company are also preparing a house goods catalogue, which, it is expected, will be ready in April.

The Chicago Rawhide Co., of 75 Ohio Street, Chicago, are doing a large business at the present time. Electric railway companies are ordering a great many rawhide gears which this company have been making for fourteen years. No dissatisfaction has ever been expressed by a railway company who have used the gears made by the Chicago company. They are growing in popularity, as no pains are omitted to adapt them to the requirements of this exacting service.

The Electric Appliance Co., of Chicago, have closed arrangements for the exclusive Western agency for canvas jacket, weatherproof wires and interior conduit, and will carry a large stock of both wire and canvas jacket flexible conduit. This material is all well known to the electrical trade. In anticipation of a heavy spring trade the company are stocking up very heavily on standard lines of supplies, such as sockets, switches, cut-outs, wires, etc., and will be prepared to meet any demand that can be made upon them.

The Lunkenheimer Brass Manufacturing Co., of Cincinnati, O., are preparing for the World's Fair a most elaborate display of their popular specialties in valves, sight feed lubricators, oil and grease cups, etc. They will also exhibit a complete line of brass and iron goods, besides some novelties in steam whistles and sight feed lubricators. They report business exceedingly brisk, being crowded with orders for their numerous specialties and receiving large contracts for special work for United States cruisers.

The International Register Co. of Chicago have removed their office from 435 Rookery to 302 Dearborn Street, where their factory is located. Larger shop space has been secured and new machinery has been added to accommodate their increasing business. Street railway companies are showing a great deal of interest in the registers manufactured by this company, numerous inquiries and orders being received daily. The company are now perfecting their stationary register, and will announce its completion in a short time. This device, it is stated, is both novel and very simple.

The Detroit Electrical Works, have received an order for sixteen car equipments from the Dubuque, Ia., Street Railway Co. and not for six as stated in our last issue. This is the road which has recently abandoned storage batteries for the overhead electric system. The Detroit Electric Works have moved their Chicago office from the Rookery Building to Rooms 917-918 Monadnock Building. This is one of the largest office buildings in Chicago, and, owing to its central location and the fact that it will be occupied largely by representatives of railway and electrical interests, the managers of the Detroit Electrical Works think that their customers and friends will find this new location of their Chicago office much more convenient than the former. Mr, L. E. Myers will have charge of the Chicago office. This gentleman writes us that he has recently closed a contract for electrical equipment for Sioux City, Ia., which calls for $40,000 worth of their apparatus. This will include fifteen forty H. P. equipments as well as all the overhead construction, in fact a complete road with the exception of track work and poles. This company have recently secured orders for equipments from a large number of railways, and have motors in operation upon the following roads, in addition to those previously mentioned: Aurora, Ill., Street Railway, fifteen cars; Riverside Street Railway of Fort Worth, Tex., six cars; Consolidated Street Railway, Grand Rapids, Mich., ten cars; Merrimack Valley Street Railway, Lawrence, Mass., fifteen cars, and the Essex Electric Street Railway Co., Salem, Mass., six cars.

The Pullman Palace Car Co., of Chicago, received the following orders recently for street cars: Two closed and six open motor cars for the Colorado Springs Rapid Transit Railway Co.; three open motor cars for the Kankakee Electric Railway Co.; eight long open and four centre vestibuled, double deck, cars for the Union Electric Railway Co. of Saratoga; twenty open motor cars for the Toledo Consolidated Street Railway Co.; two closed motor cars for the Patton Motor Manufacturing Co.; two closed motor cars for the Illinois Judson Power Co.; three closed motor cars for the Northwest Thomson-Houston Electric Co. for service at Olympia, Wash.; two closed motor cars for the Northwest Thomson-Houston Electric Co., for service at Tacoma, Wash.; one long open car for the Bay Railway Co., of Astoria, Ore.; ten open horse cars for the Capitol, North O Street & South Washington Railway Co., of Washington, D. C. Freight and passenger cars: One private car for Mr. J. J. Hagerman, president of the Pecos Valley Railway Co,; one private car for the Minneapolis, St. Paul & Sault Ste. Marie Railway Co.; one private car for Mr. G. W. Breckinbridge of San Antonio, Tex.; two dining, five passenger and five combination passenger and baggage cars for the New York, Lake Erie & Western Railway Co.; two combination passenger and baggage cars for the Chicago, St. Paul, Minneapolis & Omaha Railway Co.; one parlor car for the Windsor & Annapolis Railway Co. of Canada; twenty-two passenger cars for the Southern Pacific Co.; twenty-five passenger, ten express, ten baggage and five postal cars for the Norfolk & Western Railroad Co.; one car for the transportation of horses tor Mr. W. A. Caswell of Chicago; three first class passenger and one combination passenger and baggage car for the Cleveland & Marietta Railway Co.; one first class passenger and one combination passenger, baggage and mail car for the Wabash, Chester & Western Railway Co.; two dining cars for the Chicago, Rock Island & Peoria Railway Co.; six parlor cars for the Chicago & Northwestern Railroad Co.; twenty-five passenger cars for the Central Railroad of New Jersey; 1,000 box and 400 coal cars for the Norfolk & Western Railroad Co.

A Storage Battery Decision.

Judge Coxe in the United States Circuit Court delivered an opinion, April 9, in the case of the Accumulator Co. *vs.* New York & Harlem Railroad Co., involving the infringement of Patent No. 11,047, issued to complainant as assignee of J. W. Swan. The decision was in favor of the Accumulator Co. The invention consists in forming the electrodes of a secondary battery with perforations extending through the plates and having the active material packed in these perforations only. Swan's date, *de jure*, is January 18, 1882. Prior to this, Eaton had filled perforations and covered both sides of the plate with active material, and Brush had pressed the absorptive material into grooves. No one had packed it into holes extending through the plate, and confined it entirely to the holes, and Judge Coxe held that the arrangement was patentable.

A Progressive Firm.

The success which the firm of Barbour, Stockwell & Co., of Cambridgeport, Mass., have attained may be fairly said to be well deserved. Both Messrs. Barbour and Stockwell, as well as H. R. Luther and J. P. Winlock, who with them constitute the firm, have had wide experience in the manufacture of machinery and machine fitttings; and the work turned out by them has always maintained a record for good quality of material and first class workmanship.

The firm began with purchasing the business of W. O. Taylor, of Boston, in 1886, and in 1889 added to their works the plant of Alfred Morrell & Co. These properties, together with the foundry owned by Mr. Barbour before the formation of the firm, comprised all the works of the firm, until last June, when the increased demands made for their products led to the increase of manufacturing facilities. This consisted in the erection of the extensive plant now located at Broadway, Hampshire, Market, Clarke and Davis Streets. The estate purchased for the site comprised 90,000 sq. ft. The buildings erected consisted of a foundry 175 × 75 ft., a three story pattern storage house 156 × 50 ft., and a machine shop three stories high, 150 × 50 ft. To these buildings has been recently added a one story blacksmith shop, 50 × 80 ft. To run the machinery of this plant a 90 H. P. engine and a 100 H. P. boiler are required. 250 men find employment beneath the roofs of these several buildings.

A large proportion of the company's business is for railways, and one of the largest contracts undertaken by them was the furnishing of the curves, frogs and switches for an electric railroad in Austin, Tex. The work was put together in the firm's large yard and then taken apart again and shipped to its destination. It required a space 160 ft. sq. to lay out this work. They have also done considerable for the West End Street Railway, of Boston and for other prominent lines,

Railway Equipment Co. of Chicago.

The Railway Equipment Co. has just been organized in Chicago, with W. R. Mason as president and general manager. Mr. Mason has resigned his positions as general manager and president of the Electric Merchandise Co. in order to devote himself to this new enterprise. With Mr. Mason is associated Mr. W. L. Adams, formerly secretary of the latter company. In the electric railway field, with which Mr. Mason is now thoroughly identified, no supply man is, perhaps, better known. He has achieved success by a broad policy which, with a liberal treatment of customers, has attracted and retained the trade of street railway companies. The plans of the new company are not yet definitely settled. It is not unlikely that ultimately the company will handle some supplies for steam railroads as well as for street railways. Just at present the offices are located at 616, 618 and 619 Pullman Building, but within a very short time a store will be secured and a complete line of supplies will be carried. On this point Mr. Mason says in a prospectus addressed to the trade :

RAILWAY EQUIPMENT CO.

We beg to call your attention to the above company which has been organized for the purpose of manufacturing and dealing in electric railway supplies for use on all systems. Having had a long and practical experience in all branches of the business, we feel confident of our ability to successfully meet the wants of this branch of the trade. We shall carry in stock large quantities of everything needed for the complete equipment and maintenance of electric roads. We have lately perfected several new line devices which we believe have enough merit to claim the attention of parties about to build or make extensions.

We shall be pleased to advise parties as to the best manner of building and operating such roads. We have no affiliations whatever with any company or individual which will interfere with the exact and impartial conduct of our business.

At the earliest possible moment we shall issue a very complete catalogue, fully illustrating and describing material of our manufacture, also containing data of great interest to builders, owners and managers of electric roads.

In the meantime, we beg to assure the trade that any orders which may be sent to us will be filled promptly and at the lowest market prices. The general manager desires to express to the trade generally his thanks and appreciation of favors granted to him during his connection with a former company, and begs to state that sincere regard will be paid to their wants and suggestions.

Trusting that the conduct of our business may be such as to merit a share of your patronage, we are, very truly,

W. R. MASON,
General Manager,

Since the new enterprise was started Mr. Mason has been overwhelmed by letters expressing best wishes for his success, and promises of business. Orders, in fact, began to reach the office before the company was fairly able to handle them. The company is strongly backed, and among the stockholders are several gentlemen influential in the street railway and electrical fields. The success of the new enterprise is assured if hard work, " hustle," capital and experience are able to achieve that result.

Fall River Line.

The well known Fall River Line between New York and Fall River, Mass., connecting at the latter place with trains to Boston, resumed Sunday trips on April 3. Trains connecting with steamers leave Boston from Park Square station at 6 P. M. week days and 7 P. M. Sundays,and going East steamers leave New York at 5 P. M. Sundays and week days.

New Transit Facilities to Boston.

The Providence & Stonington Steamship Co. have placed in commission on the Stonington Line their magnificent new steamer "Maine," which is a notable addition to the Sound fleet, and is making a fine record as a fast vessel. This steamer is now making regular trips between New York and Stonington (125 miles) en route to and from Boston and the East, averaging about seven hours. The " New Hampshire " will be finished and put in commission about May 1.

Improvements on the Western New York & Pennsylvania Railroad Co.

On and after April 25, trains on the Western New York & Pennsylvania Railroad will arrive at and depart from the Exchange Street depot of the New York Central & Hudson River Railroad, in the city of Buffalo. These arrangements give to this road equal accommodations with other lines in Buffalo, and the benefit of Union Depot connections with the New York Central & Hudson River Railroad, Michigan Central Railroad, Lake Shore & Michigan Southern Railway, West Shore Railroad and Grand Trunk Railway.

The Western New York & Pennsylvania Railroad is the direct line from Buffalo to Olean, Mayville, Chautauqua Lake, Jamestown, Corry, Titusville and Oil City ; and in connection with the Allegheny Valley Railway, forms the only through route by which solid trains are run between Buffalo and Pittsburgh, Pullman buffet parlor cars on day trains, and Pullman palace sleeping cars on night trains. Trains arrive at and depart from the Pennsylvania Union Depot at Pittsburgh, giving this line the best depot facilities in both cities.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, MARCH 29, 1892, TO APRIL 19, 1892, INCLUSIVE.

MARCH 29.

Car Brake, William B. Flinn, San Francisco, Cal.	471,635
Car Truck, John Taylor, Troy, N. Y.	471,912
Car Truck, Sidney D. King, Pittston, Pa.	471,644
Device for Transmitting Motion, George S. Strong, New York	471,655
Device for Transmitting Motion, George S. Strong, New York	471,656
Electric Railway, William C. Goss, Lynn, Mass.	471,543
Passenger Car, Charles L. Pullman, Chicago, Ill.	471,761
Pole for Supporting Electric Wires, John H. Huntress, Janesville, Wis.	471,759
Power Transmission, John F. Devold and Gustav Monrath, Chicago, Ill.	471,812
Railway Rail Chair, George H. Graham, Ridgeland, Ill.	471,971
Running Gear for Street Cars, Soren Robertson, Cleveland, O.	472,001
Safety Attachment for Cable or Electric Cars, Albert Raynal, New York	471,750
Switching Attachment for Street Cars, Orson W. Brenzler, Duluth, Minn.	471,714
Track Cleaning Apparatus, Peter A. Dowd and Thomas Long, Boston, Mass	471,814

APRIL 5.

Automatic Railway Switch, George S. Maxwell and James Clark, Jr., Louisville, Ky.	472,063
Cable Roundabout, Joseph F. Fralinger, Atlantic City, N. J	472,211
Car Truck, John Taylor, Troy, N Y.	472,236
Car Wheel, Wilfred Ward, Buda, Ill.	472,415
Fare Register, William L. Silvey, Lima, O	472,232
Fare Register, Calvin B. Cushman and Horace G. Canfield, Akron, O.	472,035
Fastening and Seating of Guard Rails, etc., for Street Railways, John A. Duggan, Quincy, Mass	472,165
Hanger for Electric Wires, Henry H. Luscomb, Boston, Mass	472,220
Inclosed Supply System for Electric Railways, John C. Fyfe, Denver, Colo.	472,447
Rail Holding Splice, Frank G. Johnson, New York.	472,168
Rail Joint, Cyrus Roberts, Three Rivers, Mich	472,228
Safety Attachment for Street Cars, Philip S. Townsend, Rochester, N. Y.	472,184
Street Railway Track, John A. Duggan, Quincy, Mass.	472,164
Truck for Railway Cars, Louis Pfingst, Boston, and Sumner A. Bemis, Springfield, Mass.	472,271

APRIL 12.

Anti-Friction Car Wheel, John D. Farquher, Des Moines, Ia.	472,944
Box Brace Chair for Girder Rails, Arthur J. Moxham, Johnstown, Pa	472,767
Brake for Street Cars, Fred. W. Wood and John Fowler, Los Angeles, Cal.	472,597
Car Brake, Albert P. Massey, Watertown, N. Y.	472,929
Car Brake Shoe, George Sands, Beaver Falls, Pa.	472,955
Car Truck, James Henderson, Three Rivers, Mich.	472,923
Electric Railway Wire Suspension, Alexander Philipsborn and Walter Reichel, Berlin, Germany.	472,810
Elevated Railway, St. John V. Day, Chicago, Ill	472,862
Motor for Propelling Cars, Walter L. Davis, Chicago, Ill	472,524
Safety Attachment for Overhead Electric Wires, Charles D Brown, Minneapolis, Minn.	472,784
Street Car Door, Frank Mansfield, New York	472,737
Street Car Heater, James Allingham, Minneapolis, Minn.	472,778
Trolley Wire Clamp, Montraville M. Wood, Chicago, Ill	472,596
Trolley Wire Support, Frank C. Prickett, Kansas City, Kan.	472,953

APRIL 19.

Armature for Dynamo Electric Machines, Sidney H. Short, Cleveland, O.	473,363
Armature for Dynamo-Electric Machines, Sidney H. Short, Cleveland, O.	473,364
Armature for Electric Generators or Motors, Sidney H. Short, Cleveland, O.	473,366
Cable Grip, Elias R. Guerra, Hoboken, N. J	473,221
Cable System, James B. Mahaffey, Baltimore, Md	473,233
Car Brake, Edward A. Kinley, Bressport, N. Y	473,319
Conduit and Trolley for Electric Railway Systems, Charles W. Carll and James W. Phillips, Trenton, N. J.	472,982
Converter System for Electric Railways, Mark W. Dewey, Syracuse, N.Y.	473,253
Dynamo Electric Machine, Sidney H. Short, Cleveland, O.	473,367
Gearless Motor for Electric Railway Cars, Sidney H. Short, Cleveland, O.	473,365
Gearless Propelling Mechanism for Electric Railway Cars, Sidney H. Short, Cleveland, O.	473,368
Grip Pulley, James M. Dodge, Philadelphia, Pa	473,254
Holding Strap for Cars, Henry A. Hartman, Philadelphia, Pa.	473,255
Multiple Arc Railway System, Sidney H. Short, Cleveland, O.	473,361
Rail Joint, John Nelson, West Bay City, Mich.	473,162
Railroad Tie and Chair, Commodore P. Howell, Chattanooga, Tenn.	473,071
Sand Box for Cars, Herbert H. Hennegin, St. Louis, Mo	473,070
Sanding Mechanism for Cars, Nicholas Seibert, Boston, Mass.	473,090
Trolley Switch, Sidney H. Short, Cleveland, O.	473,362

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

A CHICAGO dispatch states the North Chicago Street Railway Co., of which Mr. Charles T. Yerkes is president, has acquired control of the experimental line in Chicago equipped with the Love electric conduit, and that the Love system will, in all probability, be adopted upon a large portion of the roads under Mr. Yerkes' control, if further tests prove equally satisfactory.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, April 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co	50	1,250,000	Q.—J.	1½	.....	107	.....
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	185	.....
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	176	178
Coney Island & Brooklyn R. R. Co	100	500,000	.....	...	.....	125	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	106
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st	....	125,000	F. & A.	7	Aug. 1897	107	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	103	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	108	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	114	115
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	10	12

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	103	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	102	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	105	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	105	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	105	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103	104
" " " Debenture	1891	200,000	M. & N.	6	1901	109	110
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	105	.....
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	83	.....

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, April 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾	.....	25	27
Broadway & Seventh Avenue	100	2,100,000	Q.—J.	2	.....	205	205
Brooklyn City	10	2,000,000	Q.—F.	2	.....	165	170
Brooklyn Crosstown	100	500,000	A. & O.	4	.....	.....	.....
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	104	108
Christopher & Tenth	100	650,000	F. & A.	1¾	.....	115	116
Central Crosstown	100	600,000	Q.—F.	1¾	.....	125	130
Dry Dock, E. B'way & Battery	100	1,200,000	Q.—F.	2	.....	125	135
42d & Grand St. Ferry	100	748,000	Q.—F.	3	.....	230	240
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	37	40
Eighth Avenue	100	1,600,000	Q.—J.	2	.....	105	110
Houston, W. St. & Pav. Ferry. Leased to B'way & 7 ave	100	1,000,000	Q—F.	2	.....	160	.....
Second Avenue	100	1,862,000	J. & J.	5	.....	95	100
Sixth Avenue	100	1,500,000	M. & S.	3	.....	130	150
Third Avenue	100	2,000,000	M. & N.	4	.....	290	305
23d St.	100	600,000	Q.—F.	2½	.....	220	230
Ninth Avenue	100	800,000	.....	3	.....	90	95

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry	.....	700,000	J. & J.	7	July, 1900	110	.....
B'way & 7th Ave., 1st mort	.....	1,500,000	J. & D.	5	June, 1904	105	107
2d mort	.....	500,000	J. & J.	5	July, 1914	105	106
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	106	107
Additional	.....	1,000,000	J. & J.	5	July, 1905	93	95
Brooklyn City	.....	200.000	J. & J.	5	Jan., 1902	105½	107¾
Brooklyn Crosstown	.....	200,000	... .	5	1902	107	109
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	114	116
Christopher & Tenth	.....	250,000	A. & O.	7	Oct., 1898	112	114
Central Crosstown	.....	250,000	M. & N.	6	Nov., 1922	118	120
Dry Dock, E. B'way & Battery, 1st mort	.....	840,000	J. & D.	7	June, 1893	104	106
Scrip	.....	1,200,000	F. & A.	6	Aug. 1914	98	100
42d & Grand St. Ferry	.....	236,000	A. & O.	7	April, 1893	110	112
42d St. Manhat. & St. Nich. Av 1st mort	.....	1,200,000	M & S.	6	Sept., 1910	112	114
2d mort	.....	1,200,000	J. & J.	6	1915	38	39
Eighth Ave., Scrip	.....	1,000,000	F. & A.	6	Aug., 1914	105	110
Houston, W. St. & Pav. Ferry	.....	250,000	J. & J.	7	July, 1894	109	111
Second Avenue	.....	1,600,000	M. & N.	5	Nov., 1909	102	103
Third Avenue	.....	5,000,000	J. & J.	5	Jan., 1937	110	115
23d St.	.....	250,000	M. & N.	7	May, 1893	108	110

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 7 Exchange Place, Members of Boston Stock Exchange. April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,400,000	J. & J.	4	1887	86	86¼
West End Com'n	50	$7,150,000	J. & J.	5	1890–1891	71	72

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, April 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co	100	$270,000	New.	...	Oct., 1887	96½	98½
Union R. R. Co., Prov.	100	2,000,000	Q.—J.	2	1862–1863	197½	205
Providence Cable Tramway	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co	100	$360,000	J. & J.	4	.....	245	250
Holyoke Street R. R.	100	150,000	J. & J.	4	.....	225	235
Northampton Street R. R.	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	3	.....	.....	65
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co	100	800.000	Quart.	1½	1867	131½	132¼
Crescent City R. Co	100	1,150,000	"	1¾	.866	90½	91½
Canal & Claiborne R. R. Co.	40	240,000	.....	...	1888	24	28
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	131½	.....
Orleans R. R. Co	50	185,000	"	2	1868	71½	74
St. Charles Street R. R. Co	50	600,000	"	3	1866	92½	93½

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	102¼	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93–'99	.....	.....
do do new	1886	40,000	M & N	6	1896	... .	.....
N. O. City R. R. Co	1879	495,200	J & D	6	1903	120	122
N. O. & Carrollton R. R. Co.	1882	300,000	F & A	6	'92–'06	113½	.....
St. Charles Street R. R. Co	1881	165,000	J & D	6	'89–'01	.....	.....

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	35	.....
State Street Horse R. R. Co	25	23,000	J. & J.	3	.....	25	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	26	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co	1874	20,000	J. & J.	7	Jan., 1894	104	.... .
New Haven & W. Haven R. R. Co	18-9	50.000	J. & J.	5	July, 1899	100	.....
Bridgeport Horse R. R. Co	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued)	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, April. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	219	220
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry	1885	£60,000		5	1965		

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref	100	$1,000,000	A. & O.	5	Jan. 1891	77	77½
Louisville St. Ry. Co., com	100	5,000,000			Jan. 1891	21½	22
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	93½	94
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	113	
Central Passenger Ry. Co	1888	400,000	M. & N.	6	1908	113	
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3		334½	335
Chicago Passenger	100	1,000,000	A. & O.	2½		91	92
North Chicago City	100	500,000	Q.—J.	7½		500	
North Chicago Street	100	5,000,000	J. & J.	4		178	178½
West Division City	100	1,250,000	Q.—J.	8¾		635	
West Chicago Street	100	10,000,000	Q.—F.	1½		132	132½
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City		4,619,500	J. & J.	4½		98¼	98½
Chicago Passenger	1883	400,000	F. & A.	6	1903	108	109
North Chicago City, 1st mort.		500,000	M. & N.	6	1900		112
" " "		1,640,000	M. & N.	4½	1927	95½	96
North Chicago Street 1st mort		2,350,000	J. & J.	5	1906	100	100½
West Division Railway		3,790,000	J. & J.	5		101	101¼
" " " Ext.		250,000	J. & D.	6		101	101½
West Chicago Street		4,160,000	M. & N.	5		101¼	101½
West Chicago Street, Tunnel		1,500,000	F. & A.	5			98

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, April 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co	50	1,500,000				28⅞	
Citizens' Traction R. R. Co	50	3,000,000	J. & J.	3		62⅜	63
Pitts. & Birmingham R. R. Co	50	3,000,000				25⅞	26¼
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.				
Federal St. & Pleasant Valley	50	1,300,000	J. & J.	3		25	35⅜
Pittsburgh, Allegheny & Man	50	3,000,000				39¾	39⅞
West End R. R. Co	50	200,000	J. & J.				50
Second Avenue R. R. Co	50	300,000	J. & J.	3			
Penn Incline Plane Co	50	250,000					
Monongahela Incline Plane Co	50	140,000	F. & A.				
Fort Pitt Incline Plane Co	50	60,000					
Mount Oliver Incline Plane Co	50	100,000					
Pittsburgh Incline Co	100	150,000					
Duquesne Traction Co	50	3,000,000				26	
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co	1887	1,250,000	A. & O	5	1927	108	
Pitts. & Birmingham Traction Co	1889	1,500,000	M. & N.	5	1929	103	
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937		
Pleasant Valley Ry	1891	300,000	J. & J.	5	1919		
P., A. & M. R. R. Co	1891	1,500 000	J. & J.	5	1931	103½	104
Duquesne Traction Co	1890	1,500,000	J. & J.	5	1930		
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909		
Central Traction Co	1889	375,000	J. & J.	5	1919		
Pleasant Valley R. R. Co	1873	75,000	J. & J.	6	1903		
Union R. R. Co	1881	100,000	A. & O.	5	1901		
West End R. R. Co	1887	75,000	J. & J.	5	1907		
Fort Pitt Incline Plane Co	1881	30,000		6	1901		
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901		
Penn Incline Plane Co. 1st Mort	1883	125,000		6	1903	102½	
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892		
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897		
Pittsburgh Incline Co	1889	250,000	J. & J.	6	1919		

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000					100
California St. Cable Co	100	1,000,000	Monthly	5		115½	116½
Central R. R. Co	100	1,000,000					12
Geary St., Park & Ocean R. R. Co	100	1,000,000		1		94	105
North Beach & Mission Ry. Co	100	1,000,000				50	75
Ferries & Cliff House R. R. Co.	100	2,500,000				36¾	40
Omnibus Cable Co	100	2,000,000	Monthly	4		57¼	60
Presidio & Ferries R. R. Co	100	1,000,000				20	30
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House		650,000	M. & S.	6	1914	100¼	110
Market Street R. R.		3,000,000	J. & J.	6	1913	123	
Omnibus R. R.		2,000,000	A. & O.	6	1918	112½	
Powell Street R. R.		700,000	M. & S.	6	1912	112½	
Park & Ocean R. R.		250,000	J. & J.	6	1914	113¾	
Park & Cliff House R. R.		350,000	J. & J.	6			95
Cal. St. Cable R. R.						104	

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., April 18. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine	100	$324,000	Q.—J.	3	1864	102	103
Cass Ave. & Fair Grounds	50	300,000			1876	44½	45½
Citizens'	100	1,500,000	A. & O.	1¼	1887	100	105
Jefferson Avenue	100	112,000			1885	102	105
Lindell	100	2,500,000	Q.—J.		1890	56	60
Missouri	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000			1890	190	200
Northern Central	100	200,000			1884	100	105
People's	50	1,000,000	M. & S.	6	1889	40	45
St. Louis	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal	50	150,000	Jan.	50	1872	15	25
Union	50	600,000			1870	20	25
Union Depot	100	1,200,000			1890	200	250
St. Louis & Suburban	100	2,500,000			1891	48	50
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine	1880	$500,000	F. & A.	6	1900	102	102½
Cass Avenue	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	107	108
Lindell	1890	1,500,000	J. & J.	5	1895–1910	99	100
Mound City	1890	525,000	A. & O.	6	1900–1910	105	106
Missouri Cable	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort	1882	125,000	J. & D.	6	1902	102	105
" 2d mort	1886	75,000	M. & N.	7	1902	104	105
People's Cable	1889	800,000	J. & J.	6	1889–1914	97½	100
Northern Central	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable	1890	1,500,000	M. & N.	5	1900–1910	97½	98
Union	1885	150,000	M. & N.	6	1895–1915	102	103
Union Depot	1890	1,000,000	J. & O.	6	1900–1910	105	105

PHILADELPHIA STOCKS AND BONDS.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Builitt Building), Philadelphia, April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'	50	$500,000	Q.—J.	4	1858	260	270
Continental	50	1,000,000	J.—J.	6	1873	120	122
Frankford & Southwark	50	1,250,000	Q.—J.	6	1854	210	212
Germantown	50	1,500,000	Q.—J.		1858	99	100
Green & Coates	50	500,000	Q.—J.	3	1858	118	120
Hestonville	50	2,050,000			1859	35	36
Lombard & South	25	500,000	A.—O.	8	1861	55	58
People's Common	25	1,500,000	M.—S.	2½	1873	49	50
" Preferred	25	750,000	M.—S.	2½		49	
Philadelphia City	50	1,000,000	J.—J.	7½	1859	150	151
Philadelphia & Gray's Ferry	50	617,500	J.—J.	3½	1858	66	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	84	86
Ridge Avenue	50	750,000	Q.—J.	5	1872	200	205
Second & Third	50	1,060,200	Q.—J.	4½	1853	159	160
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	196	200
Union	50	1,250,000	J.—J.	9½	1864	170	180
West Philadelphia	50	750,000	J.—J.	10	1857	185	190
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1		112	114
Baltimore Traction	25	5,000,000			1889	20½	21
Buffalo (N. Y.) Railway	100	6,000,000				34	36
Newark (N. J.) Passenger	100	6,000,000				29	30
BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort	1889	1,500,000	M.—N.	5	1929	109	110
" " Imp.	1892	1,250,000	M.—S.	6	1901	102½	
Germantown, 1st mort		67,000	J.—D.	5	1904	103	
" 2d mort		160,000	A.—O.	5	1899	103	
Hestonville, 1st mort		300,000	M.—N.	6	1895	104	
" " "		124,500	J.—J.	6	1901	105	
" 2d mort		75,000	M.—S.	6	1902	105	
People's, 1st mort		219,000	J.—J.	7	1905	115	
" " "		285,000	J.—J.	5	1911	100	
" Cons. mort		247,000	M.—S.	5	1912	95	
West Philadelphia, 1st mort		246,000	A.—O.	6	1906	117	

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	**Date of Issue**	**Am't Out-standing.**	**Inter'st Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, April 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5		110	110¼
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5		109½	109¾
S. Covington & Cincinnati	50	275,000	J. & D.	6		118	120
Mt. Auburn Cable	100	300,000					40
Cin. Inclined Plane Ry.	100	500,000				67	68
" " " Pref.	100	100,000		6		98½	99½
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Cincinnati Street		50,000	J. & J.	7	July, 1892	100½	102½
" "		50,000	J. & J.	7	July, 1893	102	.....
" "		50,000	J. & J.	7	July, 1894	104	.....
" "		50,000	J. & J.	7	July, 1895	.....	110
" "		50,000	J. & J.	7	July, 1896	108	112
" " extended		100,000	J. & J.	4	July, 1896	.....	101
		50,000	J. & J.	5	July, '96	101	103
Mt. Adams & Eden Park		50,000	A. & O.	6	July, 1895	.....	.....
" " "		50,000	A. & O.	6	July, 1900	104½	.....
" " "		100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's		200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable.		280,000	M. & S.	5	Mar. 1906	104	105
Cin. Inclined Plane Ry.		125,000	J. & J.	7	July, 1899	115	.....
" " " "		300,000	J. & J.	6	Jan. 1914	107	108
Mt. Auburn Cable		200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d.		100,000	A. & O.	7	Ap. '93-1908	95	100
S. Covington & Cincinnati		250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., April 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3		75	80
Union Pass. Ry. Co.	50	750,000					
Highlandtown & Point Breeze Ry. Co.	50	180 000					
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1		20¾	21¼
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
Union Ry. Co. 1st mort.		50,000	M. & N.	6		105	110
" " cons. mort.		1,500,000		5		93	100
Balto. Traction Co. (Cable)	1899	1,500,000	M. & N.	5	1929	110	110½
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	111	111⅛

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co, Bankers, 1314 F Street, N.W., Washington, D. C., April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	250	275
Metropolitan R. R.	50	750,000	Q. J.	...	1864	104	113
Columbia R. R.	50	400,000	Q. M.	...	1870	63	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	38	45
Eckington & Soldiers' Home.	50	352,000		...		35	.....
Georgetown & Tenallytown	50	200,000		...		44	50
Rock Creek R. R.	100	401,700		...		100	.....
Glen Echo R. R.	50	100,000		...			.....
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	101	.....
do. do. convert.	'83-'91	3.000,000	J. & J.	6	1899-1929	138⅝	139⅛
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	100	.....
Capitol & North C St. R. R.	1891	240,000	J. & J.	5	1921	109	.....
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	118	125

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000		...	1890	31	35
Buffalo (N.Y.) Ry.	100	6,000,000		...	1891	39	40
Paterson (N. J.) Ry.	100	1,250,000		...	1891	.....	25
Newark (N. J.) Pass. Ry.	100	6,000,000		...	1890	26	30
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid**	**Ask'd**
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	90	95
Buffalo (N.Y.) Ry.	1891	5,000.000	F & A	5	1931	94	97½
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	.....	100
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	89¾	90

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000				106	110
Brooklyn St. R. R.	100	310,000		2		170	175
Cleveland City Cable, common	100	4,000,000				22½	25
" " pref'd	100					95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½		82½	85
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½		145	150

Financial.

THE Tacoma (Wash.) Railway & Motor Co. propose an increase of capital to $750,000.

$ $ $

THE New Bedford (Mass.) Union Street Railway Co. declared a dividend of 2½ per cent. April 1.

$ $ $

THE Newburyport (Mass.) & Amesbury Street Railway Co. have filed a mortgage deed of $350,000 with the International Trust Co., of Boston, to secure an issue of bonds.

$ $ $

THE stockholders of the York (Pa.) Street Railway Co. have decided to increase the capital stock of the company to $200,000. This action was taken with a view to the adoption of the trolley system.

$ $ $

THE sale of the Macon (Ga.) City & Suburban Street Railway Co. and the Central City Street Railway Co. has been postponed until May 14. It is thought that the two systems will sell for about $225,000 or $250,000.

$ $ $

THE Continental Trust Co., of New York, last month applied to the United States District Court for a receiver for the Lansing (Mich.) City Electric Street Railway, claiming that the company must be reorganized.

$ $ $

THE sale of the Keokuk (Ia.) Electric Street Railway & Power Co.'s property appointed for March 21 was postponed for thirty days, on application of S. P. Townsend & Son, of Hartford, Conn., who hold $60,000 of the mortgage bonds.

$ $ $

SALES of stock of the Alley L road in Chicago have been recently made at 96. Such a price for the stock of a carrying company not yet in operation is almost without a precedent. It is stated that the stock is not easy to secure even at these high figures.

$ $ $

THE directors of the Baltimore (Md.) Traction Co. passed the quarterly dividend due April 1, in view of the extraordinary expenses already made and to be made in extending and improving the plant of the company and the non-completion of the new cable extension.

$ $ $

THE receipts of the Lynchburg (Va.) Street Railway Co. from June 12, 1891, to January 1, 1892, were as follows: Cash fares $11,906.17; tickets sold, $2,117.09; from other sources, $26.14. Total receipts, $14,049.49. Number of cash fares, 238,131; number of tickets sold, 61,712; total number of paying passengers, 299,843.

$ $ $

THE Essex Electric Street Railway Co., of Salem, Mass., have petitioned the Railroad Commissioners for leave to increase their issue

of bonds from $100,000 to $180,000. The road is capitalized at $50,000. Civil Engineer Doane presented a statement of the present property of the road, amounting to $178,894. It is proposed to add electric equipment, buildings, etc., making the entire value $233,028.

$ $ $

THE West Chicago Street Railway Co. have issued $1,000,000 6 per cent. debenture bonds. They are dated December 1, 1891. The proceeds from the sale of the bonds will be used to pay for the construction of about forty miles of new lines, ordinances for which were passed by the City Council March 31 last, and which the company have accepted.

$ $ $

A SYNDICATE of Philadelphia capitalists headed by E. W. Clark & Co., bankers, of that city and J. & W. Seligman & Co., and H. B. Hollins & Co., bankers, of New York, have purchased the street railway lines of Columbus, O., and organized a corporation known as the Columbus Railway Co. It is understood that the price paid for the property was about $2,250,000. The new company will issue $3,000,000 consolidated, first mortgage, 5 per cent., forty-year gold bonds, and $3,000,000 capital stock.

$ $ $

THE annual report of the Douglas County Street Railway Co. of West Superior, Wis., shows that the earnings in 1891 were $47,221; expenses, taxes and interest were $35,589, including payment of $375 for supplies on hand January 1, 1892. This deducted, there remains net $12,007 for the year. The capital stock January 1, was $100,000. There were, besides, $118,000 20-year fives and $50,000 convertible fives besides a note of $3,500 without interest, a total capital of $271,500. The company have paid 7 per cent. on the stock from the earnings of 1891, which did not enter the accounts for that year. The charges to operating for the year, including interest, taxes, and a small sum for betterments, was about 75 per cent. of the gross income.

The earnings of the road thus far in 1892 were, from January 1 to March 31, $14,537; expenses, $10,225; net, $4,312. The charges were $3,037, leaving a surplus of $1,275. During the same period in 1891 the figures were: Earnings, $7,307; expenses, $6,542; net, $765; changes, $1,181; deficit, $422,

$ $ $

THE Chicago *Tribune* in a recent issue published an article in which it alleged that $530,000 had been misappropriated by persons connected with the West Chicago Railroad Co. The disproof of the charge is given by the *Economist*, the financial paper of Chicago in these terms: "The evidence presented in support of this charge consisted of conveyances of real estate which are a part of the public records and the existence of which nobody denies. These conveyances are, however, like hundreds of others that go to the records every year in naming considerations for property in excess of the amount actually paid. The motive for such action is various in different cases. Sometimes it is done to give property the appearance of value greater than its actual worth, and sometimes because the trade is an exchange and mere arbitrary figures are used to express the price. In this instance the transfer was made to the company at figures greatly above those paid, for the purpose of including the power houses to be erected on the land. There is no evidence that any person has bought land at one price, sold it to the company at a higher price and pocketed the difference. Yet this grave crime is charged against the officers of the company and an effort is made to heighten its effect by taunts and inuendoes. The publication of this article precipitated a sharp but temporary decline in the stock of the company. A considerable number of weak holders ordered their stock sold for what it would bring. Speculators, who may have been short of the stock or waiting to buy at a low price for the long account, at once saw their chance to profit by the fright of those having less knowledge of affairs or less courage. It was a golden opportunity for the man who knew the property and its management, a cruel blow at the amateur investor or speculator. At the same time the article was so written as to probably evade the operation of laws designed to protect the characters of men from wanton attack. The effect of this article is a striking illustration of the weight in the popular mind of any utterance of a newspaper of high standing no matter how foolish or false that utterance may be or how unfair in tone.

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WANTED.—A man with over 10 years' experience, desires a position to take charge of the inspection and detective department of a street railway company in any part of the country. Can furnish the best of references regarding ability, etc. Address "W. F. G.," care of STREET RAILWAY JOURNAL. 4t

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Mark Twain and the Berlin Street Cars.

In one of his recent letters Mark Twain devotes considerable space to a humorous description of the street railway system of Berlin. He says:

There is a multiplicity of clean and comfortable horse cars, but whenever you think you know where a car is going to you had better step ashore, because that car is not going to that place at all. The car routes are marvelously intricate, and often the drivers get lost and are not heard of for years. The signs on the cars furnish no details as to the course of the journey; they name the end of it, and then experiment around to see how much territory they can cover before they get there. The conductors will collect your fare over again every few miles and give you a ticket, which he hasn't apparently kept any record of, and you keep it till an inspector comes aboard by and by and tears a corner off it (which he does not keep); then you throw the ticket away and get ready to buy another. Brains are of no value when you are trying to navigate Berlin in a horse car. When the ablest of Brooklyn's editors was here on a visit he took a horse car in the early morning and wore it out trying to get to a point in the centre of the city. He was on board all day and spent many dollars in fares, and then did not arrive at the place which he had started to go to. This is the most thorough way to see Berlin but it is also the most expensive.

But there are excellent features about the car system, nevertheless. The car will not stop for you to get on or off except at certain places a block or two apart, where there is a sign to indicate that that is a halting station. This saves many bones. There are twenty places inside the car; when these seats are filled no more can enter. Four or five persons may stand on each platform—the law decrees the number—and when these standing places are all occupied the next applicant is refused. As there is no crowding and as no rowdyism is allowed, women stand on the platforms as well as men. They often stand there when there are vacant seats inside, for these places are comfortable, there being little or no jolting. A native tells me that when the first car was put on, thirty or forty years ago, the public had such a terror of it that they didn't feel safe inside of it or outside either. They made the company keep a man at every crossing with a red flag in his hand. Nobody would travel in the car except convicts on the way to the gallows. This made business in only one direction, and the car had to go back light. To save the company the city government transferred the convict cemetery to the other end of the line. This made traffic in both directions and kept the company from going under. This sounds like some of the information which traveling foreigners are furnished with in America. To my mind it has a doubtful ring about it.

A Luxurious Car.

Speaking of the Private Compartment Cars, we quote from the San Francisco *Daily Report* of January 20, 1892, the car being identical with those in daily service on the New York & Chicago Limited over the Lake Shore Route:

"Isn't this too lovely for anything!" exclaimed a very pretty Oakland girl yesterday afternoon as she entered the Wagner compartment car attached to the Wagner vestibule train of sleepers which brought out the Eastern press delegates last week.

A D. R. reporter, standing near, at once became interested, for whatever receives so favorable a comment from an æsthetic damsel residing in the Athens of the Pacific must needs be lovely. The girl was right. Standing in one of those luxurious compartments, with everything so bright, attractive and comfortable, an irresistible desire to travel in a Wagner car seized the reporter. "All the comforts of home" and everything that the heart of the traveler could desire was there. Hot and cold water within two feet of him as he reclined indolently on what in the daytime was the most comfortable of lounges and at night is miraculously changed into the softest and most sleep inducing kind of bed. Cut off from the curious stare of his fellow travelers, the tourist can gaze his fill at the passing scenery and, when wearied of that, he can turn his gaze inward and amuse himself by wondering how the ingenuity of the Wagner people must have been taxed to devise so many comfortable things and put them in so small a space.

Even the most æsthetic tastes could not find subject matter for offense in a Wagner compartment car. All the colors blend nicely, the dark, handsomely stained wood of the car harmonizes with the elegant frieze covering of the seats.

The compartment car is in the same style as those run on the famous limited train between New York and Chicago. It has ten connecting staterooms, furnished in different styles of woods, upholstered with silk damask to correspond with the wood. The seats are covered with the finest kind of frieze plush.

The car is steam heated, and each compartment is lighted by gas and contains a lavatory, hot and cold water, closet, etc.

Oh, yes—the reporter forgot about that pretty Oakland girl. He was just in time to catch her last sentence as she stepped off the train, and this was it, honor bright: "I vow, I'll never travel in a Pullman sleeper again."

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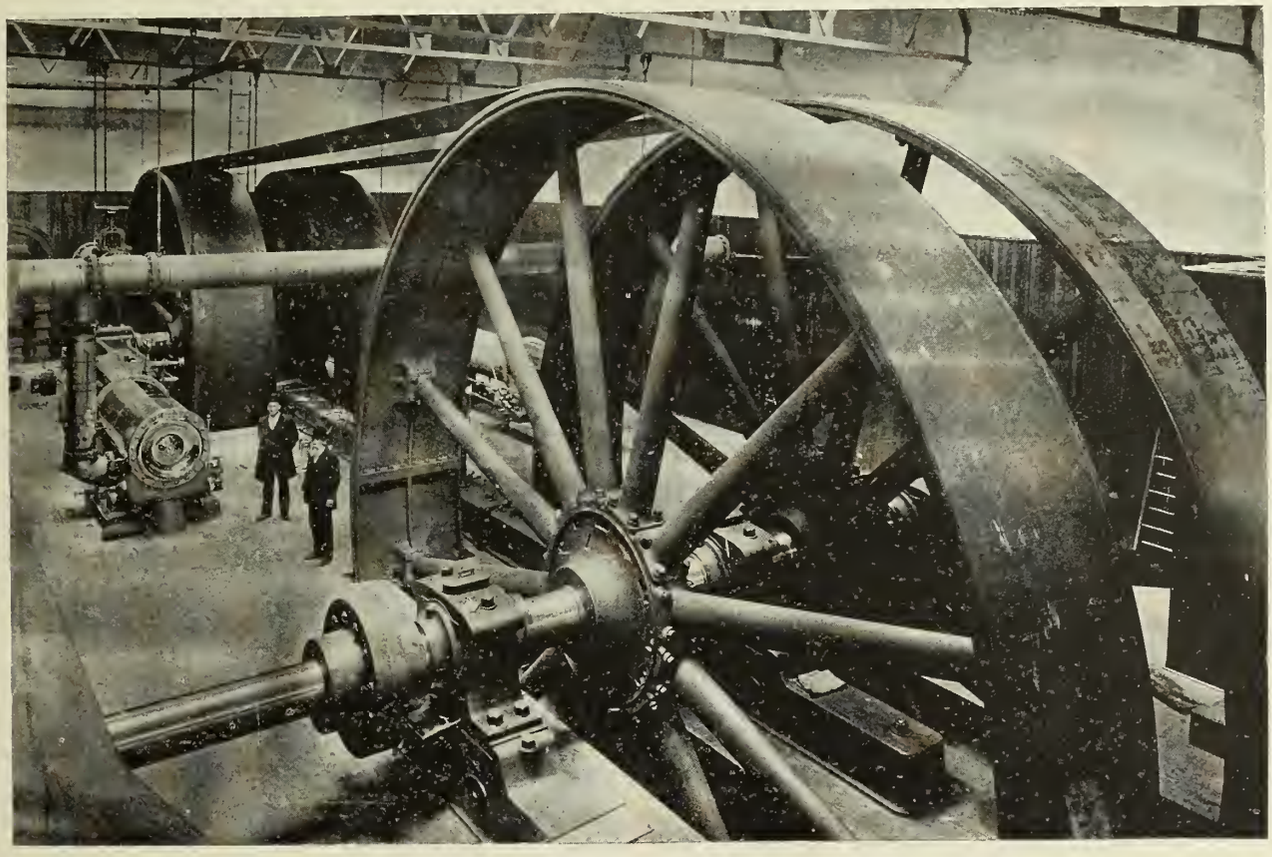
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THE STREET RAILWAY JOURNAL

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New Engine Room of the Chicago City Railway.

The extraordinary demands that have been made upon the cable lines of the Chicago City Railway Co. within the last year have necessitated a material increase in engine capacity at the power stations. At times the load has been so great that the limit of the reserve power was reached. The greatest demand was made upon the station at Fifty-fifth Street and Cottage Grove Avenue, and the Wheelock engines, which had been in operation there, were removed to make room for engines of the same make and design, but of larger capacity. The former engines were then set up in the new engine room at Twentieth Street, the equipment of which was entrusted to the Robert Poole & Son Co., of Baltimore, to form an annex to the existing power plant.



NEW ENGINE ROOM OF THE CHICAGO CITY RAILWAY.

The new engine room, of which a view is presented in the accompanying illustration, will be, when completed, the most handsome, it is claimed, in the West. The apartment is about 100 x 60 ft., and is part of the space occupied by the offices before they were located in the building adjoining the power station on the north. It is a high, airy, well lighted, and well arranged room. At the east end is built a gallery for visitors from which an excellent view of the machinery can be secured.

The foundation for the machinery in the engine room is concrete, twenty-three feet in depth. The pair of Wheelock engines has a capacity of 2,500 H. P; the cylinders are 36 x 72 ins. The band wheels attached to the crank shaft, which is eighteen inches in diameter, have diameters of twenty-four feet with sixty-two inches face, and each wheel weighs twenty-eight tons. By means of an Underwood sixty inch belt they drive a pair of band wheels, attached to the line shaft, which are thirty-two feet in diameter with sixty-two inches face. The line shaft is connected with that of the original power plant by means of a special sleeve and clutch.

The pair of engines will be capable of operating twenty-two miles of cable, and either of them may be worked in conjunction with either of the other pair of engines in the original plant. The aggregate engine capacity of the power station will be 5,000 H. P., and all the engines are of the Wheelock Engine Co.'s make.

The boilers installed in the station are of the following types: Four Babcock & Wilcox, with an aggregate capacity of 1,000 H. P.; two 500 H. P. Hazelton tripod, equipped with Roney mechanical stokers; and a battery of four tubular boilers made by John Mohr & Sons of Chicago, equipped with Murphy furnaces. All the steam pipes are covered with Excelsior pipe covering. Located in the engine room are two eight inch Schaffer & Budenberg steam injectors and one Worthington steam pump.

The Lindell Railway Co., St. Louis.

The Lindell Railway Co. were among the first of the leading street railway companies of the country to adopt electric power on a large scale, and began the operation of their entire road on the Edison system in the latter part of 1890. Many people at the time predicted that the road could never compete with the two cable roads paralleling it. Considering the simple and telling fact that the number of passengers carried during 1890, the last year horses were employed, was a little over 4,000,000 passengers, and during 1891, the first year of electricity, the number carried was 10,944,585, the exact reverse of what was predicted actually took place. The management tried storage batteries previous to adopting the overhead system, but gave up the system after spending, it was said, over $15,000.

The capital stock of the Lindell Railway Co. is $2,500,000. The president is George D. Capen; vice president, Charles F. Orthwein; secretary and treasurer, James Adkins; general manager, George W. Baumhoff. The company now operate thirty-four miles of road, divided into the Washington Avenue, Van Deventer Avenue and Chouteau Avenue divisions. The former traverses the wholesale business district and the most fashionable residence quarter of the city. From Third Street to Eighteenth Street, on Washington Avenue, a seventy-eight pound Johnson girder rail is used. A sixty-four pound Johnson rail is also employed on parts of both divisions. This rail was laid when horses were used. With light horse car traffic the ties were placed far apart, but on the adoption of electricity the number of ties was doubled. Instead of using chairs to support the rails on the new ties, as in the old construction, wooden blocks were inserted. This was supposed to give elasticity to the track. The latter is at present elastic, but the joints are in a poorer condition than any on the road. Wherever a street was unpaved the company replaced the tram with a girder rail, but to avoid tearing up well laid pavements the tram rail was retained. In the latter case great care was taken in using first class tram construction, and, in consequence, the cars ride as easily as on the girder rail, with a little more oscillation, however, than on the latter. Joints are standing up pretty well under the constant and heavy traffic. All girder rails are placed in Johnson brace chairs. Wherever the street was paved the ties were placed in concrete about two feet six inches apart. A girder curve rail is used of 100 lbs. to the yard.

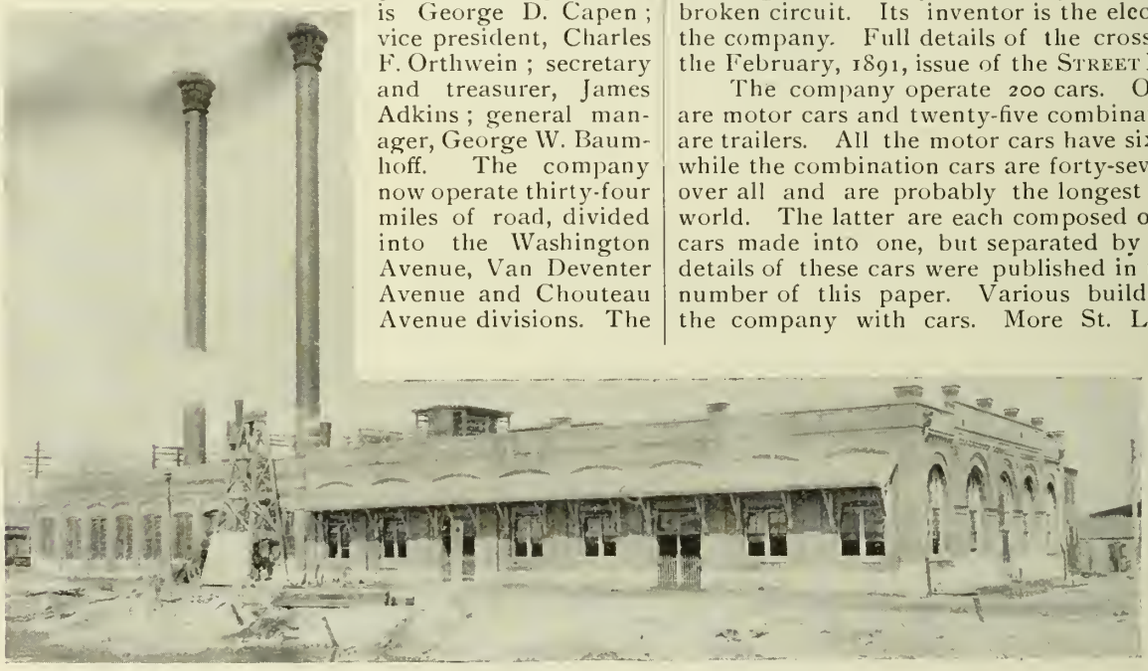


FIG. 1.—EXTERIOR OF POWER STATION—LINDELL RAILWAY CO., ST. LOUIS.

The overhead construction was very costly, and bids fair to stand for years to come. The centre poles on Washington Avenue are very heavy, and weigh 800 lbs. each. They are twenty-nine feet in height, and give a most attractive appearance to the street. At one point, where the street intersects with Broadway, the greatest traffic in the city is to be seen, and the poles are no obstruction whatever. From Eleventh Street to the eastern terminus a second trolley wire is used by the cars of the Bellefontaine railway. Two guard wires over each trolley wire keep off all broken telephone or other wires. Side poles are also used by the company, and are of the three joint pattern. They are twenty-nine feet long and weigh 550 lbs. each. The trolley wire is B. W. G. No. 4 silicon bronze, and the span wire seven strand, galvanized iron. The general manager says that in future they will use nothing but copper for the span wiring and guard wire, as iron corrodes, even if it is galvanized. All poles are placed in holes seven feet deep and twenty-seven inches in diameter. Concrete is then well tamped in about them. The return current circuit consists of two ground wires. The rail joints are bonded with insulated copper wires. The wires of the company cross those of a number of other lines, and in all cases the cars of each company use their own current. The Bagnall trolley crossing is used very extensively, and admits of an unbroken circuit. Its inventor is the electrical engineer of the company. Full details of the crossing were given in the February, 1891, issue of the STREET RAILWAY JOURNAL.

The company operate 200 cars. Of these eighty-five are motor cars and twenty-five combination cars; the rest are trailers. All the motor cars have sixteen foot bodies, while the combination cars are forty-seven feet, six inches over all and are probably the longest street cars in the world. The latter are each composed of two sixteen foot cars made into one, but separated by a vestibule. Full details of these cars were published in the October, 1891, number of this paper. Various builders have supplied the company with cars. More St. Louis Car Co. and Brill cars are used than any others. Each sixteen foot motor car as well as most of the combination cars is supplied with two 15 H. P. Edison motors. Two of the latter are each equipped with two Short gearless motors of 20 H. P. each. Another combination car is equipped with two 20 H. P. single reduction motors of the Westinghouse type. The gearless motors have been running steadily almost every day since last September and are giving good satisfaction. There is an entire absence of noise, and neither singing nor rattling. Brill's No. 7 truck is used on the motor cars of that company's make, while the St. Louis Car Co.'s truck is used on the others. The new maximum traction truck, designed by Mr. Otto Schmid, master mechanic of the company, is used on almost all the combination cars, and has been adopted as the standard for long cars. A large proportion of the sixteen foot cars are of the reversible pattern, that is, can be made open in summer and closed in winter.

The power plant (see Fig. 1) for supplying the current to this large equipment is most advantageously situated beside the tracks of four different railroads. In consequence, the coaling facilities are excellent, the company having a private switch. The station is a plain but attractive structure, 230 × 83 ft., and built entirely of brick. The front of the building faces to the left in Fig. 2, or to the south in reality. The windows of the engine room are high and airy, and on the warmest day a cool breeze is very perceptible. On the western or left hand side in the illustration is a long wooden sunshade. The engine room is 83 × 115 ft. and is separated from the boiler room by a brick partition. There are two rows of pillars supporting the roof, and thus the room is in a way divided into three open hallways, in each of which a traveling crane is provided to lift any piece of machinery. The engines and dynamos are wisely distributed, insomuch that the first hallway to the west is occupied by all

the engines except one, and the second or middle by all the dynamos except one, the extra engine and dynamo being in the third hallway. Fig. 2 gives a good idea of the location of the machinery, but leaves out two engines and four dynamos, which, under the circumstances, could not be included. There are no shifting devices or clutches of any kind employed, but the dynamos are directly belted to the engines.

The present engine equipment consists of seven machines, all of the high speed type. Of these five were made by the Southwark Foundry & Machine Co., of Philadelphia, and are Porter-Allen types; four have a capacity of 250 H. P. each and one of 450 H. P. There are two 400 H. P. engines made by Armington & Sims. The four 250 H. P. engines, and those of 400 H. P. have flywheels each with a diameter of eighty-six inches, that of the 450 H. P. engine being of twelve feet. The weight of the latter is about 16,000 lbs., and of of the others 4,000 lbs. All have tweny-five inches face. The 450 H.P. engine makes 140 revolutions per minute, while the others make 232. The cylinders only of the engines are oiled automatically, while the other parts are provided with feed cups. The Armington & Sims engines were the first installed, and the plant has been gradually increased until its present capacity is over 2,000 H. P. There is plenty of room for an ultimate capacity of 4,000 H. P. This increase will undoubtedly be made in the near future. The management are well satisfied with the results attained by their engines, and consider them superior to low speed for the work required. The electrical equipment includes ten generators, all Edison machines, compound wound, and rated at 200 H. P. and 130 K. W. capacity each, making a total generator capacity of 2,000 H. P. Four of these machines have been added within the last year.

The belts are twenty-four inches wide, are of the link type and were made by the Shultz Belting Co., of St. Louis.

An ingenious device, the invention of Mr. E. J. Bagnall, the electrician of the company, cools the armatures of the dynamos. Around the armature pulley is a sheet iron box, ending in a pipe below the pulley in the same manner as the casing fits around a steam fan. The draft created by the pulley and the link belt is conducted through the pipe which runs along under the armature to the end of the commutator and escapes through holes made in its upper portion, and rushes on to the surfaces of the armature and commutator, thus cooling them off.

The bearings of the armature shaft are oiled automatically in the following manner: On the inner surface of the bearing there is a little gutter along which oil runs, coming from the reservoir beneath the bearing. The shaft fitting in this bearing, consequently, is ever receiving oil on its surface. Connected with the reservoir is a small gauge showing the height of the oil at all times.

There are two switchboards, both of which may be seen on reference to Fig. 2. The one to the left is the main switchboard, and is very neat in construction. On it are located the ten main switches connected with the ten dynamos, and corresponding to the ten main sections into which the road is divided. There are thirty-nine feeders to these sections, and to each feeder there corresponds a field switch. The latter is also the invention of Mr. Bagnall. Its novelty consists in this, that no unscrewing has to be done to insert a fuse, as with the old fashioned switch, but when a fuse burns out the switch handle is thrown to one side on hinges, the fuse is inserted and the handle is thrown back into its former position, pressing against the fuse and keeping it in place. Any one of the sections can be cut out at any time. At the rear of the switchboard are situated the lightning arresters. There are thirty-nine small ones, made by Wirt, of Chicago, each one of which corresponds to a feeder. In case the lightning should pass through any of these, two others, made by Brush, of Cleveland, are provided, and connected in the main circuit. On the small switchboard to the right are situated the rheostats, voltmeters, ampere meters and main switches. The greatest variation in voltage is from fifteen to twenty volts. The voltmeters are of the Weston type, and the ampere meters were manufactured by the Edison General Electric Co.

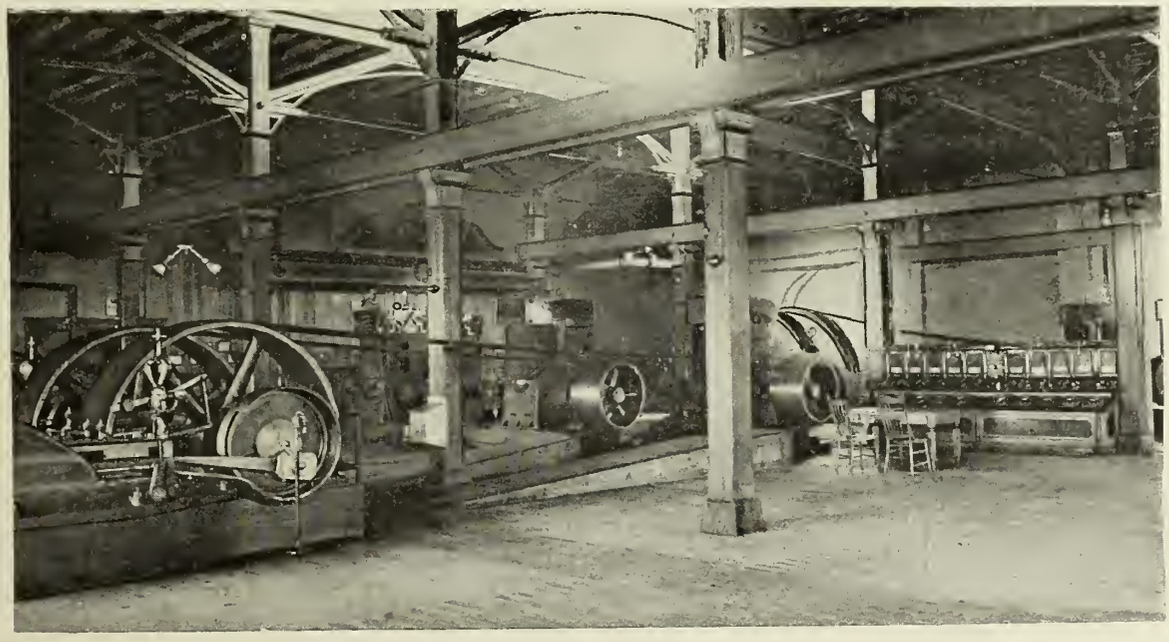


FIG. 2.—INTERIOR OF POWER STATION—LINDELL RAILWAY CO., ST. LOUIS.

The boiler room measures 115 ft. in length and 83 ft. in width. The present equipment consists of ten 200 H. P. return tubular boilers, made by Rohan Brothers, of St. Louis. They are eighteen feet in length, and have a diameter of seventy-two inches. There are sixty-two flues to each boiler, the diameter of each of which is four inches. The boilers are all built to supply steam at 120 lbs. pressure. Two Worthington pumps feed the boilers. One Ludlow heater is used, of 1,800 H. P. capacity, and measuring sixteen feet in length, and fifty-four inches in diameter. An Ashcroft steam gauge and Peerless pressure recorder are doing good service. Water supplied by the city mains is at present used, but the company are having an artesian well dug, as it is next to impossible to use the city water at certain times of the year, because of its being so impregnated with mud, and by using artesian water it is thought that the danger of explosions will be

reduced to the minimum. The well is being dug by the Robbins Drilling & Prospecting Co., of St. Louis. The coaling facilities are of the very best, and without the aid mechanical stokers. A railroad switch enters the boiler from the heater and exhaust pipes empties into them, and is used over again in the boilers. The water is always kept at a certain level.

Another ingenious and economical device is the Stewart oil extracter. All the exhaust steam from the engines is conducted into a chamber, in which there is a kind of receiver made of iron plates. These plates are so arranged that when the steam comes in contact with them it deposits the oil which is clinging to it. This oil is used again for lubricating purposes.

At present the car sheds of the Washington Avenue Division and the offices of the entire company are located at Finney and Van Deventer Avenues. Preparations are being made to move them farther west. The new site will occupy an entire square, 550 x 155 ft., bounded on three sides by Fairfax Avenue, Newstead Avenue, and Taylor Avenue. Fig. 3 is a plan of part of the shed, and Fig. 4 gives a front elevation. It is to be built on the railway station plan; that is, a high roof, truss supported. There are to be fifteen tracks running east and west. This large number will necessitate but two tracks by which the cars will enter and leave the shed. As will be seen by the illustration, no car on going out will run into any switch, all switch points being in an opposite direction. The great advantage of this can be appreciated in case of fire or any other calamity. The entire shed will accomodate 165 combination cars and 300 short or sixteen foot cars. The track work, which consists of a fifty pound T rail, was supplied by the Elliot Frog & Switch Co., of East St. Louis.

The sheds of the Chouteau Avenue diision are located at Chouteau and Jefferson Avenues. Here are located the repair shops of the company. At the time of our visit workmen were very busy building combination cars for the Washington Avenue division. The facilities of these shops are of the very best, and the most efficient and skilled workmen only are employed. The fine work turned out of the shops testifies to this. Both the Washington Avenue and Chouteau Avenue lines terminating in Forest Park, an enormous number of passengers is carried by the company in this direction during the warm months. The company have recently erected a fine pavilion at the park terminus of the Washington Avenue line. This building cost $26,000, is built of fine Milwaukee

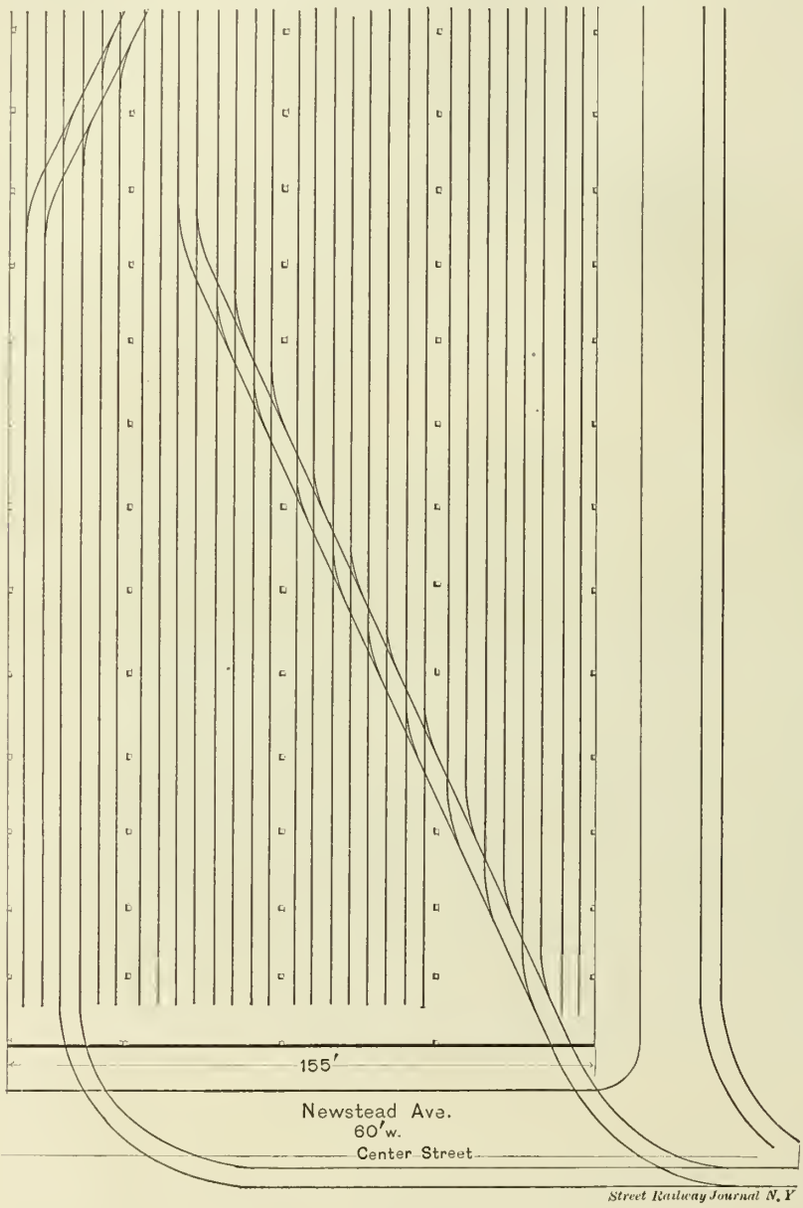


FIG. 3.—PLAN OF NEW CAR HOUSE—LINDELL RAILWAY CO.

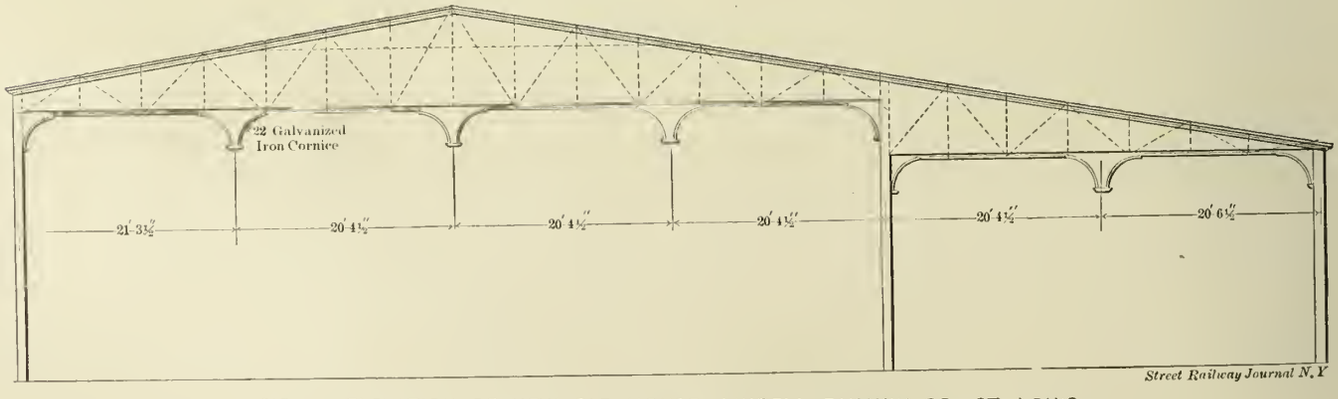


FIG. 4.—ELEVATION OF NEW CAR HOUSE—LINDELL RAILWAY CO, ST. LOUIS.

room not thirty feet away from the furnace doors. Coal heavers shovel the coal from the cars to the floor, and the firemen feed the fires with it whenever necessary. Thus it is handled but twice. There are at present two smokestacks. They are both made of iron, 140 ft. in height, and have a diameter of sixty-six inches. Each is surmounted by an ornamental fluting.

Outside the station a cave has been dug, in which are two hot wells of 10,000 galls. capacity. All the drain pressed brick, is finished and wainscoted in oiled pine, and is lighted by electricity. The tower would be a fine ornament for any large city building. It is about one hundred feet in height, and surmounted by a lookout, and is Norman in architecture. The City Park Department has ornamented the grounds round about the buildings. The front of the building where the cars stop is laid out with a fine granitoid pavement about thirty feet wide and 150 ft. long, providing stopping places for about six cars. S. L.

Massachusetts Street Railway Superintendents' Association.

On invitation of Supt. Geo. A. Murch, of the Worcester, Leicester & Spencer Street Railway, the managers of quite a number of the Massachusetts street railways, assembled at Worcester at noon on Tuesday, April 26, for the purpose of forming an association.

They were met on arrival by Superintendent Murch; escorted to a special car in waiting and conveyed to Spencer, stopping over at Leicester, where an opportunity was given to inspect the model power station and car house of this line. The party arrived at Spencer at about 3.00 P. M., where dinner was served at the Massasoit Hotel, and when the inner man had been satisfied, Superintendent Murch called the gentlemen to order, expressed his gratification at seeing so large a number present and explained the advantages that could be gained through organization. Addresses followed by Superintendent Weeks of Quincy, Superintendent Henderson of Newton, Superintendent Morton of Lawrence, Superintendent Page of Amesbury, Superintendent Bradford of Marlboro and others, and all promised to support such an organization as was contemplated, and urged its immediate formation.

On motion of Superintendent Weeks, it was voted to form the "Massachusetts Street Railway Superintendents' Association" and officers were elected as follows:—

President, Geo. A. Murch, superintendent Worcester, Leicester & Spencer St. Ry.; vice president, Benjamin J. Weeks, superintendent Quincy & Boston St. Ry. Co.; secretary and treasurer, F. G. L. Henderson, superintendent Newton St. Ry. Co. A Committee, consisting of the president, vice-president and secretary, was appointed to prepare a set of by-laws and the secretary was directed to communicate with the superintendents of all the street railways in the state, requesting them to become members.

The new association starts off with an unusual amount of encouragement and promises to do good work in the street railway field. While it is not intended that it shall conflict in any way with the Massachusetts Street Railway Association, its members believe that there is much requiring earnest discussion, that can be better done by the practical working heads of the railways by themselves, rather than when in council with other officials, supply men, etc.

South Side Elevated Road, Chicago.

Unless all signs fail, trains will be running on the elevated system of the Chicago & South Side Rapid Transit Co. during the present month. The rolling stock reached the city early in May. The engines, which are compound, were built by the Baldwin Locomotive Works of Philadelphia, and their general appearance is shown in Fig. 1. They were built in accordance with specifications prepared by R. I. Sloan, chief engineer, and D. L. Barnes, consulting engineer, of the South Side company. The general dimensions furnished by the Baldwin Locomotive Works are as follows:

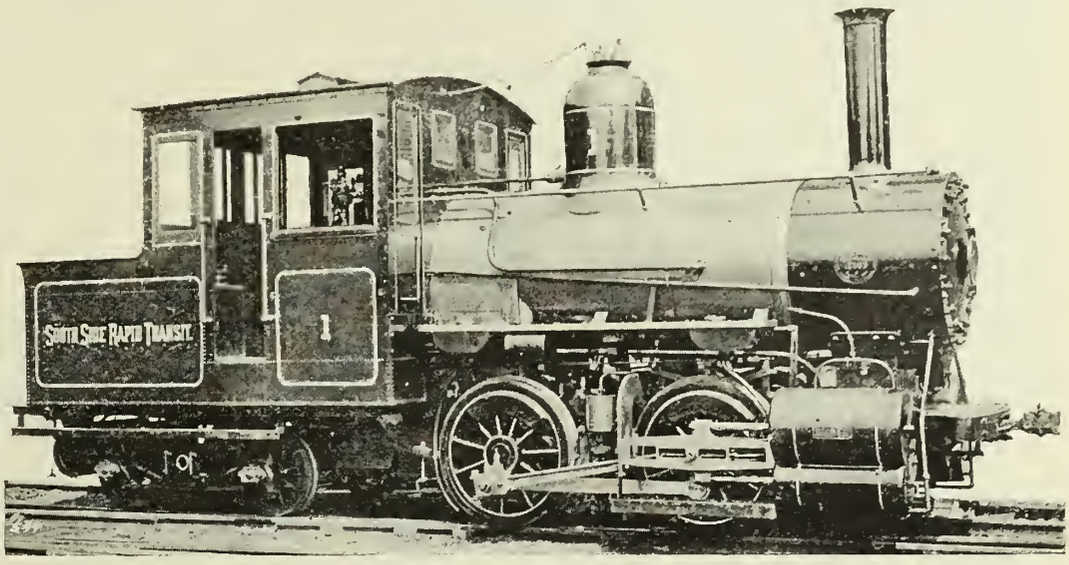


FIG. 1.—COMPOUND ENGINE—CHICAGO ELEVATED RAILWAY.

Gauge, 4 ft. 8½ ins.; cylinders, H. P., 9 x 16 ins., L. P., 15 x 16 ins.; drivers, 42 ins.; total wheel base, 16 ft. 4 ins.; D. wheel base, 5 ft.; weight, total, 58,000 lbs.; weight on drivers, 40,000 lbs.; boiler diameter, 48 ins.; number of tubes, 167; diameter of tubes, 1¾ ins.; length of tubes, 66 ins.; firebox length, 66½ ins.; firebox width, 43¼ ins.; grate area, 20 sq. ft.; heating surface, firebox, 70 sq. ft.; heating surface, tubes, 485 sq. ft.; tank capacity, 750 gals.; bunker capacity, 2 tons.



FIG. 2.—PASSENGER CAR—CHICAGO ELEVATED RAILWAY.

The engines combine many novel features which, it is believed, will render them better for service on elevated roads than any locomotives heretofore designed for this kind of work. The compound system practically does away with the offensive noise due to the exhaust steam, and at the same time the throwing out of sparks and cinders is avoided. As anthracite coal will be used no smoke nuisance will be created. The engines are designed to haul five-car trains making an average speed of twenty miles per hour, including stops. The maximum speed between stations, which are located at distances averaging three to the mile, will be from twenty-five to thirty miles.

The engines were sent to Chicago in a train drawn by the compound, ten wheel engine No. 82, built by the Baldwin Locomotive Works, which has become famous for its performances on several railroads. The movement of the train required three relays of engineers and firemen, working eight hours each, to enable the train to run day and night. Pilot engineers were taken over each division of the lines traversed by the train. Seven messengers or machinists accompanied the engines to guard against the possibility of their running hot. The train was in charge of W. J. McCarroll, assisted by Jerome J. Parmelee and H. Burrall.



FIG. 3.—INTERIOR OF CHICAGO ELEVATED RAILWAY CAR.

When the train, headed by the powerful compound engine, reached Clifton, Can., the party met with a very disagreeable experience. A customs officer informed the engineer that engine 82 was in his possession and must not be moved. He explained that in accordance with an order in council a locomotive built in the United States must pay duty on its first trip into Her Majesty's dominion, if running under steam. After a brief delay the Baldwin company filed a bond and the train was allowed to proceed. On reaching Chicago the engines were sidetracked near the elevated structure at Fortieth Street, to which they were raised up an incline by means of a donkey engine.

The passenger coaches that are to be used on the line are illustrated in Fig. 2. The car bodies are forty feet in length, and the total length, including platforms, is forty-seven feet. They are handsomely designed, and constructed in accordance with the latest patterns. The manufacturers are the Jackson & Sharp Co., of Wilmington, Del.

Transportation at the World's Fair Grounds.

The contract for operating the intramural elevated railroad at the World's Fair grounds at Jackson Park has been awarded to the Western Dummy Co., of Chicago. The plans of the corporation are not yet defined in all respects; but they have decided to use electricity as a motive power, and Thomson-Houston apparatus will be employed.

The general route of the road was shown in a plan of the World's Fair grounds published in the STREET RAILWAY JOURNAL for January. The elevated structure, which will be supported on wooden posts, will be double tracked. In all probability ten stations of handsome design will be built along the line.

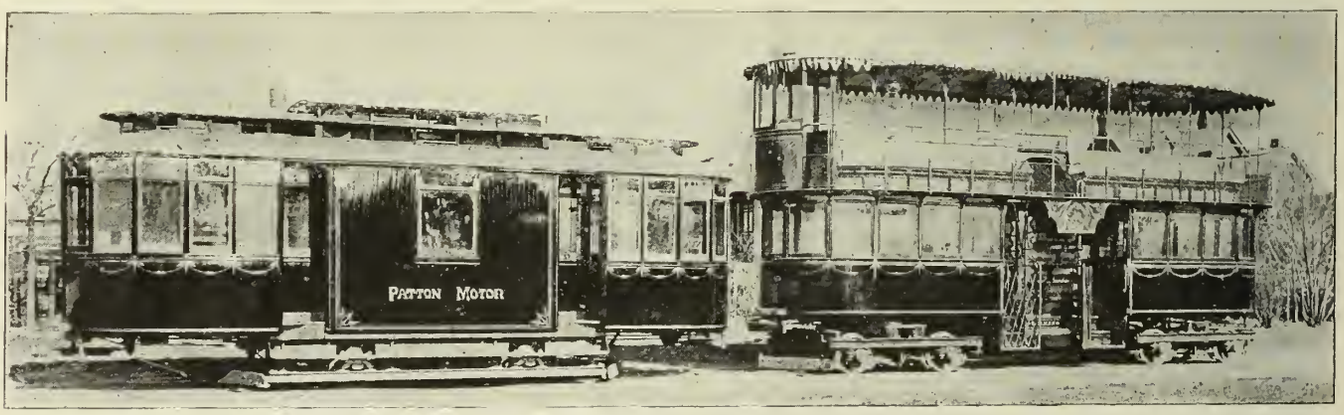
Whether an electric locomotive or motor car will be employed has not been determined, but trains of four cars will be operated. It is proposed to run on about ninety minutes headway, which will be necessary in order to conform to the requirement of the committee that the capacity of the line should be sufficient to carry 20,000 passengers an hour past a given point.

It has been supposed that the road would be supplied with electric power from the main generating station, but the estimates indicate that the requirement will be too great to depend upon the source of supply. The company, therefore, will erect their own station at some point on the grounds, to be decided upon by the authorities. According to the preliminary estimate a station with a capacity of 3,000 H. P. will be necessary.

Test of the Patton Motor.

The latest type of Patton motor was exhibited to a party of street railway men, at Pullman, Ill., May 14. The latest form differs in no essential respects from the motor which has for months been operated successfully at Pullman, and which has been described in the STREET RAILWAY JOURNAL, but experience has indicated that improvements could be made in details, which are embodied in the motor shown in the illustration drawing one of the new Pullman double decked cars. As the engraving shows, the motor is vestibuled, handsome in appearance, with interior decorations of the style characteristic of the street cars of the Pullman Co.

The motor was subjected to an exceedingly severe test with the party of visitors on board, and performed its work excellently, rounding at a good rate the short radius curves, for which the Pullman street car tracks are famous, and making trips from one end of the line to the other at a satisfactory speed. The visitors were pleased at the performance of the motor, and an order for one was placed on the spot.



PATTON MOTOR CAR AND TRAILER—PULLMAN, ILL.

The Patton motor comprises a very complete electrical installation. In the central section is located a gasoline engine which drives by a friction pulley a Bain dynamo. Storage batteries are located under the seats, in which is accumulated the current not required for operating the electric motor. The plan of the arrangement is almost obvious. The engine capacity is a little more than sufficient to operate the motor under ordinary conditions, the slight excess of energy being stored in the battery to be used when needed. As the engine is always in operation a large flow of current is accumulated in the cells when the car stops or is descending a

grade. The current from the battery alone is sufficient to run the motor for a considerable time. This fact was shown to the visitors; the engine was stopped and the motor, depending on current from the batteries alone, rounded the difficult curves at good speed. In actual service the batteries are never exhausted; and for that reason they are bound to give results that are satisfactory in all respects.

The motor car shown in the illustration was recently shipped to Portland, Ore., where it will go into service. The Patton Motor Manufacturing Co. have of late received a considerable number of orders, and motors will be turned out at the Pullman shops.

Work on the Broadway Cable Power Station, N.Y.

A description was given in our last issue of the arrangement of the machinery belonging to the Broadway cable power stations, and we present herewith a view which shows the present appearance of the work at the main cable power station at Houston Street, Broadway and Mercer Street. As mentioned in our last issue, the contractors for the entire work connected with the installation and equipment of the power stations belonging to this road are the Pennsylvania Iron Works Co., of Philadelphia. This company furnishes all the plans of construction and all the machinery which will be required.



EXCAVATION AT BROADWAY AND HOUSTON STREET, NEW YORK, FOR CABLE POWER STATION.

The contractors for the excavation and foundations of the Houston Street station are J. D. & T. E. Crimmins. T. P. Galligan & Son have charge of the work of shoring the banks, and Robert L. Darragh & Co. are the builders.

A double wall is being constructed on the three sides fronting on streets, an inner wall for the support of the building and an area wall. The former is seven feet eight inches thick at base and three feet eight inches at the level of the sidewalk. The area wall is four feet eight inches thick at base and two feet four inches at sidewalk. Both are of brick, and rest upon a continuous concrete foundation thirty inches thick. Excavations have been carried down about forty feet below street level.

The walls at present are built up on the four sides almost to the street level, and a little more than two-thirds of the earth has been removed. This part of the work is being pushed forward very rapidly. Part of the earth is drawn by horse power up the inclined plane shown in the engraving, to the Mercer Street side, the rest being lifted by two steam hoists to the surface, where it is dumped into carts and removed.

There were no quicksands encountered in the excavation as in the Bayard Street station of the Third Avenue line, but considerable water filtered into the excavation and had to be removed. During a considerable portion of the work the amount of water raised by the pumps averaged 1,250,000 gals. per twenty-four hours.

Perhaps the most interesting part of the work is that which has been done on the north and east sides, the latter being the Broadway side and the location of the wheel pit. The north side is next to a building which had to be shored up, underpinned and its foundations carried down twenty-two feet below their former depth. This was a long and difficult undertaking. After the uprights were placed in position, and needles arranged to support the wall, the earth was removed and foundations supplied in sections of twenty feet. So successfully was the work done, however, that the most careful measurements show no settlement of the building amounting to one-eighth of an inch.

The excavations on the east side under Broadway extend out a horizontal distance of forty-eight feet from the main wall of the building, the sidewalk and street pavement to several feet beyond the east track of the cable line being supported on trusses and girders. Considerable difficulty was encountered with the pneu-

matic tubes, water, gas and other pipes for which special provision had to be made. The largest and most important of these was a thirty-six inch water main which was located almost directly under the east track of the road. This main was shored up while the brick foundation upon which it now rests and which also forms the back wall of the wheel pit was built under it for its support. The Western Union pneumatic tubes are carried in the pit between the tracks just above the main cross girders and in plain sight from the pit. The rest of the pipes, which are from twenty to twenty-five in number and which include a twelve inch water main and an eight inch gas pipe, are carried below the surface of the street between the west track and the curb stone and above the pit. This space, which has a cross section about 12 × 5¼ ft., has a bottom and a top layer of concrete, the intervening space being filled with sand in which the pipes rest. The water mains are so arranged that if a leak should occur in them, the water will not leak into the engine room or pit, but will empty into drains especially provided for that purpose.

Milwaukee Street Railway System.

The entire railway system of Milwaukee will eventually be one of the most extensive in the country. Mr. Henry C. Payne, the vice-president of the Milwaukee Street Railway Co., who will ultimately operate all the lines in the city, is authority for the statement that if all the extensions now contemplated are built, between 175 and 200 miles will be traversed by electric cars. The system as now actually planned out will be about 125 miles in aggregate length. For service on the several lines from 250 to 300 cars will be required, and about 1,200 men will be employed. Milwaukee with its population of 230,000 is so compactly built that when the improvements are finished a person can travel from any point in the municipal limits to the centre of the city within thirty minutes. The work of equipping the system for electric traction is proceeding with rapidity, and the construction is being done with great thoroughness.

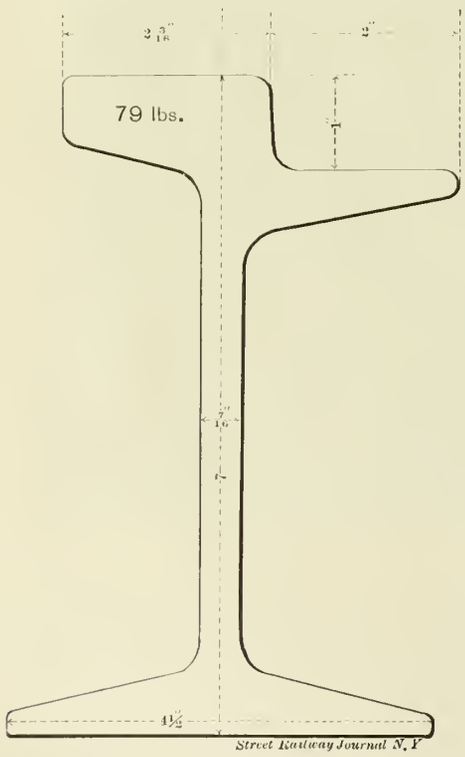


FIG 1.—RAIL—MILWAUKEE STREET RAILWAY.

The tendency of street railway companies to follow in the lines laid down by steam railroads is illustrated very forcibly in Milwaukee, both in general and in details. Cedar ties are now used, but hereafter oak will be used to a considerable extent. An order for 250,000 oak ties was recently placed in Missouri where oak is not much more expensive than cedar in Wisconsin. The change is made not because it is believed that oak will prove more durable, but because this wood will hold the spike better.

The rail which is the standard adopted by the Milwaukee Street Railway Co. is shown in Fig. 1. It was designed by the chief engineer, Mr. Bentzen and his predecessor Mr. Meyer, and is rolled by the Illinois Steel Co. In Milwaukee not so much stress is laid on the weight of rail as upon the manner of laying it. In streets paved with cobble stones or wooden blocks a five inch, fifty-eight pound rail is used; when wooden block paving is used a seven inch, seventy-nine pound rail is laid. The method of laying the rails is the same for both weights. They are spiked directly to the ties, as was done in part of the construction for the Minneapolis electric railway. Fig. 2 shows a section of track which has just been laid in West Water Street.



FIG. 2.—SECTION OF TRACK—MILWAUKEE STREET RAILWAY.

Great care has been taken with the work at the joints. The practice followed is not to locate the joint directly on a tie, but to place ties within two or three inches of the ends of the rails. Heavy splice bars are used to support the joint; those for the seventy-nine pound rail are thirty inches in length; and those for the fifty-eight pound rail measure twenty-four inches. The former are held by six bolts and the latter by four bolts. Iron rail braces are spiked directly to the ties, as shown in Fig. 2. They are set at distances of five feet where stone pavement is used, and at double that distance in all other cases.

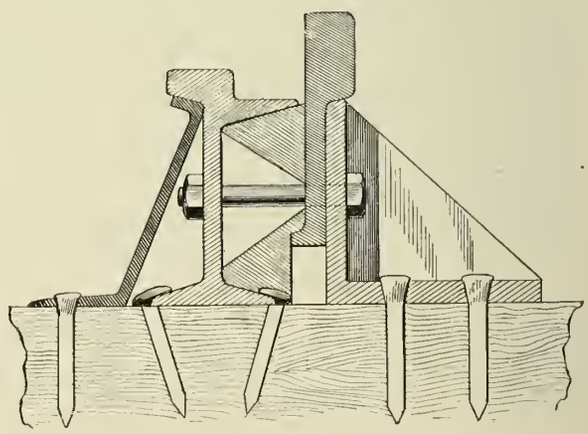


FIG. 3.—GUARD RAIL FOR CURVES—MILWAUKEE.

Great attention has been paid to the curves which, in all new work, are made on the transition plan as follows: The first five feet are bent on a radius of 200 ft., the second five feet on a radius of 100 ft., the next five feet on a radius of 66.6 ft.; the centre of the curve on a radius of forty-five ft. for the inner rail and fifty feet for the outer rail; the curves ease back into line by the same gradations, being bent on radii of 66.6 ft., 100 ft. and 200 ft. as before, but in reverse order. The construction of the curves on this plan has proved very successful. Cars can take the curves at full speed not only without danger of derailment but almost without shock.

The guard rail used on the curves is formed of an old tram rail formerly used by the company. The mode of using it is shown in the sectional view, Fig. 3. The results following the construction briefly outlined here have been highly satisfactory to the company. The engineers state that not a solitary joint in the forty-five miles of track laid last year has given them a particle of trouble. They stand up to their work in admirable fashion, as one may ascertain by riding over the line.

The street railway system, of Milwaukee, as already stated, will eventually be controlled and operated by Milwaukee Street Railway Co. While they have secured by contract both the Becker and the Hinsey lines they have not yet passed into the company's possession. When they assume control, power will be furnished from the station on River Street. The other power stations now operated will then in all probability be abandoned.

In the power station will be located the electric generating apparatus owned by the syndicate which controls the electric lighting, both arc and incandescent, and the street railways operated by the Milwaukee Street Railway Co. At the present time the incandescent dynamos, which are Edison multipolar machines, are located on the second floor. A temporary plant furnishes current for the street railway system, but work is now in progress for erecting three 200 K. W., Edison multipolar generators which will constitute the first installment of apparatus. The Milwaukee Street Railway Co. operate at the present time about forty Edison double reduction motors which have proved highly efficient in service. Since October last when they were first put in operation not an armature or field has been burned out.

The Trolley for Detroit.

The Detroit Citizens' Street Railway Co., have finally made positive arrangements for the introduction of the trolley system into Detroit, and have closed a contract for electrical apparatus with the Detroit Electrical Works. The portion of the line selected for operation by electric power is that on Jefferson Avenue as far as Baldwin Avenue, and it is stated that the line will certainly be in operation by August 1. The contract includes the entire power plant, station, overhead lines and motor equipments.

The power station steam plant will consist of three horizontal, return, tubular boilers, sixty-six inches in diameter, sixteen feet long, each to have sixty four inch flues, and three 14-24 × 14 Westinghouse automatic, compound engines, with all necessary apparatus, such as feed water heater, pump, injectors, piping, smoke stack, etc.

The power station electric plant will consist of three 100 K. W. multipolar railway generators of the Detroit Electrical Works' latest type, as well as slate switchboards of the latest and most improved design, with all instruments and attachments necessary to make a complete electric plant.

The overhead construction will consist of two No. 0 B. & S. hard drawn copper trolley wires, with necessary feeders and guard wires, supported on Milliken iron poles. The standard pole of this firm will be used for that portion of Jefferson Avenue which is seventy feet from curb to curb, and the Milliken extra heavy pole where Jefferson Avenue is eighty feet from curb to curb.

The motor equipment will consist of twelve forty H. P. motor equipments of the Detroit Electrical Works standard type.

Power Plant of the Columbus, O., Consolidated Street Railway Co.

About one year ago the Columbus Consolidated Street Railway Co. of Columbus, O., decided on changing from horse to electric power. Their station, which is described herewith, is especially interesting because at present it contains both high and low speed engines, and the relative advantages of the two, as installed, can be easily compared.

The power house is a substantial brick structure 120 × 126 ft. The engine room is 66 × 120 ft., and the boiler room 55 × 120 ft. The brick chimney is eight

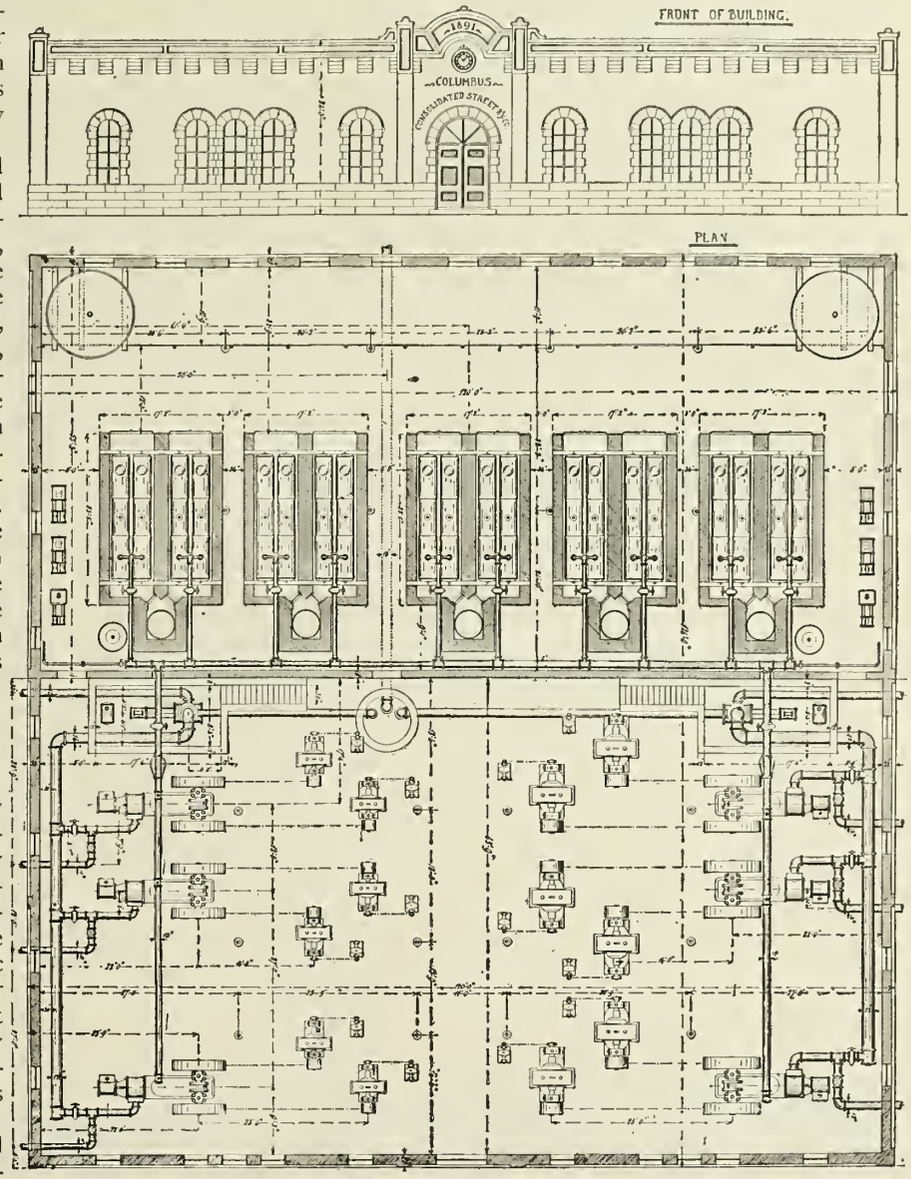


FIG. 1.—ORIGINAL PLANS FOR COLUMBUS, O., CONSOLIDATED STREET RAILWAY POWER STATION.

feet inside diameter and 170 ft. high, on foundations twenty-eight feet deep. The stack proper contains 1,000,000 bricks. For the first thirty feet the stack is built square; above this it is circular and is circular inside its entire height.

The plant is compound, condensing, the water being taken from the river 120 ft. distant, through a tunnel opening into a covered well located under the coal bin. From this point the condensing water is taken through pipes to the condenser, located in a sunken pit in the engine room.

The railroad track runs in front of the boiler room, discharging coal from the cars into the coal bins immediately in front of the boilers. The latter are six in number, were furnished by the Babcock & Wilcox Co. of New York, and have an aggregate capacity of 1,076 H. P. The condenser and feed pump are of the Blake company's manufacture. The heater was supplied by Stilwell & Bierce, and the Robinson separators are used throughout.

The high speed portion of the engine equipment consists of three McIntosh & Seymour compound, condensing engines, special railway type, rated at 250 H. P. each, and having cylinders 13 and 23 × 17 ins. (see Fig. 2) each belted to three generators. This arrangement, it is claimed, gives great compactness combined with flexibility, i. e., each boiler unit is proportioned to the engine unit, and each engine runs its own generators, each engine being entirely independent of the others. Fig. 1, on the preceeding page, shows a plan and front view of the station, as originally designed, to use high speed engines throughout. The high speed engines, together with the rest of the steam plant already described, were furnished by Pierce & Thomas of New York, who also furnished the plans and did the original engineering and construction work of the plant entire, turning the same over to the railway company in complete running order. The original plan, as shown in Fig. 1, was that each engine should drive two M. P., eighty K. W. Thomson-Houston generators, but as the traffic of the road increased more power was found necessary, and a third generator was added to each engine, making the load 330 H. P. on each, which has been carried without the slightest trouble or derangement for some eight months.

The piping throughout is made with flanged connections, fitted with valves at all points necessary to make the plant flexible, and any boiler or any engine can be thrown in or out of commission at will. The exhaust pipes from each engine are fitted with shut-off valves at their junction with the main exhaust pipes running to the condenser. In addition to this, each engine is provided with an exhaust opened to the atmosphere, controlled by a Wheeler automatic, atmospheric valve, enabling the engineer to work any engine in the battery condensing or non-condensing at will. All live steam cylinder jackets and receivers are drained by a Blake pump and receiver working automatically.

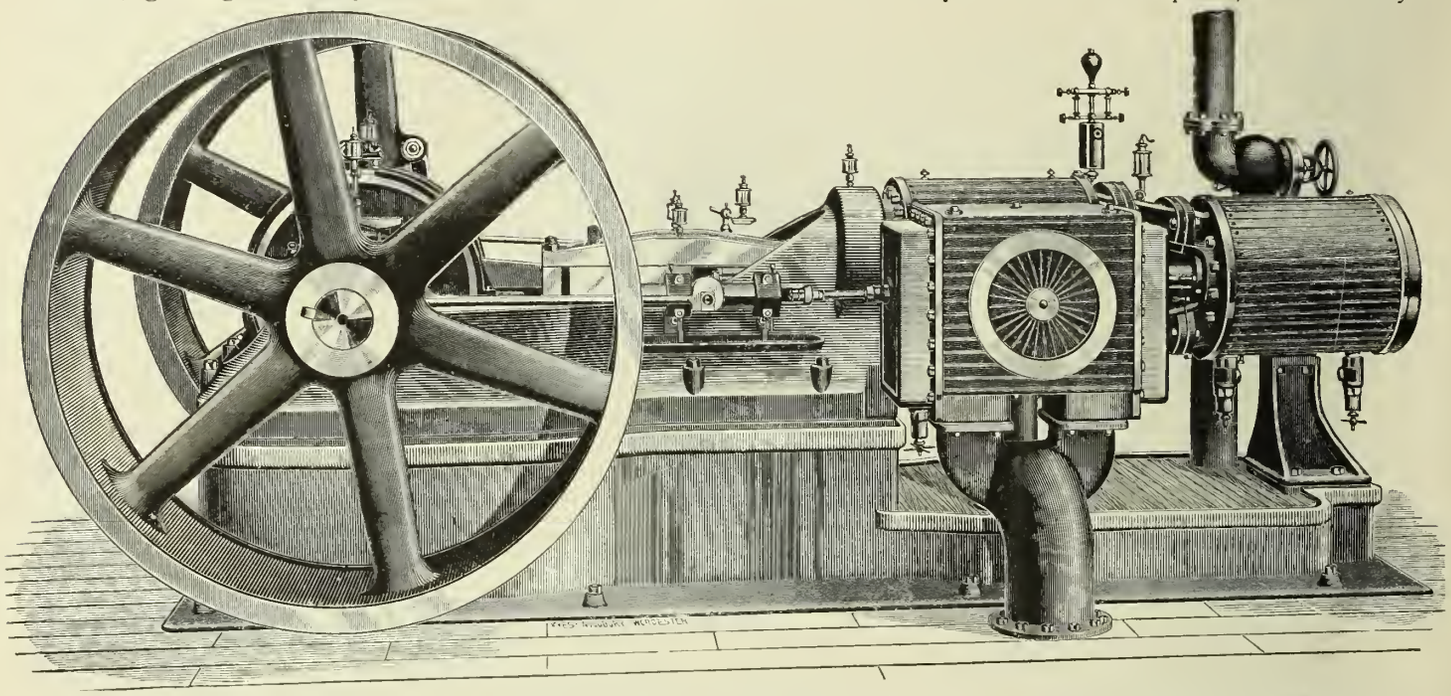


FIG. 2.—M'INTOSH & SEYMOUR TANDEM COMPOUND ENGINE—COLUMBUS CONSOLIDATED STREET RAILWAY POWER STATION.

Recently the trackage of this company has been increased, requiring more power, and the company decided to try slow speed engines. The new power equipment consists of two 800 H. P. engines (Fig. 3) built by the Buckeye Engine Co. of Salem, O. The high pressure cylinders are twenty inches diameter, low pressure cylinders thirty-six inches diameter by thirty-six inch stroke, and the speed is 120 revolutions per minute. The flywheels of the engines are fourteen feet diameter by twenty-one inch face, turned crowning for a twenty inch belt, as it is intended in the future to utilize the wheels for driving additional generators One engine is directly connected by jaw clutch couplings to each end of an intermediate shaft, so either or both engines can operate the entire length of shaft at will. The general arrangement is clearly shown in Figs. 4 and 5.

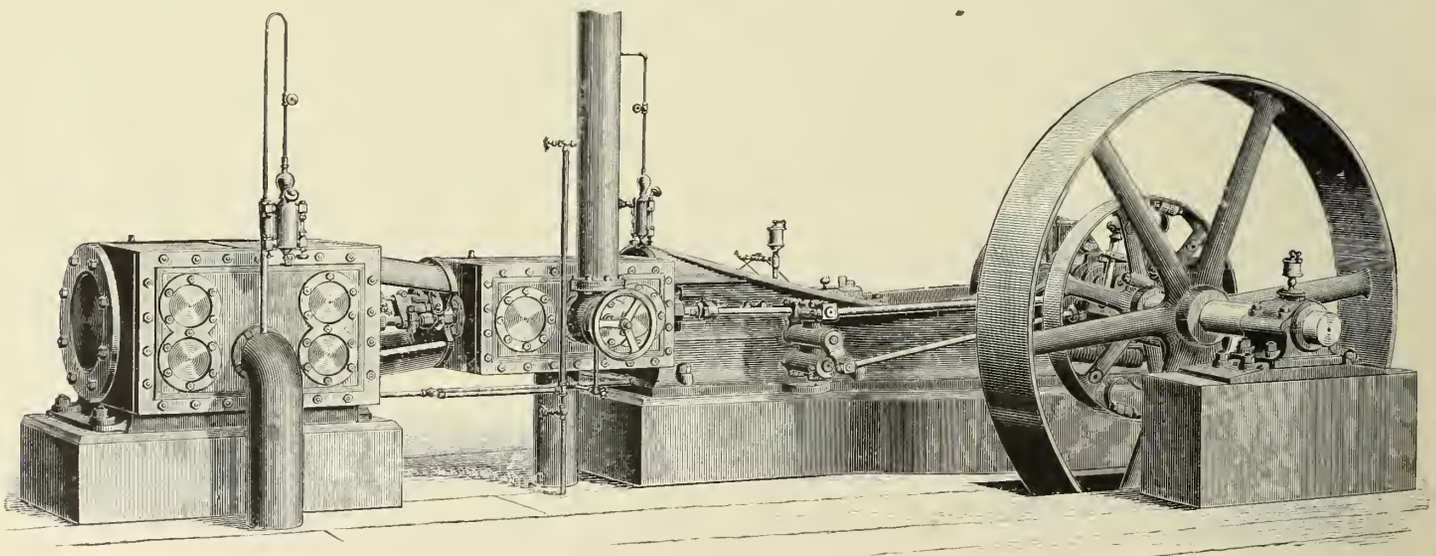


FIG. 3.—BUCKEYE TANDEM COMPOUND ENGINE—COLUMBUS CONSOLIDATED STREET RAILWAY POWER STATION.

The friction clutch pulleys, which are the largest pulleys of the type yet made, are twelve feet diameter by thirty-eight inches face, and are made of wood with a steel rim on the outside. These are designed to drive generators of 500 H. P. each, and have been tested and found capable of carrying a much greater load. The shaft is in one piece, is thirty-six feet long and nine and a half inches in diameter. The friction clutch pulleys and couplings are all operated by worm geared shifters. The clutch pulleys and shaft were furnished by the Falls Rivet & Machine Co. of Cuyahoga Falls, O. This arrangement of one engine at one end and another engine at the other end with a clutch from each engine, permits of either engine driving any generator, or when necessity requires, the second engine can be connected to service without reducing the speed of the working engine in order to do so. The building being built before contract was placed prevented the addition of a friction cut-off coupling in the centre of shaft, so that one-half of the plant, including shafting and two pulleys as well as one engine, could stand idle if desired.

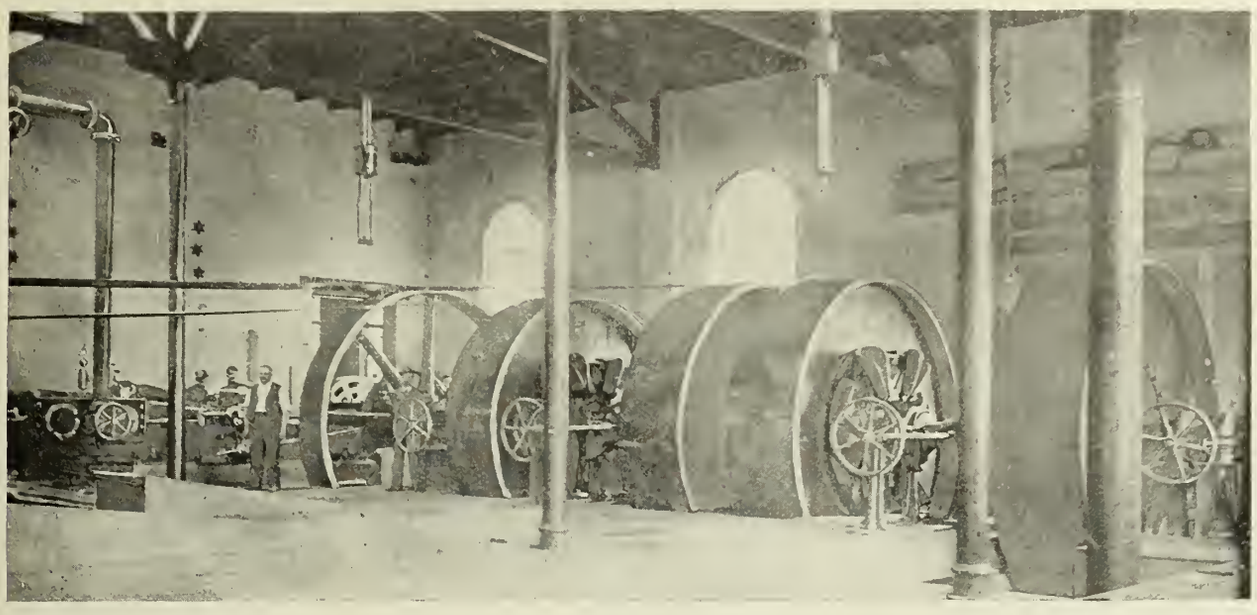


FIG. 4.—DRIVING SHAFT AND CLUTCH PULLEYS INSTALLED BY FALLS RIVET & MACHINE CO.—COLUMBUS POWER STATION.

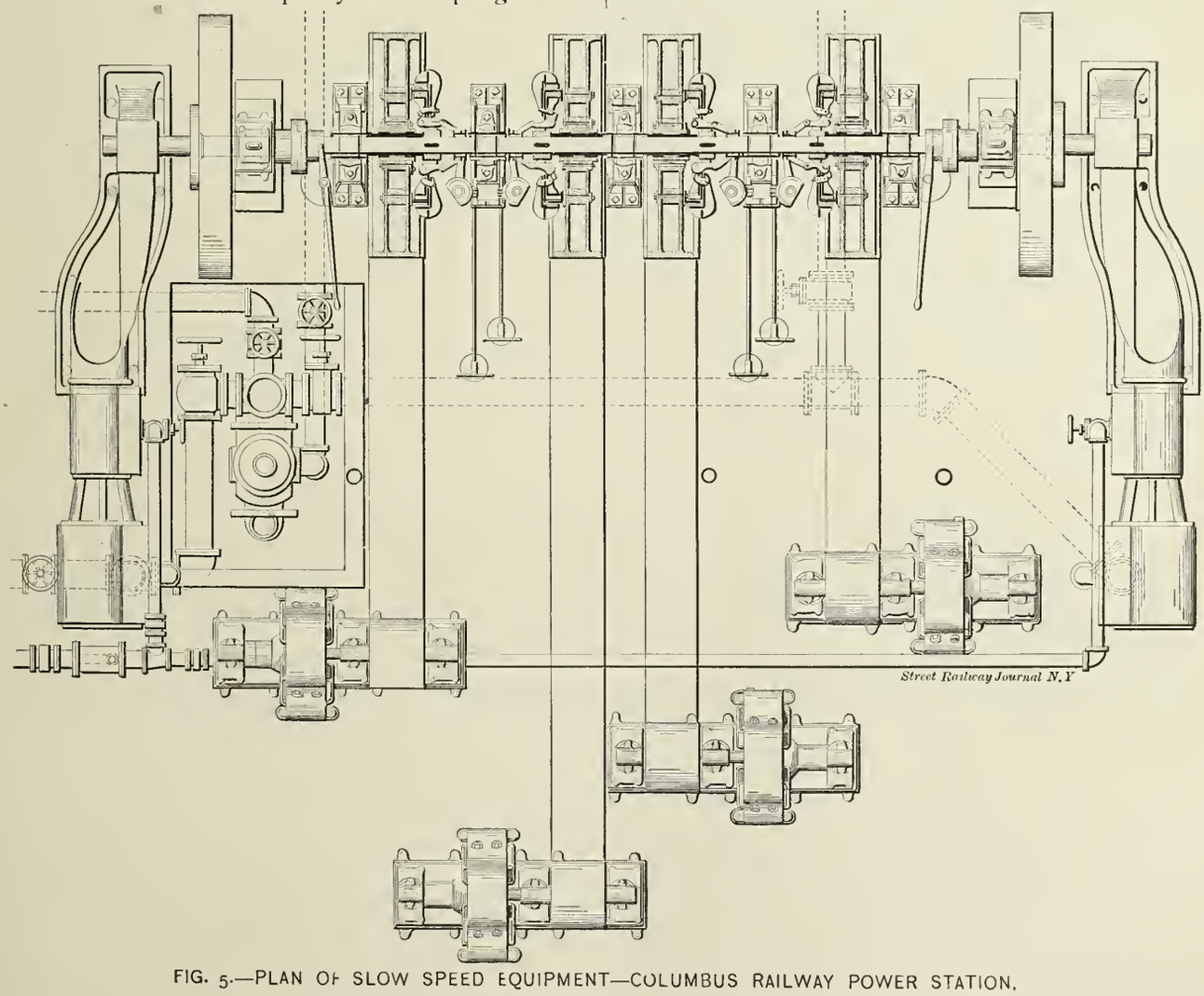


FIG. 5.—PLAN OF SLOW SPEED EQUIPMENT—COLUMBUS RAILWAY POWER STATION.

The engines are supplied with a Conover condenser. The four generators driven by the slow speed engines are also of the Thomson-Houston M. P. type and of 350 to 500 H. P. capacity each. Schieren belts are used throughout.

Compactness is a special feature claimed for the new portion of the plant, as the available space was the width of the building, sixty-five feet by fifty-five feet in length. At the same time there is ample room for passage ways around the engine and shafting and between the generators. The belts offer no obstruction, as the upper side of the belt is eight or ten feet above the floor, and the lower side, after passing through the floor, is neatly boxed, and except within a few feet of the generators the boxing is not so high above the floor as to prevent stepping over it.

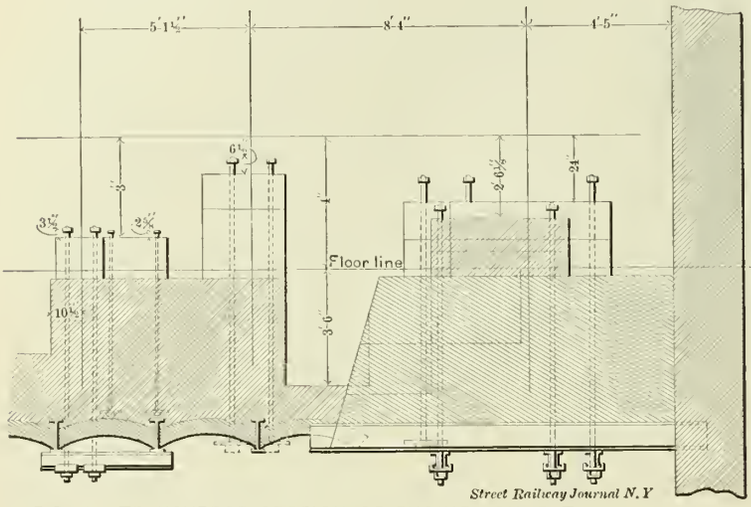


FIG. 6.—TRANSVERSE SECTION OF ENGINE FOUNDATION—COLUMBUS RAILWAY POWER STATION.

By this system either or both engines are available for driving a combination of any or all of the generators at one time, easily and conveniently meeting all the conditions of variable power occurring at different hours during the day.

Figs. 6 and 7 show the method employed in constructing the engine foundations. The building is located on made ground, the floor line being some twenty-two feet above the subsoil. It was the original intention to build up foundations for any engines which might be added, and sub-foundations for this purpose had been built of rubble work fourteen feet in height. It was decided, however, by the engineers in charge of the last installation that the walls of the building were of ample thickness and strength to carry a large percentage of the load of the foundations and machinery, so that it was determined to construct the foundation for the new plant on I beams with brick arches, supported partly by the walls and partly by the sub-foundations already in place.

The walls of the building were cut out for a depth of twelve inches on both sides and at the end, and the I beams at the building end were supported on steel plates twelve inches wide by eighteen inches long by one and one-eighth inches thick, the beams at the rubble work end being supported on plates of the same thickness, 18 × 24 ins., all substantially bedded in cement. The mason work is of select paving brick, all laid in German Portland cement with stone coping under the engines and pedestals supporting the shafting. The result is entirely satisfactory, as there is no vibration to foundations or building when the engines are in operation. Fig. 7 shows a side section of the engine foundation, and Fig. 6 an end section section of same with foundation of one shaft pedestal.

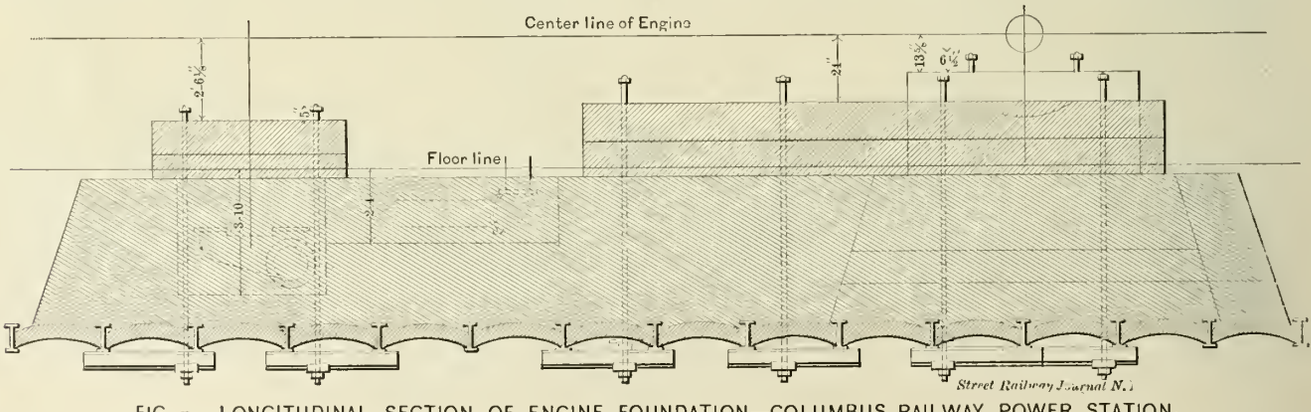


FIG. 7.—LONGITUDINAL SECTION OF ENGINE FOUNDATION—COLUMBUS RAILWAY POWER STATION.

The Botanical Garden Street Railway of Rio de Janeiro.

The Companhia Ferro Carril de Jardim Botanico has an exclusive franchise for one large section of the city of Rio de Janeiro, and it enjoys the distinction of being the best managed of any of the Rio street car companies.

In his last annual report the president of the company states: "The most notable event in the history of the company during the past year (1890) has been the extension of our franchise, granted by the City Council and approved by the minister of the interior in the name of the federal government in legal form, the papers bearing date of August 28, 1890. By this contract the Jardim Botanico Street Railway Co. secure an extension of franchise for forty years, dating from August 30, 1890. In return the Jardim Botanico Street Railway Co. agree: to pay at once, in cash, the sum of 1,500 contos of reis ($345,000); to pay an annual tax of 150 contos of reis ($34,500); at the end of this extension the entire property of the company shall revert to the municipality of Rio de Janeiro. Beyond these terms, the company agree to excavate a tunnel through Mount Copacabana, to construct some new and important lines, and to reduce the fares on some lines." The zone system of fares is in use.

The distribution of passengers as shown by the annual report was as follows: Number paying 100 reis (2.3 cents), 7,526,237; number paying 200 reis (4.6 cents), 4,991,749; number paying 250 reis (5.75 cents), 31,120; number paying 300 reis (6.9 cents), 208,130. The total receipts for the year were $444,524, and the total operating expenses, $206,103; number of cars, 107; number of mules, 1,399.

The cost of feed per animal per day was 12.31 cents, and the cost of taking care of each animal per day 5.21 cents.

A WRITER in a New York paper speaks of the curious conclusions sometimes drawn by foreigners. He mentions this incident: "I have in my possession a letter from a Chinaman, who asks me in all seriousness if the 'advertising cars run by electric power on the streets of St Louis, really do profit by the rabble who jump on them from time to time and ride a greater or lesser distance. My Chinese friend had seen the advertising wagons on the street, and had seen men carrying advertising placards day after day, and he naturally concluded the street cars, which are pasted over with advertisements inside and out, belonged to the same category. He thought people got into these cars to read the advertisements, and when he was asked for his fare he wrote me to know if it was a 'square deal.'"

Track Construction.

(*Continued.*)

From Advance Sheets of "Street Railways" (Trams).

By C. B. FAIRCHILD.

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TIE RODS.

The importance of proper connections between the abutting ends of rails is recognized by all, but the value of cross connections is often overlooked. The pavement should not be depended upon for holding rails to gauge; this result should be secured by employment of suitable tie rods. Brace chairs may answer for low rails spiked directly to the ties, but for high rails, or where the rails are supported on chairs or stringers, it will be necessary to connect the rails to tie rods placed at frequent intervals. The spacing of tie rods will depend somewhat upon the height of the construction, but, ordinarily, they should not be placed more than four or five feet apart. They should be well made of heavy, flat, steel bars not less than one and a quarter inches wide, and from one-fourth to half an inch in thickness, with three-fourths of an inch round, threaded ends. Flat bars are more difficult to make than round bars, but they interfere less with the paving. Tie rods are preferably provided with two nuts at each end to facilitate adjustment, and jam nuts may be employed on the outer ends for additional security.

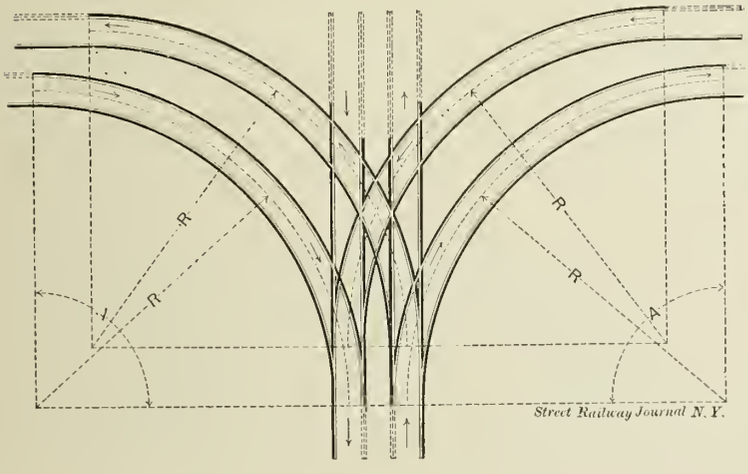


FIG. 1.—DOUBLE TRACK THROUGH Y CURVE.

SPECIAL CONSTRUCTION.

After a street railway is finished so far as it relates to the roadbed, ties, rails and joints. it is far from finished in regard to all the necessary requirements for successful operation. In fact, it may be said in some cases that it is only fairly commenced, for there is urgent necessity, even though the line contains but a single track for curves, switches, crossings, terminal and depot facilities, so that the original cost may be almost duplicated by the different classes of supplementary expenses, especially where intricate and involved construction is required.

It will be impossible to describe in this connection all the different features of special construction, for the conditions differ radically on different lines, and different types of rails have each a corresponding pattern for special work, so that while the different features are being constantly improved a favorite switch of one period is considered inferior to a new kind ; hence it will be necessary for the builder to refer to the illustrated catalogues of the rail makers for suggestive details, and in most cases the work of preparing and placing the material must be left in the hands of rail makers or others engaged in this special line of work.

There are some general requirements, however, that relate to this kind of work which service has developed that may be studied with profit. In the first place, it will be necessary to discard a good many notions and ideas that have formed the basis of practice with animal traction, for on mechanically propelled lines, and with electricity especially, the conditions are entirely different.

Attention has previously been called to the necessity of employing spiral transition curves in the survey, but this is useless unless the rails are laid accurately to the engineer's lines. Care must also be taken to place the connecting straight track at a perfect tangent to the initiatory curve, otherwise the car will lurch on entering or leaving the curve. The radius of a curve should not be less than thirty-five feet for cars with a six foot wheel base and double track curves leaving a double track should not be struck from the same centre (Fig. 1).

The inside curve may be made with the longest radius that conditions will allow and the outside with a radius that will not lessen the distance between the cars. Whatever the radius, the rails should first be bent to the proper arc, for if they are sprung into position after spiking one end the portions of the ends will be straight and the cars will suffer a shock at every joint. The outer rail of a curve may be elevated or not, depending upon the radius and local requirements. In some localities permission can not be had to elevate the rail.

Specially designed grooved rails are provided for use on curves with different track systems. One of those for the girder system is illustrated in Fig. 2; this is laid upon ties, chairs or stringers and properly braced.

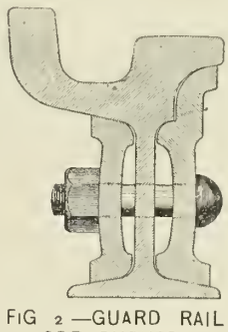


FIG 2.—GUARD RAIL FOR CURVES.

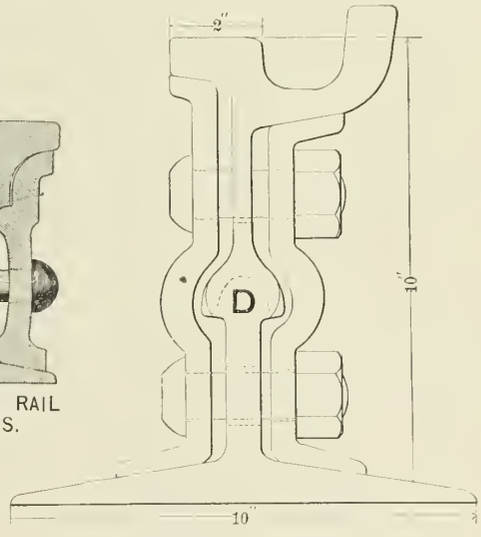


FIG. 3.—ELECTRIC GIRDER RAIL

Another design known as the "electric girder rail" for curves is shown in Fig. 3, in which the upper part down to the broken line D is continuous, and the foot is electrically welded to the rail at such intervals as correspond to the spacing of the ties.

Rails for curve construction are sometimes constructed with an adjustable guard so that when the guard is worn it may be removed and a new one substituted without disturbing the rail or foundation.

Turnouts for single track lines are preferably made equilateral or diamond shape (Fig. 4), and should not be made shorter than 250 ft., and the track should be a perfect tangent to the lead which should be formed at each end on a curve instead of an angle, and the switch pieces should be of sufficient length to allow of the curve being made with a long radius so that the cars may be run over them at a fair rate of speed.

Drop switches or blind switches are not suitable for electric lines, as it is frequently necessary to run in both directions. Cast iron switch pieces and frogs are being discarded, as those made of wrought iron or steel are considered preferable and are generally cheaper in the end. A construction known as "solid switch pieces" is being quite extensively employed for all special work, and consists of providing as a foundation pieces of open hearth steel, which are cast to proper dimensions and angles, and to which the steel guard rails are electrically welded, making a solid and durable construction.

In this connection a few illustrations of difficult construction are given (Figs. 5 and 6) as suggestive designs for curves, crossings and depot work. As a matter of history the ordinary stringer construction with tram rails for horse car lines is illustrated in Figs. 7 and 8. This style of construction, although unmechanical in that the expansion and wagon traffic soon loosen the fastenings, and the joint plates cut into the stringer, has served its purpose fairly well with animal traction, for repairs could be made without disturbing the pavement, but it is entirely unfit for mechanical traction, and it is a waste of money to build it. If a company contemplating electric traction cannot afford to put down a good track and roadbed they had better be content with animal power.



FIG 4.—DIAMOND TURNOUT.

PAVING.

The paving of the street between the rails and tracks is an important consideration in building and maintaining a line operated either by animal or mechanical power. This matter is usually regulated by local authorities, but it is important that street railway companies have some knowledge of the different materials and methods employed, for frequently they are able to use their influence to secure the adoption of a system of paving that is most desirable from the operator's point of view.

The essential requisites of a good street pavement, as stated by General Gilmore in his admirable "Manual of Roadmaking," are "that it shall be smooth and hard in order to promote easy draft; that it shall give a firm and secure foothold for animals, and not become polished and slippery from use; that it shall be as noiseless and as free from mud and dust as possible; also that it can be easily cleaned, and shall not absorb or retain surface liquids, but facilitate their prompt discharge into the side gutter catch basins. It should also be of such material and construction that it can be readily taken up in places and quickly and firmly relaid, so as to give easy access to water and gas pipes, and permit of being readily repaired at all seasons of the year."

Whatever the system of pavements adopted, it should be borne in mind that a good foundation is as necessary for its stability as that of any other construction.

Cobble Stones have been extensively employed in this country as a material for forming the path between the rails of such street car lines as were operated by animal power, and were generally considered the best because they offered a good footing for the horses and could be readily replaced after a street had been dug up, but they are not the safest or the best under mechanical traction, because the stones are liable to become loosened and roll under the wheels. Although entirely wanting in most of the essential requisites enumerated above, and possessing in nearly every particular features which a pavement should not have, doubtless cobble stone pavements will continue to be used to some extent in new towns and cities, and for this reason a brief description of the method of construction is given.

Cobble pavements are usually formed of rounded or egg shaped, hard pebbles, varying from six to ten inches, and in width from three to six inches. After the roadbed has been excavated they are set side by side in close contact with each other, with their smallest ends down, in a bed of clean, damp sand or small gravel from eight to ten inches in depth. After being set, the stones are firmly settled to their beds by a heavy rammer so as to bring their tops to the same surface, when a layer of gravel two or three inches thick is spread upon the surface and allowed to work its way in between the stones. Particular attention should be given to the selection of the gravel which should contain sufficient iron loam to insure cementing qualities.

Cobble stone pavements require constant repair, and should a stone work loose it should be immediately put back in place lest the adjoining stones become loosened, resulting in rapid depreciation.

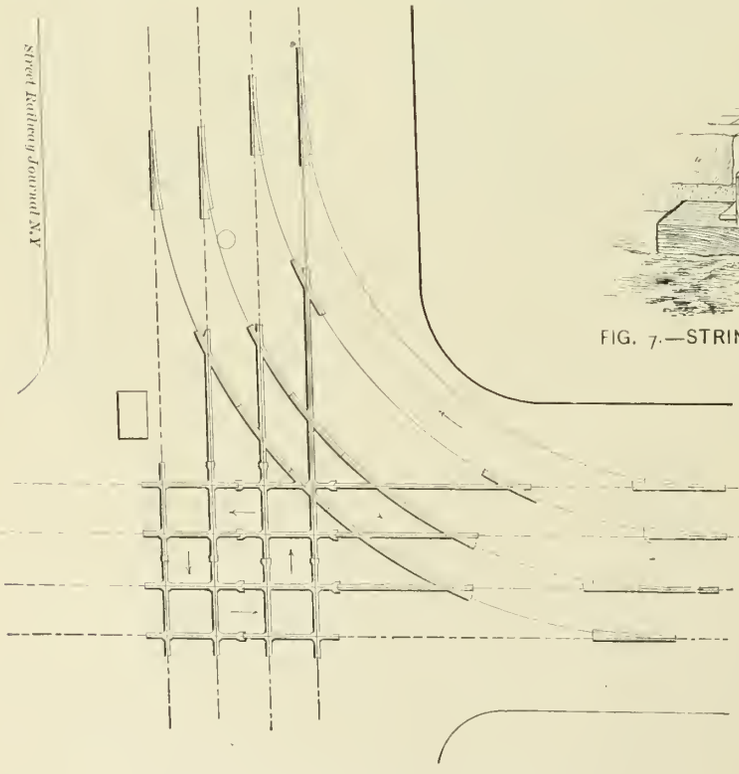


FIG 5.—DOUBLE TRACK CROSSING AND CURVE.

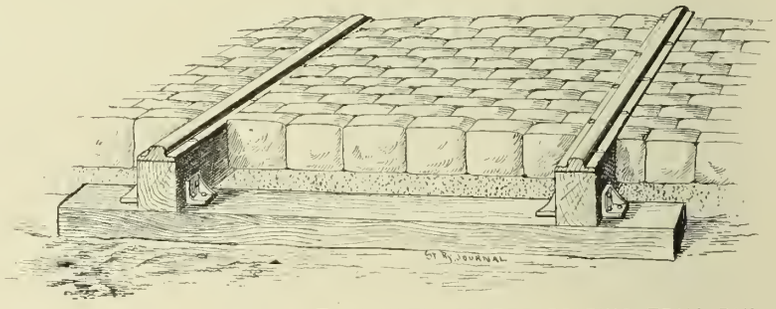


FIG. 7.—STRINGER CONSTRUCTION WITH CENTRE BEARING TRAM RAIL.

Stone Block paving is generally considered the most durable for heavy traffic. The material, or formation, should have the qualities of toughness, hardness and not be liable to become slippery. Granite, trap rock and sandstone formation are extensively used for this purpose. Granite is more satisfactory on some accounts, but trap rock is equally durable. The selection will depend largely on the supply to be had in different localities.

The size of the blocks should be proportioned to the number and weight of the vehicles which will pass over them. The standard dimensions for stone paving blocks in the vicinity of New York are three and a half to four and a half inches in width measured along the street, and from eight to twelve inches in length measured across the street, and seven to nine inches in vertical depth. Over rail ties and other places, blocks of less depth may be used, but the same general dimensions on the top surface should be maintained. It is important that the blocks on any one section be of uniform depth, so that when they finally settle to their beds the top of each surface will be on the same level. All the stones should be sound and of uniform quality as to hardness, color and grain; no outcrop, soft, brittle or laminated blocks should be used. It is also better, in case the material has been mined from different quarries, that the stones from each quarry should be piled and laid in separate sections of the work.

When the blocks of stone are nearly cubical in form, split as nearly as possible to right angles, with six inch faces, it is termed Belgian pavement, so named from its common use in Belgium. This so called Belgian pavement is falling into disuse in this country, however, for the reason that the blocks, being wide, provide a poor foothold for horses, the slip to strike a joint proving injurious.

The foundation for stone blocks may be formed of gravel, concrete or rubble stone grouted with concrete. The depth of the foundation should be proportioned to the amount of the anticipated traffic—not less than six inches in city streets—and whatever the material it should effectually cut off all connection between the subsoil and the bottom of the paving stone.

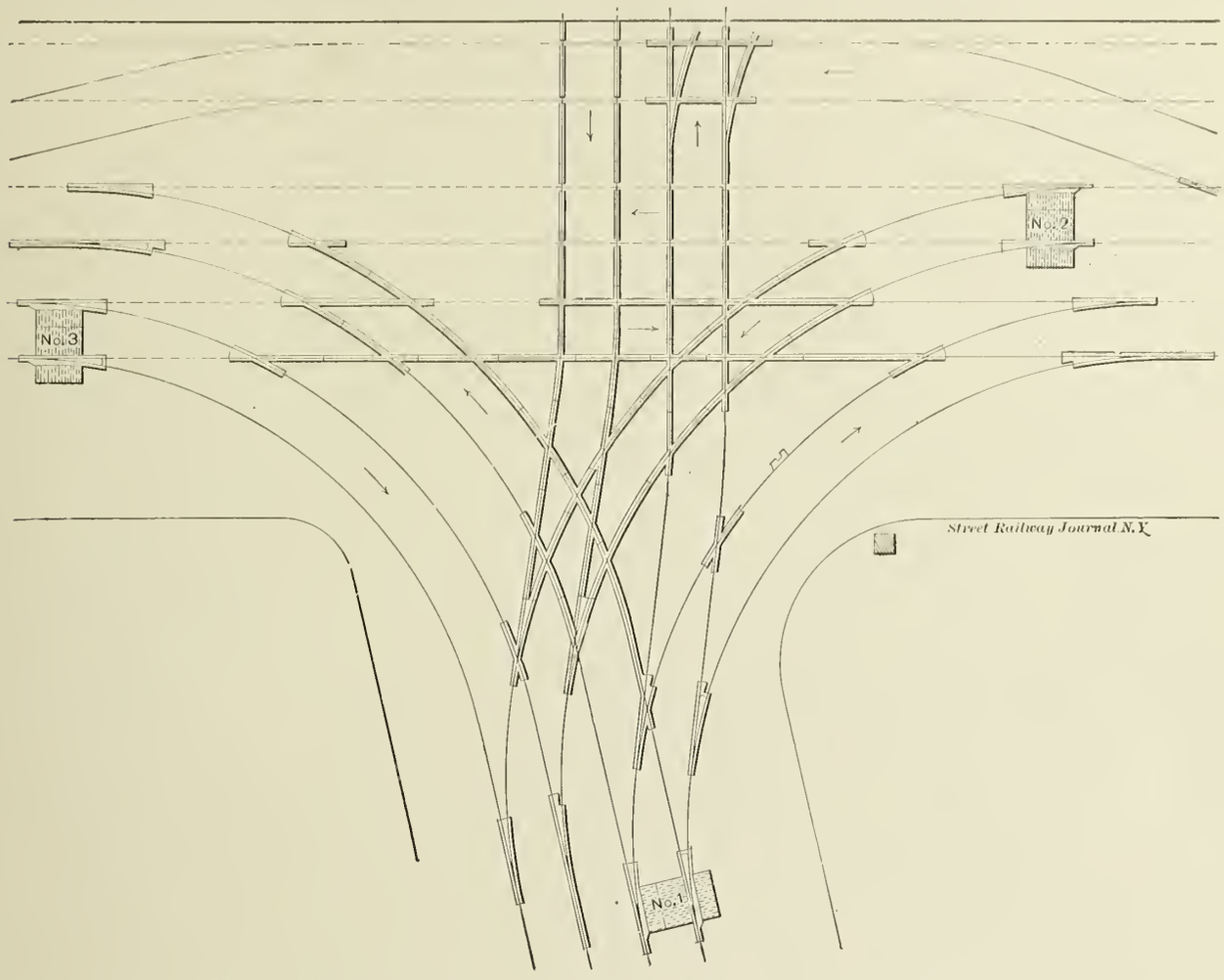


FIG 6.—DOUBLE TRACK TROUGH THREE PART Y CURVE WITH CROSSING.

In case a gravel foundation is to be employed, the roadbed should be carefully excavated to a uniform depth of from ten to thirteen inches, depending upon local requirements and the depth of paving blocks to be used, and all superfluous matter should be removed. Should rock or masonry be encountered it must be removed a little below the level of the foundation or subgrade. The foundation is then brought to an even surface conforming to the grade, and in case there should be found any spongy material or vegetable matter in the bed, it should be removed and the space filled with clean sand, and carefully rammed so as to make it compact and solid. The entire roadbed may then, if required, be rolled with a heavy (ten ton) steam roller until the surface is firm and compact. In case the steam roller cannot reach every part, the remaining portion may be tamped or rolled with a small roller. On this foundation should then be placed a layer of sand or fine gravel of sufficient depth.

In laying the pavement the stone blocks should be placed in courses at right angles with the line of the street, except at intersections of streets, and in other special cases, when the courses may be laid diagonally. On steep streets it is a good plan to lay the blocks in oblique course pointing up the grade and meeting at an angle in the centre. The channels thus formed by the continuous joints will facilitate the discharge of the surface water into the gutters (Fig. 9).

Each course of blocks should be of uniform width and depth and so laid that all end joints shall be close joints and broken by a lap not less than three inches. If the grouting is to be of sand, the joints between courses should be as close as possible, but if a grouting of mastic and gravel is to be employed, the joints between courses may be an inch or less. In case sand is to be employed, the blocks, on being laid, should be covered with clean, fine

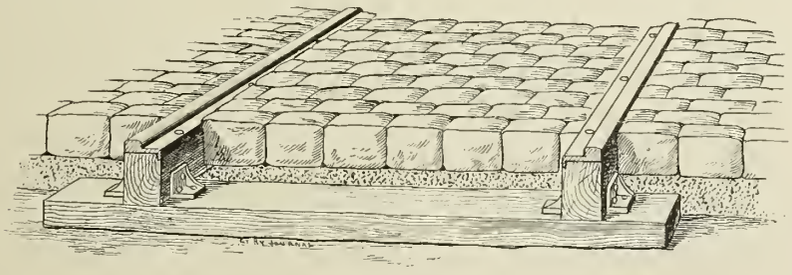


FIG. 8.—STRINGER CONSTRUCTION WITH SIDE BEARING TRAM RAIL

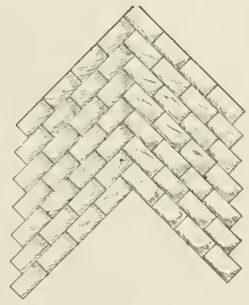


FIG. 9.—GRADE PAVING.

sand, which should be carefully raked until the joints become filled, when the blocks should be thoroughly rammed to a firm, unyielding bed, with a uniform surface conforming nearly to the grade and crown of the street. When quite a section has been thus far completed it should be covered with a second coat of clean, sharp sand and receive a second ramming until the work becomes solid and secure. It is usual to employ one rammer to every two pavers.

A more durable paving is secured by providing a concrete foundation upon which to support the blocks, in which case the roadway should be excavated to a depth of sixteen inches below the top line of the proposed pavement, and carefully prepared as above described for a gravel foundation. Upon this foundation the concrete is placed to a depth of six inches, except over railroad ties, cable or electric conduits or other subway structures, when the depth may be increased, diminished or omitted as may be necessary.

In preparing concrete only fresh ground Portland, Rosendale or equally good hydraulic cement should be used. In case Portland is used the mixture may be made of one part by measure of cement, three parts of clean, sharp sand and seven parts of broken stone. With the Rosendale the proportions may be, by measure, one part cement, two parts sand and four parts broken stone. The mixture should be made in a suitable box or on a platform, and in no case upon the pavement or ground.

The sand and cement should be mixed dry, when water of sufficient quantity only to form a mortar is added; the broken stone, having been first wet, should then be added and the mass turned over and worked until the broken stone is completely covered with the mortar, when after being placed upon the prepared bed the concrete should be compacted with wooden rammers until it has a clear mortar surface, which should be at a uniform grade below the top of the finished pavement.

The broken stone should be sound and solid trap, limestone, or an equally durable formation, and of a size not larger in any dimension than will pass through a two inch ring, and should be carefully screened before using to free it from dust and dirt. The operation of mixing and laying the concrete should be performed as expeditiously as possible, and if necessary, protected from the action of the sun, wind or frost until set. None should be used which has been mixed more than three hours. The surface should be kept wet until covered with sand, and at least thirty-six hours should be allowed for the mixture to set before the paving blocks are laid. As the work progresses and connection is to be made with a section set or partially set, the edge of the section should first be broken down to free it from dust, when it should be wet in order to make the joint fresh and close.

Upon the foundation a layer of sand or cement mortar should be placed to provide a bed for the paving blocks. In case sand is used, it should be clean, sharp and perfectly free from moisture, and should be spread to a depth of not less than one and a half inches, or of a depth necessary to bring the blocks to a proper grade when thoroughly rammed.

In some cases, especially between the rails and tracks of a cable line, it is desirable to employ cement mortar as a binding material for the blocks. A mixture of sand and cement is spread upon the foundation, and into this soft mass the blocks are pressed to a proper level and left till the mortar is set. The joints may then be filled with a grouting of the same material.

The more general practice, however, provides a bed of sand on which to rest the blocks, and the grouting consists of gravel and a mastic cement. The stone blocks being laid in courses as above described, with the joints between courses not more than one inch top and bottom, are then covered with clean, hard, hot, dry gravel, of such a size as will pass through a sieve of three-quarters of an inch mesh and be retained by a quarter inch mesh, and then brushed into the joints until they become filled, when the blocks should be thoroughly rammed, and then more hot gravel applied and again rammed and the process repeated until the joints are full and the blocks are brought to an unyielding bearing with a uniform surface, true to the roadway on the established grade.

A portion of the gravel at the top of the joints is then raked out to the depth of about two inches, when the paving cement, or mastic, should be applied while the gravel is still hot. The mastic to be employed for filling the joints may be of coal tar or asphalt, or a combination of the two In case coal tar alone is used in cold climates it is apt to become so hard and brittle in winter as to crumble from the vibration of the blocks. On the other hand, if clear asphalt is used, it deteriorates after a time and crumbles, and does not maintain a watertight joint. The following combination, however, has given good results, and is recommended: A cement composed of twenty parts of refined Trinidad asphalt and three parts of residuum oil mixed with 100 parts of No. 4 coal tar. Suitable cauldrons being provided on the work, the mixture is heated to a temperature of 300 degs. Fah., and while still boiling should be poured into the joints until all the interstices of gravel are filled, and the joints are filled flush with the top of the blocks. Dry, hot gravel of proper size, having previously been heated in pans provided for the purpose, should then be spread along the joints and bedded into the cement by tamping with a light rammer or other instrument.

The durability of the pavement depends, in a great measure, on the gravel filling. The cement and mastic filling not only assist in holding the blocks in place, but, being impervious to water, they prevent the entrance of moisture, which would tend to soften the foundation and cause the blocks to settle unevenly, or when frozen heave them from their beds. The importance of excluding moisture from paving foundations on cable lines has been noted in the second chapter. It prevents freezing and consequent slot closure.

Besides providing paving blocks of suitable quality and dimensions, attention should also be given to the quality and dimensions of the bridge or crosswalk stones, the manhole heads and the curb and gutter stones.

The North River bluestone or granite, free from seams or imperfections, is regarded as excellent formation for these purposes, and whatever material is used it should be equal in quality to these. The dimensions of the bridge stones should not be less than four or more than eight feet, long except in special cases, and two feet wide and of a uniform thickness, which may vary in individual blocks from six to eight inches. They should be dressed on the top so as not to vary in evenness by more than a quarter of an inch, with sides and ends cut square to the full depth and the ends cut to a bevel of six inches in two feet in order to provide a diagonal joint, which will prevent wheel gutters being formed at the joint as is the case when the joints run parallel with the street. The bridge stones should be firmly bedded on a foundation of clean, sharp sand, and be tamped in such a manner as to admit of no further settlement. In some cases a row of paving blocks is laid between the courses of bridge stones, in which case the joints should be filled in the same manner as the joints of the adjacent pavment.

The dimensions of the curb stones should be not less than three feet in length, five inches thick and twenty to twenty-five inches deep. The top should be cut to a bevel of one inch, the front cut smooth to a depth of fourteen inches, and the ends truly squared. When in place they should be backed up by at least a foot of clean, gritty earth, free from clay and loam. The frames and heads for the sewer and water manholes should be cut to the required dimensions.

Asphalt, in some of its various forms, is rapidly growing in favor as a paving material in those sections of the country where the climatic conditions are favorable. There is some objection to asphalt as a pavement between street car tracks where the lines are operated by horses, on account of its slipperiness and the difficulty of getting at the foundations for repairs; with mechanical traction, however, and a substantial roadbed, these objections are obviated.

The use of this material obviates the intolerable noise which is a necessary accompaniment of stone pave-

ments, and, being a non-absorbent, it is, for sanitary reasons, a most excellent pavement. As formerly constructed, horses were liable to slip on it in wet weather, but this defect has been remedied in a measure, and animals on becoming accustomed to it do not slip to any great extent. The surface being slightly elastic, the limbs of horses receive less shock than when driven on a hard surface, and the animals generally keep in better condition, both for this cause and because, being smooth, there is little resistance to draft.

Asphaltum is known as bitumen and mineral pitch. There are two forms in which the material is used as a pavement, and a capital distinction should be made between them. One is pure asphalt which is of the consistency of rosin, is black like coal and burns more freely than coal. The other is rock asphalt, and consists of shellstone, sandstone or limestone impregnated with from 8 to 20 per cent. of bitumen.

Pure asphalt is obtained in great quantities from or near a lake in the district of La Brea on the island of Trinidad, one of the West India islands. Some interesting particulars relating to the mining of asphalt in Trinidad, are found in the article on "Asphalt: Where and How Mined," in another part of this issue.

The natural asphalt rock is mined at Seyssel, France; Val de Travers, Switzerland; Ver Wöhle, Germany and other foreign countries, and in this country in Southern California and Kentucky. The foreign varieties are generally of limestone formation, but so far the discoveries in this country are of sandstone formation. The deposits in California seem to have been formed of a loose mound of sand saturated with bitumen, as the ultimate particles are found to be rounded as if by the action of water, but the Kentucky variety is a black sandstone in character, the particles being of a true sand crystal structure, sharp, gritty and flinty. It seems to have been impregnated with the bitumen under heat and great pressure, and is found in veins or strata of various thicknesses, from nineteen to sixty feet. The natural rock asphalt, when it contains from 9 to 12 per cent. of bitumen, does not require to be mixed with any other substance for forming pavements. The rock is crushed or powdered and then placed in portable heaters and raised to a temperature of from 200 to 250 degs., which softens the bitumen; and while still hot it is spread over the foundations and powerfully compressed by ramming, tamping or rolling with hot iron tools, so that the molecules unite, and the mass when cold assumes the essential qualities of the original rock. The imported varieties are considered best, although very good results are had with some of the native material, especially with that found on the Pacific Coast, many of the street car lines in San Francisco being paved with it.

Trinidad asphalt is not suitable by itself for paving purposes, but it is first mixed with sand, powdered carbonate of lime and petroleum oil in certain proportions which have been determined from long experience and careful observation to be the best. The mixture may be varied to suit the varying conditions of climate and traffic. The materials are mixed together at a high temperature in suitable cauldrons, and while still hot spread two or three inches thick over a concrete or other foundation by means of iron rakes, and then thoroughly compressed by a heavy roller.

The concrete foundations for asphalt pavement may be formed in about the same manner as above described for stone blocks; but the best results are obtained by spreading the wearing surface or paving proper upon an existing stone block or macadam pavement. In this case the surface should be thoroughly swept and cleaned with stiff brooms and the joint filling removed to a depth of two inches. A binder coat of bituminuous concrete should then be spread over the blocks, filling all depressions and bringing the surface to a uniform grade and cross section. The stones composing the binder coat should not be more than one and a quarter inches in their largest dimensions, and, having been heated in revolving ovens, should be mixed by machinery with a coal tar residuum known as No. 4 paving mixture, in the proportion of one gallon of coal tar to one cubic foot of stone, and then spread with hot iron rakes to such thickness that, after having been thoroughly compacted by tamping and hand rolling, the thickening of the binder at any point will not be less than three-quarters of an inch. It will be found of advantage to provide a binding coat, as above described, with any foundation, be it concrete or old paving, as it tends to prevent the wearing surface from crawling and buckling, a defect that is sometimes observed in asphalt pavements.

The foundation having been thus prepared, the wearing surface may be prepared and laid as follows, the method being about the same as that required for this class of pavements in the city of New York:

First, an asphaltic cement is manufactured, which is composed of pure refined pitch, (lake asphaltum) and petroleum oil, having a specific gravity of from eighteen to twenty degrees Beaumé, mixed in the proportion of 100 parts of the asphaltum and from fifteen to twenty parts of the oil. The cement having been prepared, the paving mixture is formed of the following materials and indicated proportions:

Asphalt cement from twelve to fifteen parts.

Fine sand from seventy to eighty-three parts.

Pulverized carbonate of lime from five to fifteen parts.

The sand and asphalt cement are heated separately in suitable apparatus to about 300 degs. Fah. The carbonate of lime, while cold is mixed with hot sand, and then both are combined with the asphaltic cement at the required temperature. The mixture is then brought to the ground, and while at a temperature of not less than 250 degs. is carefully spread by means of hot iron rakes to such a depth that after being compressed it will have a thickness of two inches. The surface is then compressed by means of hand rollers, after which a small amount of hydraulic cement is swept over it, when it is thoroughly compressed by means of a heavy steam roller, the operation to continue for not less than five hours for every 1,000 yds., of surface.

In order to make the gutters entirely impervious to water, it is recommended that a width of one foot next the curb be coated with hot, pure asphalt and smoothed with hot smoothing irons so that the pavement at this point shall be saturated with an excess of asphalt.

In case rock asphalt is to be used, it is customary to specify that it shall be a mixture of material from the Sicilian and German mines or other mixtures of equal quality, which, ground to a fine powder containing from 9 to 12 per cent. of natural bitumen, with from 88 to 91 per cent. of pure carbonate of lime and free from quartz sulphates, iron pyrites or aluminum, shall be laid without any additions whatever. The process of preparing the powder consists of heating it in a suitable apparatus to 200 or 250 degs, and spreading and compressing it, in the same manner as described for the asphalt mixture, to such a depth that after having received its ultimate compression it will have a thickness of two and a half inches, the surface to be rendered perfectly even by heated smoothers, when it is to be sprinkled with clean, sharp sand. For the reason that the pavements constructed of rock asphalt do not obtain their ultimate compression from traffic for a longer period than that required for the Trinidad pavement, it is recommended that the former be laid to the depth of two and a half inches.

The Trinidad pavements do not become so slippery in wet weather as the European rock ashphalt pavements, and offer a better footing for horses, for the reason that the body is composed of sharp sand, while the body of the latter is a smooth, impalpable limestone. There is but little difference in this respect, however, between the pure asphalt and the native rock varieties, for, as stated previously, the particles of the body of the native varieties are sand.

In joining asphalt pavement to track rails it is customary in some localities to place a row of paving blocks as headers (long and short stones alternating and toothing into the pavement) on each side of the rails to absorb the vibrations of the rail and provide a track for

street vehicles. In practice it is found better to provide a concrete foundation for the blocks, whatever be the foundation for the pavement proper.

Asphalt is also wrought into blocks or bricks and laid in about the same manner as stone blocks. In this form it is principally employed for sidewalks or for footpaths in parks and commons, but has been employed for street pavements in Washington and Baltimore to a considerable extent. While apparently giving satisfaction, these pavements have not been in service long enough to test their duraability.

Blocks of Wood, set on the end of the grain, have been extensively employed as a paving material in this country and elsewhere for a number of years. The original type of wood pavement is the Nicholson, named after the inventor, in which blocks of yellow or white pine were employed, usually about four inches wide and from four to sixteen inches long and six inches deep. The method of construction consisted in excavating the street to a depth of nine inches, and placing a foundation of clean sand, upon which a flooring of tarred or creosoted pine boards one or two inches thick was placed. Upon this flooring the blocks were set in parallel courses running across the street, the courses being separated from each other by thin battens of pine, and the spaces filled with a mixture of sand, gravel, coal tar or their equivalent.

Nicholson's method has been greatly improved, and in fact is not used in the best European practice, especially as to foundation and the use of battens for separating the blocks. The only successful practice consists in providing a concrete foundation, and placing the blocks close together. Besides pine, chestnut, cedar, red wood, eucalyptus and some other kinds of wood are used, depending upon the supply to be had in any locality. Blocks, hexagonal in shape, possess many advantages, but round, conical and rectangular in shape are also employed, which are laid with various combinations of concrete, tar, asphalt and gravel. To prevent decay, the blocks are frequently creosoted or impregnated with various chemical preservatives. Wood pavements are apt to be slippery in wet weather, and are very perishable, both from wear and from decay, and are objectionable, for sanitary reasons, as the blocks absorb the surface liquids and at times give off offensive odors.

Wood blocks are cheaper in their first cost than granite, and in certain localities are necessarily employed because other material is not to be had except at great cost, and notwithstanding the above objections, they have a number of points of excellence to recommend them when new, among which are ease of draft and noiselessness, are easily kept clean, produce less shock to the limbs of horses, lessen the wear of vehicles and admit of high speed, and smooth passage.

As before noted in the second chapter, this type of pavement is not suitable for use for paving the tracks of cable lines, as the swelling of the material from moisture tends to slot closure.

Wood pavements will be found to be a very expensive luxury when laid on streets subject to excessive traffic. Their success abroad is due not only to their expensive construction and careful and costly maintenance, but also to favorable conditions which do not exist in the cities of this country. Among those conditions are the regulations requiring that the wheels of all vehicles be provided with wide tires and that the horses be shod with smooth shoes without calks.

Vitrified Brick made from a peculiar clay is being extensively employed as a paving material in the cities of Ohio and other Western cities, and is regarded with considerable favor. The material is ground fine and then moulded under heavy pressure to the same form and with about the same dimensions as ordinary brick, when it is vitrified by burning so that it will not absorb moisture.

Some manufacturers form the brick with parallel grooves extending around sides and ends (Fig. 10), which become filled when the joints are grouted and serve as a lock to hold the block in place and prevent its being forced up by sub-pressure. The bricks are usually formed with rounded corners on the top to provide a sure footing for horses, and are set on edge on a foundation of concrete or broken stone, with a cushion of sand. The grouting consists of sand, or, preferably, of mastic cement.

Brick pavements have long been in use in Holland where they have proved to be very durable, but, it is



FIG. 10.—VITRIFIED PAVING BRICK.

claimed by the new process of manufacture, that a superior paving brick, equal to stone and of uniform size is produced, which has the advantage of being less noisy than stone and more economical. The use of this material thus far in this country has been limited to streets subject to a comparatively light travel, but the manufacturers claim that they are strong enough to withstand the heavy traffic of our large cities.

Broken Stone is extensively employed for roadmaking, and although it may not be strictly regarded as a paving material, the leading systems of stone roads are admirably adapted for suburban lines and streets in small towns, while they are undesirable for large cities.

Two leading methods are employed for making stone roads, known as the macadam and telford systems. The first is constructed by placing successive layers of broken stone directly upon the soil, so that they form a crust on the surface, producing a durable roadway, and which retains the name of the inventor, McAdam.

Roads made with layers of broken stone resting upon a sub-pavement of stone blocks or ballasting, are called telford roads after Thomas Telford, by whom they were first constructed in Great Britain. The advantages and disadvantages of the "bottoming" which forms the chief difference between the two systems have been the subject of lengthy disscussions between their respective advocates. The character of the soil, whether wet or dry, would seem to determine a choice between the two methods, although the latter can doubtless be built somewhat cheaper, for the foundation stones may be of an inferior quality and the labor of breaking them avoided. Of late years little distinction is made between the two systems, and the term "telford" is frequently applied to the foundation of macadam roads. In preparing for the foundation, the surface, subsoil and other matters should be removed to the proper depth and the bed should be rolled, shaped and trimmed to the required grade in the same manner as described for stone block paving. The foundation stones should then be set close together with their longest sides parallel to the curb, and then firmly wedged by inserting and driving down with a bar in all possible places between them, stones of the same quality. All projections and irregularities should then be broken off with a hammer, care being taken not to loosen the stones, and the chips should be worked and driven with the hammer into all the interstices not already filled by the process of wedging, so that the foundation when completed shall present an even but not too smooth surface and be about eight inches thick under the macadam. The material for the macadam should be hard and tough. The most useful are the basaltic and trap rock formations, while certain classes of green stones—selenitic granite—are good, as are also the boulders and pebbles of tide water regions. The stones should be broken into pieces not larger than will pass through a ring of two and a half inches in diameter, and then spread (on a dry day) over the bed, the first coat being not over three inches thick and entirely free from earthy mixture. This is then compacted by admitting the travel upon it, or better, by a heavy roller, men being stationed to rake down any ridges that may be formed. When sufficiently consolidated, a second coat of three inches is added, when moisture may be introduced, which will greatly facilitate the union of the two courses. A third coat is added as was the second, and a

fourth if necessary. To hasten the smoothness, an inch of gravel or finely crushed stone may be spread over the surface and be passed over by the roller. The stones being properly placed, combine by their own angles, and after a few years adhere together in a smooth, solid surface which is not likely to be affected by the weather or displaced by frost.

It will be difficult to construct a satisfactory macadam pavement on street car lines where tie rods are employed in the construction, as these interfere with a proper bonding of the material. On lines with very heavy traffic it is also difficult to maintain this class of paving in good condition. In any event, roads of this kind need careful attention. The wear of the material, whether mud or dust, thould be continually removed and replaced by new materials. A road treated in this manner will need no repairs, as such ; but if put in order only at intervals it will need serious repairs

COST OF CONSTRUCTING PAVEMENTS.

The present contract price for paving the streets of New York, including the curb and bridge stones, is about as follows :

For granite blocks on gravel foundation $2.80 per square yard.

For granite on concrete foundation $3.60 per square yard.

For asphalt (either Trinidad or rock) on concrete base, with a five year guarantee, $3.00 per square yard.

For asphalt on concrete base, with a fifteen year guarantee, $3.80 per square yard.

For asphalt on an existing stone pavement as a base, with a fifteen year guarantee, $3.40 per square yard.

Vitrified brick pavements on broken stone foundations cost in the vicinity of the manufactories about $2.15 per square yard.

Wood pavings cost usually about $1.25 to $1.50 per square yard.

The cost of cobble paving is generally from $1.90 to $2.10 per square yard.

CEMENT.

For the reason that cement constitutes an important element in the construction of paving foundations and cable conduits, and is also used as grouting and for other purposes, it is as important that some knowledge of its nature and manufacture be had as an aid in selecting the best brands as it is to know the particulars regarding other materials, such as stone and asphalt.

The first natural cement known to commerce was produced in England in 1796, in an attempt to imitate the Roman cement which has given to the ancient works of the Romans their lasting character ; hence, when a cement was produced that, when mixed with sand, would harden under water, the name "Roman cement" was given to it, and the material resembled closely the Rosendale and other natural cements now manufactured in this country. The process of manufacture, as now adopted in this coun- is a very simple one, and consists in quarrying argillaceous limetones or dolomites containing certain percentages of lime, magnesia, silica and aluminum ; calcining the broken rocks in open kilns with coal at a light heat and drawing the calcined product continuously from the kilns and grinding it between millstones. The resultant powder is barreled or put in sacks and becomes the ordinary light burnt, natural, hydraulic cement of commerce.

The first commercial Portland cement of commerce was produced in England in 1824, and was made by combining the English chalks with clay from the river, drying the mixed paste in the form of bricks, eggs or balls and calcining at a high heat the material thus produced. The calcination was done in closed kilns, and the product was a clinker, which when ground formed a cement of great strength and hydraulic character, to which the name of "Portland cement" was given, because the stone it produced, when used in concrete, resembled in color the well known "Portland" building stone of England. Portland cement differs from the natural light burnt, hydraulic cement in that it is an artificial product wherein the proportions of lime, silica and aluminum are combined in uniform proportions, and the material that is calcined in a kiln becomes a new rock or stone artificially produced by the mechanical mixing of the clay or lime, or of the natural rock composing it, so that chemical action necessary for the production of the highest grade cement can take place under the most favorable circumstances. In the natural cement the rock is taken in the condition that Nature has given it, and the calcination is at a low temperature, so that a large percentage of the material is inert and has no value of a cementing character ; while in the Portland cement, burnt at a high heat, all the elements are active.

Knowing, therefore, the facts governing the production of hydraulic cement, one is able to determine which is best for a particular work. It must not be inferred, however, that the manufacture of Portland cement is confined to foreign localities, for while the development in the manufacture of the cheaper grades of cement in this country has been going on very rapidly, the development of the Portland cement industry has received a great deal of attention, so that the ingredients of the product and method of manufacture are no longer shrouded with an air of mystery, but the American cement companies have demonstrated their ability to make, by improved processes, a Portland cement, equal to the best foreign grades, out of natural rocks, and also out of marls and clays which are the chemical equivalents of the chalk and clay of England.

While the consumer should make a capital distinction between Portland and natural cement, he need make no distinction between American and imported Portland except in regard to price. The purchase of cement of whatever brand should be on condition that it be subject to the practical tests which are usually employed by engineers and architects in the purchase of cement. As previously stated, cements are usually shipped in barrels or bags. In case, however, the material is to be delivered and stored along the work before it is used, it is better to stipulate that it be shipped in coopered barrels, and after being in position it should be carefully sheltered from storms ; and in no case should the barrels be allowed to rest directly on the ground or upon sidewalks, but should be blocked up by suitable underpinning.

West Side Cable Power Station, Chicago.

The engine capacity of the power station of the West Chicago Railway Co., at the corner of Washington and Jefferson Streets is to be doubled. The 500 H. P. engines have been removed, and a pair of engines, capable of developing 1,000 H. P. each is now being erected. The cylinders are 36 x 60 ins., and the engines are of the make of Fraser & Chalmers of Chicago. Rope transmission is employed, as in the previous installation. A six foot rope sheave is located on the engine shaft, which will drive, by means of twenty-four single ropes, a twenty-eight foot rope wheel. It is expected that the plant will be ready for operation during the first week of the present month. The load which was carried by this station has been shifted to the new smaller power house in the adjoining building where a 500 H. P. engine, built by the Corliss Engine Co. of Providence, R. I., is in operation.

THE engineer of one of the Chicago cable street railroads recently made the following statement to a newspaper man : "We have found that the power required for the operation of the system on rainy days, when the tracks were wet, was fully 20 per cent. less than on dry days, and at the same time we estimated that at least 25 per cent. more passengers were carried at such times. This gives a very large showing in favor of wet rails where cable power is used, and the adhesion between wheel and rail is not depended upon for traction. With a steam locomotive or an electric motor the result is just the reverse, for with them the slippage is excessive when the rails are wet. Under these circumstances rainy days are a greater blessing to the cable roads than is generally supposed."

Notes from the Field.

Lawrence, Mass.

One of the most successful among the smaller roads of New England is the Merrimack Valley Street Railway which connects the towns of Methuen, Lawrence, South Lawrence and Andover. The cars on this road were operated by horse power until about March, 1891, when the road changed hands, and Mr. J. N. Beckley, of Rochester, was elected president, and at that time the road was equipped with electric power, the motors selected being those manufactured by the Detroit Electrical Works.

The length of line at present is fifteen miles, but the contracts have been signed for the construction of a one and a half mile extension. For ease in operating cars the line is divided into four sections, the cars on each section being distinguished by color as well as by the lettering and the signs they carry.

The track is laid with forty-five pound tram rail, forty pound T rail and forty-five pound Johnson girder rail, the latter being the type employed on all the recent work, with the exception of about one mile where a T rail was laid. The girder rail is mounted in chairs on ties, and the track is block paved, a double joint chair and angle splice bars being used at the joints. With the tram rail the joints rest on a twenty-seven pound joint plate with a lip on each side. The T rail when paved to is on chairs, with tie rods and splice bars at joints. All the T rail was supplied by the Pennsylvania Steel Co. The rails are double bonded for a return circuit, the resistance being further reduced in the case of the tram rails by the use of a supplementary wire. Galvanized iron rail bonds are used.



DETROIT MOTOR CAR ON 10 PER CENT. GRADE—LAWRENCE.

The overhead wires are supported upon side poles. Iron tubular poles are used for about two miles, the rest being equipped with sawed wooden poles. The points at which the cars will stop to receive or discharge passengers are indicated by a white band painted about the railway poles on each side of the street at a distance of about ten feet from the ground.

As the grades on the line are many and severe, notably on the North Andover division, the satisfactory service of the electric apparatus is especially worthy of remark. One loaded trail car is often drawn by one motor car up the long 9 per cent. grade in Andover and upon other parts of the line. Fig. 1 shows a Detroit car mounting a 10 per cent. grade on the Methuen division.

The rolling stock of the company consists of three snow plows and forty-eight cars, of which nineteen are motor cars and twenty nine trail cars. Fifteen of the motor cars are equipped with the Detroit system, using one motor on the car, geared to both axles, and four are equipped with Thomson-Houston S. R. G. motors. McGuire trucks are used with the Detroit equipments, and the motor car bodies and the trail cars were manufactured by the Ellis Car Co., Lewis & Fowler, Jones' Sons and the Newburyport Car Manufacturing Co. The cars are equipped with Lewis & Fowler registers, and the rack advertisements are supplied by Carleton & Kissam.

The three snow plows were made by the Newburyport Car Manufacturing Co., and are equipped with Thomson-Houston motors mounted on the platform and connected by sprocket chains with the car axles.

The power house of the Merrimack Valley Street Railway Co. is a substantial brick building near the eastern terminus of the road, and is on the banks of a stream, so that an ample supply of water for condensing and and other purposes is available. The tracks of the Boston & Maine Railroad are directly in the rear of the station, and a siding from these has been laid so that coal is delivered from the railroad car directly in front of the boilers. The boiler room is forty-two feet wide and forty-three feet long, and is separated from the engine room by a brick fire wall. The boiler plant consists of two batteries of Babcock & Wilcox boilers, their total capacity being 480 H. P. These are provided with two Worthington independent jet condensers, taking water from a distance of sixty feet horizontally, with twenty-one feet lift. The feed pumps are of the Worthington duplex pattern, and the heater is of the Wainwright type

The engine room is forty-seven feet wide and sixty-six feet long, and contains three engines of the McIntosh & Seymour tandem, compound condensing type. Two of these have cylinders 13 and 23 × 17 ins., and are of 250 H. P. each, and the third has cylinders 11 and 19 × 15 ins., and is of 150 H. P. These engines are direct belted by Schieren belts to five M. P., eighty K. W., Thomson-Houston generators.

The steam pipe to each engine is fitted with a Robertson separator. There is also a combined pump and receiver, which drains the water of condensation from the live steam pipes, and from the engine cylinder jackets and receiver, forcing this water directly into the boilers at nearly a boiling temperature.

The exhaust steam from all condensers and feed pumps is discharged into the heater. The live steam pipe system throughout is thoroughly drained and provided with independent valves for each boiler and each engine, thus making the plant perfectly flexible, and enabling the engineer instantly to throw out or into commission any boiler or any engine. Magnesia sectional coverings are used.

Each engine exhaust is furnished with a shut-off valve, placed near the main steam heater, running to the condenser, and in addition to the main exhaust each engine is fitted with an exhaust pipe opening into the atmosphere, this atmospheric pipe fitted with a Wheeler automatic atmospheric valve. This device enables the engineer to start any of the engines working until such time as the engine is well loaded and warmed up in perfect working order. By opening the valve in the exhaust to the condenser the engine is at once closed to the atmosphere.

The steam gauge in use was made by the Crosby Steam Gauge & Valve Co. of Boston, and the vacuum gauge by the Ashcroft Manufacturing Co. of New York and Bridgeport. In the engine room is also an automatic damper regulator operated by the steam pressure, manufactured by Locke & Bros. of Salem. Vacuum oil is used, filtered by the Purity Oil filter, the supply being kept in a special cabinet manufactured by the American Oil Cabinet Co. of Boston.

The switchboard, which is also in the engine room, is of wood, open framework style, and with switches, regulators, etc. of the standard Thomson-Houston pattern. Simplex wire is used for wiring to the switchboard and for feeders.

The engine and boiler plants have recently been increased to the extent of 250 H. P., which it is believed will handle any future increase in load.

Pierce & Thomas, engineers and contractors, 42 Cortlandt Street, New York City, did the engineering and executed the contract for the complete steam plant, installed and turned it over running. Since its installation it has operated with eminent satisfaction and success under a load much heavier than it was originally designed for.

The main car house 72 × 156 ft. adjoins the power station, is of brick and one story in height.

The officers of the company are J. N. Beckley, president; A. E. Butler, treasurer; N. E. Morton, superintendent.

Boston.

A visit to the offices and power stations of the West End Street Railway is always an extremely pleasant feature of a trip to Boston, and being in that city recently, we lost no time in calling at the large power station on Harrison and Albany Avenues. The work of construction and installation of apparatus here is being pushed forward as rapidly as possible. The engine equipment, as stated in a former issue, will consist of thirteen units of 2,000 H. P. each, and six of these are already in place They are triple expansion, condensing, Reynolds-Corliss engines, built by E. P. Allis & Co. of Milwaukee, Wis. Only one of the 500 K. W. Thomson-Houston M. P. generators which have been adopted as a unit, has been installed yet, but a very good idea of the future interior appearance of the station can be obtained. The switchboard will be in a separate room adjoining the engine room, and the amount of copper required to connect the generators with the board will be 28,000 ft. of 600,000 circular mils section. The company are also building a station at Cambridge, which will have a capacity of 5,000 H. P., and will use three engines of the type employed at the main station. These engines are already in position.

The current for the cars at present in use is supplied from the Allston station, and from the temporary plant at the main station, part of the generators being at present located in the future boiler room and part in a frame structure.

A visit to the manufacturing and repair shops of the West End company in the large brick building, formerly the Hinkley Locomotive Works, and adjoining the power station, showed a scene of great activity. The lower floor is devoted to the inspection and repair of the running gear. Here was also a new truck which the West End company are building for their long cars. It is of the the radial pattern which has proved successful on West End Railway, but with eight wheels. There are two wheels of the usual size at each end which carry the motors, and a small four wheel truck in the centre. There have been many reports that the West End company contemplate abandoning the use of long cars. This, we were officially informed, is not true.

The system for a "return" adopted by the West End company is most complete, and as it has not been mentioned in these pages, a few words of description here will undoubtedly prove of interest. In the first place, the ends of adjoining rails are bonded, whether they are also joined by angle plates or not, and every track has at least one supplementary copper wire to which every bond is connected. In some cases as many as five supplementary copper wires are carried between the rails. To still further reduce the resistance of this side of the circuit, heavy copper plates are sunk in the bay near the station and connected to the earth terminal on the switchboard, similar plates being sunk in the Charles River and at other points on the line where opportunity affords and connected with the rails. Not being satisfied with even this, the company use a number of direct overhead connections between the rails on distant portions of the line and the switchboard. Copper is the material employed for the bonds, and the total amount of this metal purchased by the West End company during the last three months of 1891, in the shape of feed wire, trolley wire, bonds, etc., aggregated a million and a quarter pounds.

The present practice at the station is to connect the positive pole of the generator to the earth, and the negative to line, the theory being that this not only reduces the electrolytic action on the copper bonds, but also helps the action of the lightning arresters by providing a flow of current, toward the station instead of away from it. Lightning arresters are used on each car, on each feeder at the switchboard, and a lightning arrester and choking coil is between each generator and the earth.

The problem of fenders has troubled the company to a considerable extent. As mentioned in a previous issue, a committee consisting of Prof. Geo. F. Swaine of the Massachusetts Institute of Technology, W. B. Clark of the West End company and C. E. A. Barrett, treasurer of the Boston & Lowell Railroad Co., were requested by President Whitney to determine the best type of fender and safeguard to use on the Boston electric cars. An elaborate series of experiments has been tried by this committee, and the number of different devices tested was about fifty. The fender trials were made both with long and short cars, and consisted in picking up straw dummies placed on the track. As a result, the company have practically decided upon the adoption of a fender for their long cars, the type of fender best suitable for the short cars not having yet been determined. The long car fender consists of a rectangular wire netting projecting, when in use, about four feet in front of the car and carried horizontally about four inches above the track. The netting is upon a frame, three sides of which are of iron, the fourth side, the front, being made of stout rubber. The device is always in position when the car is in operation, the committee having early decided that the use of an adjustable fender dependent for action in case of danger upon the presence of mind of the motorman was objectionable. Forty cars will be equipped with this device immediately, and if it proves satisfactory all the long cars will be provided with it.

According to the present system of appointments every new motorman on the road has to serve first as a motor inspector or helper in the repair shop from two to six weeks, or until he shows his familiarity with the motive apparatus. He is then given a certificate of competency signed by the superintendent of electric power, which can be revoked for cause. This system is being extended to all the motormen in the employ of the company as rapidly as possible and will go far toward insuring the best of care of the motors on the part of the operators.

DUANE DOTY in a recent article published in the *Herald*, of Chicago, reviews at length the annual report of the patent commissioner.

This reference to electrical invention is made: "What could better illustrate the marvelous advance in electrical industry than the fact that 1,250 patents, or four a day, were issued upon devices where electricity is used; of these we find 32 upon electric lighting systems, 7 on electric heaters, 49 relating to dynamos, 25 of them being for electrical machine dynamo, 30 on electric meters, 66 on electric motors, 39 on electric switches and 34 on electrodes.

"Hundreds of millions of dollars are now invested in the many applications of electricity, and a new profession—electrical engineering—has been created and the subject is taught in all our colleges and universities; all of this is the growth of little more than ten years. The above electrical patents do not include those relating to the telegraph and telephone." The railway patent list is thus alluded to: "Under the heading 'railway' the record shows 739 patents for the year, or two a day; of these 9 are for time signals, 10 for metallic ties, 40 for railway ties, 10 for spikes, 55 for switches, 42 on rails, 15 on railway gates, 10 on frogs, 8 on elevated railroads and 94 on electric railways."

Liverpool's Street Railways.

By J. McGhie.

Although the street railway with its polished rails and easy running cars, has not pervaded England to the extent it has in this country, yet some of its cities possess systems which can vie with our best ones in general excellence and interest. London, Birmingham, Glasgow and some of the Yorkshire and other northern towns are equipped with rolling stock which is a credit to them and an example to other cities. London has several systems, its size being such that no one company has been found equal to purveying universally to the transit requirements of that mammoth aggregation of human beings. Wise in their generation, however, the tramway companies keep strictly to their own territories, and competition outside of the omnibus companies, is unknown.

Liverpool, that city of 650,000 souls which the average American only catches a passing glimpse of as he hurries from the landing stage to the railroad station, stands unique in the possession of an almost perfect street horse railway system.

Its position on the banks of the Mersey, with its business quarters spread in a small area along the docks, and its residential portion distributed in a huge semi-circle around this, has rendered the general disposition of its car lines peculiarly simple. All of these lines, with the exception of those which cross the radial ones on the further side of the semi-circle, converge to the great landing stage—a huge floating wharf three quarters of a mile long—whence all the Mersey ferries run, and in the map appear as radii of the semi-circle just mentioned. Here the aggregation of car lines has the general appearance of an approach to the terminus of some great railroad. Each car, as it reaches the landing stage, runs on its own line along the water front, or what is known as the Pier Head, for a short distance, comes to rest for a few minutes, and then starts on its return journey.

The entire system of tramways is in the hands of one company—the Liverpool United Tramways & Omnibus Co., which is also proprietor of all the omnibuses with the exception of fifteen—seven of which run in opposition to it while eight work in co-operation with it. The origin of this company goes back as far as 1860, when a few omnibuses plied about Liverpool in opposition to each other. The owners of these, obeying the consolidating impulse of the day, amalgamated their interests and formed the Liverpool Road & Omnibus Co. They might have continued to run omnibuses until this day, had not some American gentlemen in 1868, fully alive to the advantages of running cars on rails, gone over to Liverpool and there formed a company to lay down car lines and run cars. This Liverpool Road & Railway Co. laid down six or seven miles of rails, but the public, refusing to recognize its efforts to secure its patronage, the cars were run without profit until 1876, when omnibus and car company joined hands and became the corporation which operates the lines at present. The new company began to extend its operations without loss of time, and has worked to such effect that to-day there are between sixty to seventy miles of double car track. Sixty-one and a half of these are worked at present; the remainder, lying on the outskirts, are not used, as their operation would be unprofitable.

This company, also, runs a line of omnibuses along the ten miles of granite docks. These omnibuses are of peculiarly heavy construction, with slightly flanged wheels, and are run on the ordinary tracks of the steam railroad which is used to remove the cargoes of vessels unloading at the wharves. The overhead dock railroad, which one of the shareholders terms a 'monster on crutches,' of which a full description was given in the February number, will do away with these, owing to the withdrawal by the Mersey Docks & Harbor Board of the right to run them over the dock lines, but new omnibuses are now being built to run outside the dock gates, and the toll now paid to the Dock Board will then be so much money saved.

By a clause in the company's franchise, the corporation of Liverpool and other local authorities possessed the right to take over all the lines of the company at the termination of the lease. This lease terminated in 1880, and the corporation decided to take advantage of its right. The lines were taken over and are now rented to the car company. Up to the year 1880, the company had constructed all car lines, but the corporation now does this work, and has also the charge of maintaining the road in good order. The corporation receives from the company 10 per cent. on the cost of construction, which is £6,000 ($24,800) per mile, while the other local authorities receive 9 per cent. on the same amount.

The grooved rail is exclusively used. These rails are securely bolted to heavy wooden stringers, impregnated with creosote which are laid on ties. Tie rods are also used. The bed of the road is solid concrete, laid on a foundation of well tamped rubble. Over the concrete is run a heavy layer of pitch covered with a light bed of sand in which the granite blocks are laid. The interstices between the stones are grouted with fine screened pebbles and filled with pitch, and the result is a roadbed which almost defies wear and time.

The tram cars are large four wheeled, single truck vehicles with places for passengers inside and on the top, and are capable of carrying, when all places are filled, about fifty passengers. Each car is drawn by three horses, two in the heavy harness and one tandem. Their carrying capacity is limited to the number of places provided, and the standing passenger uneasily hanging to a pendent strap is unknown. A by-law of the municipality, stringently enforced, is an especial safeguard against any overloading of the cars, and as soon as the interior or exterior places are completely filled, the conductor puts up a sign to that effect, and warns off those who, on this side, would crowd in or hang on to the rail and steps. The driver sits on a level with the passengers of the inside, the roof of the car projecting as a shelter over him, as on our cars. As no one is allowed to stand on the platform, the vacant space beside the driver is utilized for such bundles and packages as are too bulky to be carried inside or on top with the passengers.

In order to facilitate the running of cars at the intersection of Byron, Manchester and Victoria Streets, St. John's Lane and Whitechapel, where there is a constant flux of heavy traffic, a regular switchman's box has been constructed. Semaphores are erected at a short distance before the switch is reached and, as on the steam railroads, are worked by levers, also controlling the switches, operated by the switchman from the box. This is, we believe, the only instance in which the railroad switch system has been applied to the horse car system, and it works admirably.

The cars are built by the company at an average cost per car of $900 (£200), and are roomy, fine looking, well upholstered with cushions, easy running and comfortable. The average earning per car is about $106 (£22) per week, allowance being made for restricted service on Sunday when the ordinary Liverpudlian has little or no use for street railway cars.

The total number of cars constructed to date is 234, of which 171 are in constant use. They run in the aggregate about 4,000,000 miles per year, and carry on an average about 28,000,000 passengers. The total number of omnibuses at present built is 133, of which eighty-seven are in use. These travel about 1,700,000 miles, and carry about 8,000,000 passengers annually. The total mileage covered by the conveyances of the company is, therefore, about 5,700,000, and the total number of passengers 36,000,000. This for a city with a population of about 650,000 (Bootle being counted in as it is partially covered by the same system) is, perhaps, not very considerable, but it must be remembered that the average Englishman walks in many cases when his American brother would avail himself of the cars.

The number of employes is 1,450, and the company now has in its stables a stud of 3,162 horses. Each horse travels fourteen miles a day, and lasts about six or seven years. They are heavy, powerful beasts of Flemish or Norman breed, and usually end their days on some farm.

They consume a daily average of thirty-one pounds of provender—hay, beans and Indian corn—per day. This is about three pounds more than do the horses of car companies in other towns of England, but they have to cope with the hard work of pulling the cars up some very steep gradients, a sudden rise, beginning about a mile and a half from the river, almost mathematically dividing the business portion of the city from the residential quarter. It can easily be realized that a daily increase of 9,500 lbs of feed amounts to a very perceptible addition in the cost of maintenance of the stud at the end of the year. The average price paid per horse is about $155 (£32).

The fares are so arranged as to run from a minimum of one penny (two cents) to a maximum of six pence (twelve cents) according to distance. To check these fares the bell punch, an American invention, is used. Even using this and compelling the conductor to punch the ticket before the passenger, was not found a sufficient safeguard against the "knocking down" of fares, but the ingenuity of Mr. O'Neill, the manager of the line, has almost reduced the chances of dishonesty to a minimum. Formerly, the conductor punched a hole in the ticket, the color of which denoted the amount of fare paid, before handing it to the passenger ; now, he is obliged to punch one hole for each penny paid. In the former case, the pieces punched out of the tickets fell into a receptacle, and were counted as a check on the conductor. This was a tedious task and materially increased the cost of labor. An improvement on the registering punch was made, and now each time a ticket is punched the machine registers, and the conductor turns in his correct number of pennies at the end of his trip. The passengers are expected, as here, to act as an additional check on the conductor. Each car conductor carries in a small oblong frame attached to his leather cash satchel, a sheet with numbers printed upon it. The inspectors or "spotters" board the car unexpectedly at different points, and cancel the number corresponding with that of the passengers which the car is at that moment carrying. With all these precautions taken to keep the conductor straight, he generally finds that honesty is the better policy.

To the American, notwithstanding his practical spirit and general keenness after profit, the plastering of advertisements over the horse cars seems anomalous and unsightly, but in Liverpool, the cars are used extensively as advertising media, and both the exteriors and interiors are utilized.

The city seems to be no nearer the adoption of a system of mechanical haulage that will successfully supersede the horse, than it was before the latest developments in rapid transit were introduced here, although the company expresses itself as anxious to adopt some scheme in that direction if it can at a price, if not cheaper than, then at least as cheap as, horses. All kinds of haulage systems have been offered to it, and extensive experiments made. Compressed air was tried by the promoters under favorable circumstances, but was found by them unprofitable. The cable system was offered, but objected to by the corporation, who, unlike that of New York, view the tearing up of their streets with horror, and, as tenants, the company had to abide by the decision of the municipal authorities.

Electricity has also been tried. It was found to answer excellently as a haulage power, but commercially its cost was considerably greater than that of horse traction. An offer of electrical haulage, at seven pence (fourteen cents) per mile, was made to them with an additional charge of $7,700 (£1,600) for each car fully equipped with its electrical machinery. The seven pence per mile was much greater, relatively, than the cost of horse haulage, exclusive of the outlay of £1,600 on each car —which would amount in the aggregate to $1,800,000 (£374,400). The company seems to have been unlucky in its electrical experiments, for the same electrical concern which offered to haul its cars for fourteen cents a mile offered, subsequently, to the Glasgow municipality, to haul its cars for seven cents a mile, laying the difference to the fact that Liverpool is a city of steep gradients. The tramway company is now anxiously studying the results of the Thomson-Houston installation at Roundhay, Leeds, with a view of adopting electrical power as soon as it can be shown that under the different conditions an American system can be operated in England at a commercial profit over horses.

The Tramway company has had, like most companies formed for a similar purpose, to make a struggle for its existence, but it has now reached a period of comparative prosperity. Its mortgage debt in 1884 amounted to 417,600 (£86,980); it has been reduced to $91,200 (£19,000). In 1883 it was shackled with a good-will account of $1,173,600 (£244,500) which has been so reduced that now it amounts to no more than $363,600 (£75,750). The shareholders are receiving a regular dividend of 5 per cent. per annum, and the company is so operating the cars to the satisfaction of the public that there is no doubt that its franchise will be extended at the close of the lease now running. The improvement in the general status of the company, and the perfection to which the system has been brought are due almost entirely to the energetic devotion and perseverance of Mr. J. O'Neill, the manager and secretary, who has now been twenty-six years with it, and has, so to speak, fostered it from its youth up.

Asphalt: Where and How Mined.

Since asphalt is being extensively used as a paving material, it is interesting to know something of its origin and where it is found and how prepared for use. The Department of Public Works, of New York City, having had certain pavements constructed with an inferior asphalt, undertook an investigation and made tests of the material as supplied by different contractors ; and in order to make a careful study of the subject the commissioner, Mr. Thomas F. Gilroy, directed that the consulting engineer, Mr. Stevenson Towle, visit the asphalt lake on the Island of Trinidad and personally examine the deposits and method of mining. In obedience to these instructions



FIG. 1.—ASPHALT LAKE—SOFT ASPHALT IN CENTER.

Mr. Towle visited Trinidad in October, 1891, and in a report recently presented to the Department of Public Works, he has given a very interesting account of this visit, from which, by permission we make the following extracts, and have produced the accompanying illustrations from photographs kindly furnished by him :

Asphalt is found in different parts of Trinidad, but only in the district of La Brea (Spanish for "The Pitch") is it found in sufficient quantity for commerce, or of a quality suitable for street pavements. The wonderful Pitch Lake is situated there, and also with the extensive deposits of "iron pitch" and "land pitch" on the slope between the lake and Gulf of Paria.

The lake is about one mile from the sea, at an eleva-

tion of 138 ft. and contains 115 acres. It is quite circular in shape, and the outlines are well defined. On the south the land rises gradually from the lake, to the sea.

The surface of the lake is not level. It has an inclination of a few inches in one direction, sufficient to drain off the frequent rainfalls. Besides this slight inclination, the surface has a fall of a few inches from the centre toward all sides. Another and distinct characteristic is that the surface is not flat and even, but is formed of irregular, oval-shaped, flattened domes, or slightly convex



FIG. 2.—DIGGING AND LOADING ASPHALT.

surfaces, separated by channels of water a few feet wide and a few inches deep, flowing toward outlets. There are several small islands, from fifty to sixty feet in diameter, scattered over the surface of the lake, and resting on the asphalt itself. These islands have sufficient depth of soil to support the growth of quite large trees. The whole appearance of the lake is very odd, strange and difficult to describe. In color it is a dark chocolate brown, and looks very like a patch of mushrooms flattened out and pressed closely together, separated only by the narrow and shallow channels of water already described. In the centre of the lake is a space of several hundred square feet of soft, fluid asphalt. This is the celebrated "Pitch" or "Boiling Spring" (Fig. 1). Here the temperature is colder than in the solid parts of the lake. The appearance of boiling is due to the escape of large volumes of sulphureted hydrogen gas, which keeps the liquid mass violently agitated. This "spring" is commonly, but erroneously, thought to be the source of supply. In fact, it is the last of the asphaltic deposits, and is ages more recent than the deposits of "iron" and "land pitch," and much more recent than the solid part of the lake itself. This very fact should prove conclusively that the lake has never overflowed to form the deposits outside it, and that these deposits of "iron" and "land pitch" had no such origin.

The surface of the lake is sufficiently firm to support the weight of the loaded carts. The asphalt is mined for commerce from different parts of the lake to a convenient depth of about three feet. It is easily excavated with picks, loaded directly into carts (Fig. 2), and hauled to the shore ready for shipment (Fig. 3). A marked peculiarity of the Pitch Lake is, that the pits or excavations made during the day fill up during the night, and in a few days no trace of them can be found. This is due to the great viscosity of the lake asphalt, and is one of the features which distinguish it from all other asphalts found in this district. On the slopes from the lakes to the sea, and beneath the sea itself, are found the vast deposits known as "iron" and "land pitch." The greater part of these are covered with several feet of earth, supporting a dense tropical forest growth. The village of La Brea is over these deposits, the houses and streets resting directly on the pitch itself. These deposits are known by American dealers as "overflow pitch," but the inhabitants and geologists term them "iron" and "land pitch." The asphalt from these deposits varies in color from gray to black (Fig. 4). The "iron pitch" exists in extensive compact masses of detached deposits, and is extremely hard and brittle, and almost black in color. The "land pitch" is found mixed with more or less dirt and foreign matter, and varies in color from gray to black. Both kinds are mined from the village lots and from deposits on both sides of the road leading from the village to the lake. These village plots are the ordinary size village lots, and are generally occupied by the cabins of the owners, who either mine the deposits themselves or lease them to others for mining. The asphalt is carted to the shore and piled in heaps ready for shipment, which is almost exclusively to the United States. The cargoes are often made up of asphalt mined from several different deposits. This accounts for the great variety met with in the same shipment. I noticed one pile made up in this way, and adjoining it a pile of "lake" asphalt. The difference in the two was very marked. The pile of "land" and, "iron pitch" was of a variety of colors, from gray or black, lustreless and brittle, and mixed with earth and decomposed asphalt. This latter feature was owing, no doubt, to careless sorting and "cutlassing," as the cutting and trimming off the decomposed surfaces of the deposit is called. The pile of asphalt from the lake was bright and uniform in color. Another peculiarity of the "iron" and "land pitch" is that when excavations are made the walls of the remaining asphalt do not run in and fill up the excavation. The angles and projections only are rounded off and softened by the sun's heat. This shows that these kinds flow but slowly, if at all, and in this respect are very different from the lake deposit.

The different asphalts found on the island of Trinidad have, undoubtedly, a common origin. Geologists, however, differ on this point. Messrs. Wall and Sawkins, government geologists, hold that the asphalts are of vegetable origin, and formed in the same way as peat and coal. In this opinion most geologists agree. Others claim that the asphalts are of volcanic orgin, and some hold that the source is to be found on the mainland of



FIG. 3.—LOADING ASPHALT UPON LIGHTERS.

South America opposite, where there are found vast deposits.

* * * *

I collected and brought home with me samples of asphalt from different mines in the La Brea district, which are fair samples of the different deposits. These I submitted for analyses, and from the report of the analyses it was found there is a difference of 3·80 per cent. in the bitumen contained in the respective samples. A marked difference in the softening points will also be observed, the variation being as great as ninety degrees Fah. In asphaltic oil there is a difference of 3.68 per cent. These differences

are in favor of the lake asphalt, which contains a much larger quantity of bitumen and asphaltic oil than the samples of the other deposits, and will require the addition of less residuum oil in the preparation of the asphaltic cement for street pavements.

In my judgment, asphalt showing a deficiency of asphaltic oil is not suitable for pavements, as deficiency in that oil detracts from the durability of the asphalt.

The analyses also show that the asphalts containing the least asphaltic oil have the highest softening point, and are consequently harder and more brittle than asphalts with a lower softening point, and correspondingly greater elasticity, which latter quality paving experts consider essential, as it gives the pavement the necessary adhesiveness.

Trinidad asphalt is extensively used in Europe in the pavement of sidewalks, and a condition in the specifications for such work is that the asphalt shall be "viscous and not brittle under ordinary temperatures."

This large proportion of lake asphalt exported to Europe would indicate that the lake asphalt alone meets the requirements of foreign specifications.

Statistics show that 41,177 tons of raw and 4,827 tons of refined asphalt, taken from lands outside the lake,



FIG. 4.—LAND PITCH—LA BREA VILLAGE.

were imported into the United States, the greater part having been used in pavements.

The lake asphalt is mined and exported exclusively by the Trinidad Asphalt Co., and is imported into the United States by the Barber Asphalt Paving Co., the Warren-Scharf Asphalt Paving Co., and the Crawford Paving Co.

The durability of asphalt pavements depends wholly on the suitability of the asphalt for the purpose. It must be of such a nature as to permanently and thoroughly cement together the sand and limestone powder forming the body of the pavement. It must be elastic, independent of the residuum oil required in making the paving cement, and in no degree brittle.

To secure materials that may be relied on to make the best pavements, it is the practice of European engineers to designate in the specificatons not only the kind of asphalt to be used, but also to name the mines and companies that will be allowed to furnish the material, and only to receive bids from such contractors as have shown ability to furnish the material required, and have done satisfactory work.

It has been found necessary to follow this practice in this city as to material for rock asphalt pavements, and the same course should be followed with regard to the Trinidad asphalt pavements.

In view of the importance of obtaining the best asphalt, I would recommend that the asphalt from the Pitch Lake at La Brea, Trinidad, be made the standard of quality. This standard is now required by the specifications for asphalt pavements in Washington."

Meeting of the Tramways Institute of Great Britain and Ireland.

The first quarterly journal, for 1892, published by the Tramways Institute of Great Britain and Ireland, has recently been issued and contains the reports of the tenth quarterly meeting of the Institute held at Alexandra Hotel, Bradford, January 7-8. The president, Mr. W. J. Carruthers-Wain occupied the chair. The papers read were on the "Bradford Corporation Tramways," by J. H. Cox, an abstract of which we give below, on "Steam Traction," by W. Vaux and on "Gas as a Locomotive Power in Connection with Street Tramways" by Nott Knight.

In the report of the Rating Committee, which was the business first brought before the Association, and during the discussion which followed the report, it was shown that the street railway tracks were very heavily assessed, in some instances as high as £400 per mile, and that one company, the Swansea Tramway Co., was now engaged in litigation in the hope of securing an allowance of 75 per cent. on the net ratable value. A resolution was passed contributing the sum of 100 guineas towards the costs of this company in their suit, on the understanding that the Attorney-General be retained by them to argue the case. Below is an abstract of the paper by J. H. Cox, City Surveyor of Bradford, entitled :

THE BRADFORD CORPORATION TRAMWAYS.

The town of Bradford, which owns its tramways, leasing them to an operating company, is somewhat peculiarly situated in the bend of a deep valley. The population at the end of the census of last year was 216,361. The area of the borough is 10,776 acres. The corporation for the last quarter of a century, in addition to carrying out the ordinary duties of a sanitary authority, have shown great public spirit in establishing or acquiring pretty nearly all the large undertakings which are necessary for the prosperity of a large manufacturing town, and at the present time they are the owners of the waterworks, gasworks, electric lighting works, markets (both wholesale and retail), public abattoirs, cemeteries, parks, public baths, museum and free libraries, fever and small pox hospitals, convalescent home, and eighteen and a half miles of tramways.

The generally steep and narrow character of the main roads converging to the town was instrumental in delaying the introduction of tramways, but the necessity of better means of locomotion was severely felt even twenty years ago, when, with the exception of the Great Northern Railway to Laisterdyke, and a few small omnibuses which ran at long and irregular intervals, no facilities for quick traveling existed whatever. A corporation which had ministered so well for the requirements of the inhabitants in other matters was scarcely likely to allow the construction of tramways within the borough to fall into the hands of outside promoters, and so it happened that in the year 1880 the Town Council applied for and obtained powers to construct tramways on three routes, viz., Manningham Lane, Leeds Road and Sunbridge Road, having a total length equal to seven and a half miles of single line.

Previous to commencing the construction of the lines, tenders were invited for leasing and working them when complete, and ultimately they were leased to Messrs. Turton, Mason and Busby, of Leeds and Liverpool, for twenty-one years at an annual rental of £290 per mile for the first ten years, and £300 a year for the remainder of the term—equal to about 7¼ per cent. on the outlay.

The rail used is of the Winby & Levick type and is of steel six inches high, with a bottom flange three and a half inches wide, weighs sixty-five pounds to the yard, and is rolled in lengths of twenty-four feet. The rails are mounted on wrought iron base plates each twelve feet long, twelve inches wide, and three-eighths of an inch thick, and are secured thereto by means of cotter bolts and cotters at intervals of two feet on alternate sides of the rail. The Manningham Lane section was opened on January 31, 1882, and for the first seven years was worked exclusively by horse power, during which time the repairs were nil. Since October, 1888, steam power has been used in addition to horses, and from that time the cost of maintaining the line has rapidly increased. The Leeds Road section was opened in June, 1882, and the Sunbridge Road line followed in September of the same year. Both these lines have been worked entirely by steam power from the first. The gauge is four feet. The rails were provided and laid at £1,998 per mile, and the concrete foundation and granite paving were laid by the corporation workmen at a cost of £2,500 per mile.

In 1882 a six and a half mile extension was laid, the type of rail used being of Bessemer steel of the girder pattern, seven inches deep and seven and a half inches bottom flange, weighing 103 lbs. to the yard, at the price of £8 10s. per ton, delivered at Bradford. Contracts were subsequently made for the supply of similar rails at the reduced rates of £7 18s. 9d. per ton and £7 16s. 3d. per ton respectively.

The girder rails were rolled in thirty foot lengths, and cost, including laying, but exclusive of points and crossings, £1,750 per mile. The foundation for the roadway was laid on a bed of concrete six inches in thickness, composed of broken stone and lias lime in the proportion of six to one. The surface of the concrete for the width of the tramway was floated to a smooth face and the rails laid thereon, but as it was found impossible to make the bottom flange of the rail to touch the concrete at all points, it was decided to run a thin layer of hot pitch underneath to fill the intervening space. At this time the rails were fished with steel fish plates only sixteen inches long and weighing twenty-two pounds per pair, bolted together with bolts one inch in diameter and nuts to match, each bolt and nut together weighing one pound five ounces.

Tramway engineers and managers have found out by stern experience that the rail jointing or fishing is the weakest part of the line, especially where steam traction is adopted ; and in two or three of the

later tramway extensions in Bradford the fish plates have been lengthened, first to two feet, then to two feet six inches, and now it has been decided to have the next lot made three feet in length. The section of the fish plates will likewise undergo alterations, and eight bolts will be provided instead of four. Shoe plates of wrought iron, half an inch thick and twelve inches square, have been placed under the ends of the rails to prevent one rail sinking below another at the joints, but in future these shoe plates will be increased in length to at least two feet. Marshall's patent spring points have been largely used on the Bradford tramways, and they have been found very suitable and reliable for steam traffic. A marked improvement has also been made by the insertion of Dawson's patent drain rails for intercepting water flowing down the grooves of the train rails and conveying it direct into the sewer, thus preventing damage to loose joints and avoiding pools of water in various places on the track. The sides of the rails were plastered flush with the top flanges with a mixture of Portland cement and river sand, in order that no hollow space should be left between the rail and the paving setts abutting thereon.

The whole of the carriage way, including the width of the tramway, was paved with granite setts three inches by six inches. The joints of the paving were grouted with a mixture of hot tar and pitch. The Manchester Road line was completed and opened on September 5, 1884, after being leased to the Bradford & Shelf Tramway Co. for a term of twenty-one years, at a yearly rental of £400 per mile of single line, equal to about 11 per cent. on the outlay. The total amount expended on the construction of tramways in Bradford to this date is £76,500, and the term for repayment of the borrowed money is thirty years. The tramways are maintained by the corporation, and during the last two or three years the cost of maintenance has become a somewhat serious question, and this is attributable to several causes. In the first place, the original lines laid on Winby & Levick's system are not sufficiently substantial for the ponderous engines and cars which are now used ; in the second place, large quantities of water are discharged on to the tracks in all weathers, and a large proportion of this water finds its way into the loose joints of the rails, where it occasionally becomes frozen. At other times a sort of churning process goes on at these loose joints, which in many cases softens the underlying concrete. No doubt great wear and tear is caused by the incessant application of the brakes on the downward journey, rendered necessary by the long and severe gradients which exist on nearly all the Bradford tramways. In order to secure the adhesion necessary to climb these steep inclinations, amounting in several cases to one in fifteen, heavier and more powerful engines have been introduced, dragging huge bogie cars capable of carrying sixty persons, until the old practice of using sixteen inch fish plates has proved quite inadequate to meet the strain. The actual wear of the tread of the rail on the Leeds Road single line is five-sixteenths of an inch in nine and a half years, and a quarter of an inch at the passing places. On the Manchester Road tramway the wear on the up and down lines is practically the same, viz.: five-sixteenths of an inch in seven years.

When the tramways were first commenced in Bradford, an arrangement was entered into whereby the Street and Drainage Committee undertook to keep in repair the paving between the tram rails and for a space of eighteen inches beyond, in consideration of receiving an annual payment from the Tramways Committee equal to £35 per mile of single line. Of course for the first few years the repairs were practically *nil*, but during the last few years the cost of keeping the paving in order has exceeded the amount allowed to such an extent that, long before one-half of the term of the lease is expired, the Street and Drainage Committee will be out of pocket unless a fresh arrangement is made. It may be urged that it all comes out of one pocket, and that even if tramways were not laid along these streets the space in the centre would have to be paved for ordinary traffic. No doubt there is something in this argument, but not so much as would appear at first sight, because the four or eight continuous straight joints caused in the paving by the single or double set of tram rails respectively are a source of very great weakness to the road.

The average cost of maintaining the eight and a third miles of tramway on Winby & Levick's system, for the first eight and a half years, has been £53 per mile per annum of single line. If steam had been used on the Manningham Lane section from the opening of the line, the cost of maintenance would have been about £75 per mile instead of £53. The average cost of maintaining the Manchester Road line for the first six and a quarter years, on the girder rail system, has been £28 per mile of single track per annum. Of course, the expense of maintenance is increasing rapidly every year, and it is very probable that some of the lines will have to be renewed before the expiration of the lease, eleven years hence.

In 1890 the Bradford corporation obtained a provisional order for constructing tramways in Wakefield Road and Bolton Road, but before laying them they considered it advisable—having regard to the great expense of maintaining the lines for steam traction—to ascertain if any other motive power could be adopted which would be suitable for working the steep and tortuous route.

The cable system of traction was well considered, and I presented to the Corporation Tramways Committee a report on the subject in October, 1890, pointing out at length the merits and demerits of the system.

There is no need to repeat to an audience like this the many advantages which may reasonably be urged in favor of the cable system when applied to tram routes with severe gradients in populous districts which are able to support a very rapid service of cars ; but it was felt by the Tramways committee that the Wakefield Road and Dudley Hill route, although running through an improved district, could not at present provide traffic to warrant a quicker service than about fifteen minutes.

Further consideration of cable haulage was, therefore, dropped for the time, and inquiries were made respecting the capabilities of electricity as a motive power.

In order to obtain some notion as to the capabilities of electricity in propelling tram cars on steep gradients, the Tramways Committee have entered into an arrangement with Mr. M. Holroyd Smith, acting with Messrs. Easton and Anderson, whereby those gentlemen are to fix, by means of poles and span wires, an overhead conductor, consisting of a slotted copper tube three-quarters of an inch in diameter, placed midway between the two existing tramway tracks, a total distance of 624 yds. ; starting with a totally level gradient of 1 in 340 for 50 yds., then curving into Cheapside on a gradient of 1 in 13.22, with a radius of 64 ft. 6 ins., followed by a straight inclination of 1 in 14.75 for 193 yds., 1 in 20 for 137 yds., and terminating at the end of a tolerably level gradient of 1 in 104 for 150 yds.

A car is being specially built for the purpose, will be fitted with two fifteen H. P. motors, and will be capable of carrying thirty-six passengers—eighteen inside and eighteen outside.

The corporation undertake to supply the electric current required during the experiment from the Electric Lighting Works, in Bolton Road, at a pressure of 300 volts. It is intended to run the car for about one month during the hours of daylight so as not to interfere with the electric lighting of the town.

A record will be kept of the energy expended in climbing each of the inclinations referred to, together with the rates of speed, distances traveled, and number of passengers carried during each journey ; and special attention will be paid to the amount of energy required to start the car on the respective gradients.

It is hoped that the information will enable the committee to form some approximate idea as to the capabilities of electricity as a motive power for working tramways, and guide them in coming to some decision with respect to their future tramway extensions, and more especially as regards Wakefield Road. If the results of the experiment are sufficiently encouraging, it is intended to supply the electricity for working the Wakefield Road line from existing works.

The Electric Street Railway and the City.

"The Electric Street Railway in its Relation to City Life" was the subject of discussion at a meeting of the Providence (R. I.) Commercial Club, held at the Narragansett Hotel, May 14. The speakers were T. Commerford Martin of New York, editor of the *Electrical Engineer;* Prof. Elihu Thomson of Lynn, of the Thomson-Houston Electric Co.; Henry M. Whitney, Esq., of Boston, president of the West End Street Railway Co., and Lieut. O. T. Crosby of Lynn, of the Thomson-Houston Co. Capt. Eugene Griffin of Boston, who was to have been one of the speakers, was unable to be present.

Among others present were C. A. Coffin, H. M. Daggett, Jr., Ex-Gov. Littlefield and G. C. Sims. After dinner had been served and enjoyed President Watson introduced as the first speaker Mr. T. Commerford Martin, who spoke in part as follows :

Five years ago the electric railway was practically an unknown thing in America. The suddenness and brilliancy of its development have been equaled only by the abuse and calumny that have marked its advance. Like every new thing, it has its shortcomings ; like every great invention, it has still to pass through many stages of improvement ; like many an innovation, it offends some tender sensibility or deeply rooted prejudice; and the old battle that has been fought so often has to be fought again.

At the close of last year there were in this country 10,599 miles of street railway with 35,877 cars. Of these, 4,061 miles were electric and 8,892 cars were electric. The total of horse, cable and electric mileage had increased during the year 1,490 miles, but electricity standing alone had increased 1,538 miles. The total of horse, cable and electric cars had increased during the year 3,826 cars, but electricity standing alone had increased 3,300 cars. There were at the end of the year seven times as many miles of electric road as of cable, and more than twice as many electric cars as there were cable cars. There were at the end of the year over 400 electric roads in America. Last March, in looking over the figures of population, I ascertained that of the sixteen cities in the United States having over 200,000 inhabitants, 14, or 87 per cent., were equipped with electric roads. Of the forty-two cities having between 50,000 and 200,000 inhabitants, 41, or 97 ½ per cent., had electric roads. Of the remaining 391 American cities with a population of over 8,000, I do not know of a score that have not electric roads or serious plans for establishing one; while since March every one of the larger cities referred to as the exceptions in the above percentages have fallen into line with a formal approval of this new method of urban travel. The investment to date touches $100,000,000.

As everybody knows, steam motors are completely out of favor for use within city limits. Their glorious record of half a century in long distance travel does not deceive any one dwelling in a city as to the insuperable defects and nuisances of noise, smell, smoke, dust, steam escape, oil drippings, etc., which may more readily be tolerated remotely in the open country. And may not the same be said as to the horse? There are, for example, close upon 15,000 horses engaged in hauling street cars around New York city. It is high time that every one of these was dispensed with, as well for its own sake as for that of the city, whose air it assists in polluting, and whose population it aids in driving into closer quarters somewhere else.

There are to-day only 594 miles of cable road in this country. The reason of this simply is that only a large city can support a cable road, and hence a great many of our most active and progressive communities were condemned to the slow travel of the horse car, because there was no temptation to capital to change the method. It is evident that upon such a heavy capitalization as the cable requires, the earnings must be

very heavy, but there are not a great many cities in the Union that would warrant such an investment.

For the vast majority of our cities and towns, then, electricity becomes the sole means by which they can enjoy that which counts for so much in the sum of comfort and convenience—swift, clean, frequent and profitable transportation. I look upon electric roads as a beneficial agency in the more equal distribution of a happier population around any centre, thus increasing the value of outlying property, while by the stimulation of local trade enhancing the profit earned in the area lying within the region thereafter more legitimately restricted to business occupance. Facilities of rapid transit also make for a pure city government. Old London is herself an instance of this, for so long as her swarms hived within the narrow limits she was municipally as corrupt as any city could well be, but to-day her population, spread over a vast outer area, and with multiplied means of communication, governs itself as I believe no other community in the world can claim to do.

Henry M. Whitney, president of the West End Street Railroad, of Boston, was the next speaker. Among other things he said: I dare say many of you here have been abroad and are somewhat familiar with the social life of the large cities in the Old World. About two years ago I had the occasion to investigate something of the system of transportation in Germany, and indeed throughout the old cities of the world, with a view to finding out exactly what was the relation between the roads and the cities and what effect it had upon the social life of the population. The city of Berlin has often been quoted in our municipal and legislative halls as an example that should be copied by the cities and towns here.

I found in the city of Berlin with its 1,700,000 inhabitants, that there were but half as many dwelling houses as in Boston with its 450,000 inhabitants. I found in Germany that people lived in large tenement houses upon an average of sixty-five people under a single roof in a depraved condition. Almost as many people in Berlin live in cellars under ground as are contained in this whole city of Providence. The wages paid in Berlin are in many cases not exceeding a quarter of what is paid to the laboring people of this country.

Now, the system of transportation in the State of Massachusetts or in the city of Boston is that a man may go the whole distance of the line for a single fare of five cents. What is the effect of this? It is exactly just what you would expect. The poor people of the American city move into the suburbs, and there find healthful homes for their families. Every year this area grows in extent larger and larger and more and more difficult for the transportation company to meet this condition of things.

No person, to my knowledge, has been seriously injured since the system was put in Boston, three years ago. From that day to this, while it is true two or three horses have been killed, to my knowledge no single person has received any injury worth talking about at all. That this is a deadly current is shown to be a mistake. Hardly a week passes that a lineman does not receive a shock, and burns his fingers, perhaps. I know of no serious case. There is no suit against the company alleging injury from this cause. The experience of the people I represent has been one so far of entire approval of the system as a whole. I am not here before this body of men to say I do not think the wires objectionable. I would be glad if they can be dispensed with.

What has been the effect upon property? It has been what you might expect. That is, if you extend the area to which a man may go and come, you extend the value of your property. You give them advantages for it, and you profit by the trade you receive. We started a line over Beacon Street some years ago. I have lived in Brookline from 1866 to the present time. I lived on the corner of Beacon and Pleasant Streets for more than twenty years. During the whole of that time not a single new house was put upon that street. I believe not one in twenty-five years. The land along the line of that Avenue was selling at from three cents at the reservoir to fifty or sixty cents at St. Mary Street, the dividing line between Boston and Brookline. To-day it is assessed on an average thirty-four cents a foot.

The property on that side increased in five years $3,900,000. The increase within 500 ft. of Beacon Street was something more than $1,900,000. That made an increase of nearly $6,000,000. The rate has been $11 on the $1,000. The whole cost of that improvement, besides sewer and water expenditure, which the town must have put in, and under our system would assess back, was $220,000, making an annual burden at 5 per cent. of $11,000.

Now, I believe that that increase in valuation is very largely due to the fact that we have there a system of electric railroad, and I find the same thing is true wherever the electric system goes. Property becomes more valuable and people desire to live upon the line of the electric road. The consequence is that property advances in price.

President Watson then introduced Prof. Elihu Thomson as the next speaker. Mr. Thomson's address was a graphic description of of how electricity is generated, and its application and uses. The question had often been put to him, What is electricity? What is its real nature? All we know is, it is about the simplest of Nature's agents.

He also spoke briefly upon the disadvantages of the storage battery system, and said the trolley system had taken its place. If anything comes up that is better than the trolley the railroad companies will at once conform to it. But let us do the best for the present with the things that are at our disposal. A great deal has been said about the danger of trolley lines, but our records show that no human being has been seriously injured by the current. The trouble is, people unacquainted with the subject are apt to confuse electricity with lightning.

The last speaker was Lieutenant Crosby, who spoke of the electric road in Richmond, Va., and the tribulations experienced before experience had been gained in the use of electric machinery. He took an interesting view also of the social side of the problem.

Legal.

1. GETTING ON STREET CAR IN MOTION—QUESTION OF FACT. Whether a person in getting upon a street car in motion is chargeable with a want of ordinary care, is a question of fact for the jury. It is not negligence *per se* for a person to get on or off a street car drawn by horses while the car is in motion. An instruction that such act is conclusive evidence of contributory negligence as to bar recovery was properly refused.

2. GREATER CARE REQUIRED IN REGARD TO STEAM CARS. A stricter rule than that applicable to horse cars must be held to apply to steam cars. So an act in getting upon a train drawn by steam, which would amount to gross negligence, might be prudent if done on a horse car, when the latter was not in rapid motion.

3. PLACING TELEPHONE, TELEGRAPH AND ELECTRIC POLES NEAR TRACK—NEGLIGENCE OF. When a street railroad places its track so near such poles or other obstructions which it is necessary for its cars to pass, that its passengers in getting on and off, and while upon them are in danger of being injured by contact, it is a fair question for the jury whether the company is or is not guilty of negligence.

4. RIGHT OF STREET CAR TO STOP AT NEAR CROSSING—INSTRUCTION. In an action by a passenger on a horse car against the company, to recover for a personal injury by being propelled against a pole near the track, while getting on the car in motion, the defendant asked the court to instruct that under the ordinance of the city the company had no right to stop its cars except on the further crossing, which was refused. *Held*, proper, it being immaterial whether the defendant had the right to stop its cars at the further crossing or not, there being no claim that the driver refused to stop the car at the place where the plaintiff got on the car.

5. DANGEROUS USE OF STEPPING BOARD—OBSTRUCTIONS. It has been held that it is inexcusable in a railroad company to permit an obstruction to stand so near its track as to render the use of the running board dangerous to life or limb, inasmuch as exceptional cases may arise where it is lawful and proper for even a passenger to use such stepping board.

6. Where a passenger was injured while standing on the running board, seeking a seat, an instruction as a matter of law, that he had no right to be where he was at the time of the accident, therefore defendant was not liable for the injury unless done willfully. *Held*, to have been properly refused, it failing to state any facts upon which he had no right to be where he was at the time of the accident.

7. USE OF STEPPING BOARD — TRESPASSER. If the plaintiff was merely using the steps for the purpose of ascending into the car, he was where he had a right to be, and if he stood upon the steps too long it could not be said that he was a tresspasser, as to relieve the company from any liability than from an willful injury.

8. WAIVER OF RULES OF CARRIER—NEGLIGENCE. Although a person may get upon a horse car in motion, in violation of a rule of the company, yet if it is made to appear from the evidence that such rule has been waived or revoked in his favor, he will, nevertheless, be entitled to his action for his injuries from any want of care on the part of the company. If the conductor sees that the passenger gets aboard while the car is in motion at a moderate speed and makes no objection or warning, a fair question is presented for the jury to find from all the circumstances whether the rule has not been waived.

9. NO FARE PAID—TRESPASSING. It cannot be held that a party is a trespasser after he gets upon a car, even though no fare has been paid or collected of him before he meets with an injury, simply because he has violated a rule of the company. It is not necessary that there be an express contract in order to constitute the relation of carrier and passenger, nor that there should be a consummated contract. A contract may be implied from slight circumstances, and it need not be actually consummated

by the payment of fare on entry into a car of the carrier. The matter depends largely upon the intention of the person at the time he enters the car. Judgment for plaintiff affirmed.

The North Chicago Street Ry. Co. v. *Williams.* Ill. S. C., January 18, 1892.

Note: This important decision covers numerous points of vastly great interest to street railway managers. Here a distinction is made between horse and steam cars as vehicles of a common carrier. Whether electric and cable cars will be classed as horse or steam cars is not passed upon. The cases decided on these subjects are numerous. On the one hand a passenger in attempting to get on or off a moving railroad (steam) train is guilty of such negligence as to preclude a recovery (53 Ill 510). One knowing the location of the tracks, etc., assumes the risk and cannot recover (35 Ohio St. 627). It has been held that one entering upon a car in violation of the rules of the company is not a passenger: 2 Rover on Railroads, 979; Hutchenson on Carriers, Sec. 587; 72 Md. 377; 2 Wood on Railways, 1,035.

A person who intrudes himself on a train cannot recover for an injury unless willfully inflicted (22 Ill. 633; 131 Ill. 61). On the other hand it has been held to be gross negligence to place even a temporary track in such close proximity to a pole. 91 Ill. 298; 53 Mich. 43.

It is not negligence *per se* for a person to get on or off a street car drawn by horses while it is in motion. It depends upon the circumstances of each case and is a question for the jury (42 Minn. 42; 148 Mass. 210; 49 Hun. 610).

It has been repeatedly adjudicated that it is not negligence, as matter of law, for persons to ride upon the platforms of street cars. 8 Allen 234; 36 N. Y. 135 and 67 N. Y. 596.

The contrary is true of steam cars; 51 Ill. 495; 99 Penna. St. 492. It has been held in a number of cases that riding on the steps of a horse car or side steps (running board) of a horse car would not preclude a recovery for injuries caused by collision with another car or other obstacles (36 N. Y. 135; 1 Sweeney 490; 97 Pa. St. 55; 38 Kans. 375; 37 Mo. 537; 50 N. J. L. 435 and 54 N. Y. 230.

Street Railways—Crossing Steam Railroads—Priority of Right of Way—Grade—Injunction—Equity. The complainant street railway company, having by ordinance obtained consent to construct a line upon certain streets, but when it proceeded to construct its line of railway over and across the line of track of the respondent railway company at the intersection of said streets, the latter company by its agents and employes, illegally and forcibly tore up, removed and destroyed a portion of its line of track; hence this action to enjoin and prevent respondent from interfering in any manner with the construction of complainant's line of track across the respondent's road or tracks at the intersection of B. and F. Streets. On motion to continue the preliminary injunction the court

Held, 1. That the Act of June 19, 1871 (P. L. 1360), regulating the crossing of one railroad by another, does not apply to street passenger railways.

2. That the construction of a street passenger railway upon a street, changes only the mode of use of a public highway, and does not impose on the property over which the highway is laid out and opened, an additional burden or servitude; and this is the case whether the railway is operated by horses or electricity.

3. That the street railway company has no greater rights and privileges toward a steam railroad company whose tracks it crosses, than have the owners of private vehicles or omnibuses used for hire; the steam railroad company has always the superior right of passage.

4. That upon a bill in equity to restrain a railroad company from interfering with the laying of the tracks of a street passenger railway over the tracks of the railroad, the defendant has not the right to complain that the plaintiffs have not built a continuous route as required by the Act of May 14, 1889, under which they were incorporated. The proper remedy in such a case is by *quo warranto.*

5. That a street passenger railway company locating its tracks over a railroad will not be required to file a bond conditioned to compensate the railroad company in damages. In such a case the street passenger railway company being required "to stop, look and listen" before crossing the railroad company's tracks, no damage arises from delay of trains.

Du Bois Street Ry. Co. v. *Buffalo, etc., Ry. Co.*, Pa. Com. Pleas. Ct., Sept. 1891.

Collision at Crossing With Street Car—Negligence—In an action against a railroad company to recover damages for the alleged negligent killing of plaintiff's intestate, it appeared that the decedent was a street car driver, and that in coming toward defendant's track he slowed his car to a walk when he was within about twenty-five or thirty feet of the railroad crossing, and that he could have seen the approaching train seventy-five feet down the track when twenty-five feet away from the crossing, or could have seen the train 160 ft. down the track when within sixteen feet of the crossing; that the deceased did not stop his car, but seemed to be looking at his horses, with his hand on the brake; that there was a flagman regularly stationed at the crossing, but that he was in the flag house and gave no warning of danger.

Held, That it was a question for the jury to determine whether the absence of a flagman from his post of duty warranted deceased in presuming that it was safe to cross defendants' track at the same time, and a finding that the driver was not guilty of contributory negligence would not be disturbed. Judgment affirmed.

Richmond v. *Chicago, etc., Ry. Co.* Mech., S. C., 1891.

Note: This was not a unanimous decision. The principle of law that one about to cross a railroad must stop, look and listen, was excused on the ground that defendant's flagman was on duty, but made no effort to warn the driver of danger; that the negligence of the flagman was the negligence of the defendant. This reasoning has met with some adverse criticism.

Street Railways—Crossing—Contributory Negligence. In an action by plaintiff to recover damages for a wagon crushed by the defendant's cars, while his employe endeavored to drive across defendant's track.

Held, that it is gross negligence to drive in front of a moving street car so near as to make a collision inevitable; such conduct defeats an action to recover for self-inflicted damages.

2. *Charge of Court—Rule as to Looking and Listening. Held*, that it is error in a trial judge to leave a jury without any rule of law governing the duty of a driver when approaching a street railway. It may not be necessary to stop before approaching a street railway crossing, but it is necessary to look before driving on the track.

Carson v. *Federal Street & P. V. Pass. Ry. Co.*, Penna. S. C., January 4, 1892.

Negligence of Company—Hasty Starting of Car—Evidence. Where, in an action to recover damages for loss of services and expenses incurred by reason of the injury of plaintiff's infant son, there was evidence that the conductor of defendant's car signaled the driver to start before plaintiff's five year old boy and his attendant had reached a place of safety upon the car, and while standing on the running board of a summer car, the latter immediately started with a jerk, thereby throwing the child under the car and crushing his leg.

Held, that a verdict for plaintiff will be sustained, though such evidence rests solely on the testimony of the child's attendant.

A. Kersloot v. *Second Avenue Ry. Co.*, N. Y. C. A., March 1, 1892. *Note:* This was not a unanimous decision. Finch and Gray, J. J. dissent. Sec. 8 N. Y. Supp. 926.

The Street Railways of New York City.

BY W. N. AMORY.

An analysis of the Reports of Street Surface Railroads of New York City, as they appear in the New York Railroad Commissioners' Report for 1891, presents an interesting array of figures.

The number of railroads operated is fourteen, counting a lessee railroad with its lessors is each case as but one. The total length of double track railway, including switches, turnouts and sidings owned or operated by these companies, is 138.28 miles. The total capital stock authorized by law or charter is $30,350,000. The total funded debt is $33,642,000. The grand total is $63,992,000. The average capital stock per mile of double track is $219,472; the average funded debt is $243,278 per mile of double track; and the average of capital stock and funded debt combined is $462,750 per mile of double track. The New York & Harlem Railroad Co. (the Madison Avenue line) is stocked at the rate of $1,132,500 and its funded indebtedness is at the rate of $1,359,570 per mile of double track, which is far above the average of the other railroads. Omitting the New York & Harlem Railroad Co., the average capital stock for all these railroads per mile of double track is $157,196 and the average funded debt, $167,060, making an average total of $324,256 per mile of double track, including switches, turnouts and sidings.

The total cost of roads and equipments is given as $53,260,598, of which $5,493,271 is for equipments and $47,767,327 is for roadbed, superstructure, right of way, real estate, building, fixtures, etc. On these figures the average complete cost per mile of double track railroad is shown to be $312,820; and omitting the New York & Harlem Railroad Co.

The total number of passengers carried for the year was 226,650,615. This is an average *per diem* of 629,157 passengers. The average receipts from passengers *per diem* were over $31,000. Taking the population of New York at 1,800,000, each inhabitant rode on surface railroads 127 times during the year, and spent $6.35 for car fares on surface roads. The average number of passengers carried per mile of double track was 1,660,694; thus a road of five miles of double track on the average would carry over 8,000,000 passengers yearly.

The gross earnings from operations were $11,361,229. The operating expenses (excluding all taxes) were $8,048,085. The percentage of operating expenses to gross earnings from operations was 70.83 per cent. The operating expenses of one company were as low as 57 per cent., while another's reached 99 per cent.

The percentage of gross expenses, including cost of operation, payment of taxes, rent, interest, etc., to gross income from all sources (omitting the New York & Harlem Railroad Co.), was 88.34 per cent.

The average full cost of carrying a passenger was 4.42 cents, leaving but a little more than half a cent net profit on each passenger carried.

The income from all sources was $10,628,545. The deductions from gross income, being expenses of every nature, were $9,407,516. The net profits remaining were $1,221,029, applicable to dividends on capital stock. These last figures do not include the New York & Harlem Railroad Co., which being very heavily over-bonded did not, after paying operating expenses, earn the interest on its funded debt, but did declare a small dividend, although had this company been stocked and bonded at an average rate it would not only have paid the interest on its funded debt, but would have earned besides a handsome dividend on its capital stock. The average amount of dividends earned on capital stock (omitting the New York & Harlem Railroad Co.) was 6 per cent. The average of dividends declared was a little more than 5 per cent. on total amount of authorized capital stock.

The total number of employes, including officials (estimated in the case of one company) was 7,991. Total number of horses, 15,805; total number of cars, 2,420. This is an average of a little more than six horses to a car, while the average number of cars per mile of double track is seventeen. The number of accidents reported was 132, of which twenty were fatal. Of the twenty persons killed, ten were passengers.

In this connection a brief examination of the report of the Manhattan elevated roads also may prove interesting. The capital stock of the elevated roads authorized by law or charter amounts to $30,000,000. The amount of funded debt authorized is $40,000,000, a total of $70,000,000. The total of double track road, including all sidings, turnouts and branches is 45.05 miles. The total length of double track roads, exclusive of branches, turnouts, sidings and switches, is 37.07 miles. The average capital stock per mile of double track road is $809,280. The average funded debt authorized per mile of double track road is $1,079,040, making a total of $1,888,320. The gross earnings for the year from operation were $9,846,710; the operating expenses (excluding all taxes) were $4,975,141; the net earnings from operations were $4,871,569. The cost of operation was 50.53 per cent. of earnings. The number of passengers carried during the year was 196,714,199. This is a daily average of 538,943 passengers. The total number of accidents for the year was twenty-nine. There were but four passengers killed and one injured, which is a wonderfully good record. Of employes eighteen were injured and six killed. No railroad now built and operated has made a record that can be compared with that of the New York elevated railroad in this respect.

The elevated railroad tickets are exactly two inches in length. If the tickets sold in one day were stretched along the track they would reach from South Ferry to the terminus of the Third Avenue line and back again to South Ferry, as there are more than seventeen miles of elevated railroad tickets purchased every day by passengers and dropped in the chopping boxes.

World's Fair Notes.

The French steamship line, Havre to New York, has agreed to return free all exhibits which it brings to the Exposition at regular tariff rates.

The Canadian Pacific Railway will exhibit at the Fair a model passenger train, and also models of the fine ocean steamers in that company's service.

A bill protecting foreign exhibitors of patented articles from all possible prosecution for infringement has been passed by the Senate, and is pending and reported sure to pass in the House. The bill reads: "That no citizen of any country shall be held liable for the infringement of any patent granted by the United States or any trade mark registered in the United States where the act complained of is performed in connection with the exhibition of any article or thing at the World's Columbian Exposition at Chicago."

Bids for furnishing the generating apparatus for the electric power plant to be used at Jackson Park, have been opened. The Eddy Electric Manufacturing Co., of Connecticut, offered to furnish the 300 H. P. generating apparatus for the Transportation Building free of cost. The National Electric Manufacturing Co., of Eau Claire, Wis., offered to furnish the apparatus for this building for $2,500. The Mather Electric Co., of Manchester, Conn., bid on the Mines Building, and offered to furnish 600 H. P. for $2,450. The Thomson-Houston company's bid for furnishing all the apparatus aggregated $52,900.

THE Short Electric Railway Co., through their Seattle agents, Chas. H. Baker & Co., have secured the contract for line equipment and cars for the Third Street line in Seattle. There will be six St. Louis cars equipped with two 20 H. P. Short single reduction motors each, and the road will open in about ninety days. This line is the property of the Rainier Power & Railway Co.

THE Midland Electric Street Railway, which connects with the St. Louis & Suburban line, was put in operation last month.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
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Track Construction for Street Railways is constantly tending toward the standard established by steam railroads. This tendency is illustrated very strikingly in Milwaukee, where the belief that construction cannot be too good, has taken strong hold. A general view of the work which is being done on the comprehensive system in that city is presented in this issue.

A More Senseless Proposition can hardly be imagined than that embodied in a bill before Congress which empowers the District Commissioners to designate the number and headway of cars which shall be run on the various street railway lines of Washington at different hours. This is only a step towards a transfer of management of this most important industry from the hands of the owners, who by long experience are supposed to know best how to conduct the business in the best interest of the patrons as well as owners, to those of men inexperienced in the business, and who are already overburdened with other duties.

The Objectionable Features contained in the city ordinance granting a franchise to the Union Railway Co., of Providence, R. I., which, as we stated editorially in our last issue, prevented the sale of new bonds, has been removed or rather amended by the action of the legislature which extends the franchise for twenty years and makes such conditions as seem to be satisfactory both to the railroad company and city authorities. The provision in the franchise that the city, after ninety days' notice, may order up the rails in certain streets, is retained, but it is stipulated that the company shall be given another location as nearly similar in public convenience as possible whereon to use and operate their tracks.

Interesting Statistics relating to the operation of the street car and elevated lines in New York City will be found in another column. This matter has been compiled with great care from the last published reports of the Board of Railroad Commissioners of the state, and is in shape to be readily understood. It will serve as a standard by which persons interested in the operation of lines in other cities will be able to determine the relative economy with which their own lines are being operated, and will prove valuable matter to the student of industrial progress. One remarkable feature in connection with the operation of the elevated lines, which reflects great credit upon the management, is the very small number of accidents that have occurred. This fact is emphasized when the enormous number of passengers transported daily is considered, and, as an aid in comprehending this, it is stated that if the number of tickets (each being two inches long) which are sold daily were placed end to end they would extend over a line more than seventeen miles in length.

The World's Fair at Chicago will offer to the manufacturers of street railway apparatus and appliances an excellent opportunity to show their latest products to the many visitors interested in street railways who are certain to attend the Fair both from this country and abroad. To learn just what steps have been taken in the line of individual exhibits, we recently sent a letter to the principal manufacturers of street railway apparatus asking whether an exhibit would be made, and if not, the reasons for not doing so. The replies received show that a hearty interest in the Fair is being generally felt, and that many manufacturers have already secured space or have applied for it, while nearly all expect to have an exhibit. To those who have as yet made no arrangement for space, and who contemplate so doing, we would urge the desirability of early action. Applications for space may be addressed to Willard A. Smith, chief of the transportation exhibits. Geo. W. Pearson, president of the Metropolitan Railroad Co., Washington, is chairman of the World's Fair Committee, appointed by the American Street Railway Association.

The Operation of the Elevated Road in Chicago, which will begin the present month, will mark the date of a new era in transportation. While the line will ultimately reach the World's Fair grounds, only a four mile section of the road is to be operated at present. The elevated system will doubtless relieve to a certain extent the congested condition of affairs which has been heretofore referred to in these columns, but while the road parallels one of the cable lines on the South Side it is not thought it will seriously injure the business of the latter. That this is the general impression is indicated by the fact that the stock of the cable company has been rapidly rising in value for several months, and the advance is still in progress. At the same time investors seem to be confident of the success of the elevated company, for their stock reached par before the rolling equipment reached the city. This fact is considered almost without a precedent. As to the capacity of the road, the officers say the facilities are sufficient to transport 12,000 passengers an hour from the downtown terminus. The elevated structure is all that could be desired both in point of strength and in the matter of appearance; the rolling stock is of the very latest design, and the management includes men who have had extended experience in connection with elevated roads. The new enterprise will undoubtedly prove

successful financially, and will add immensely to the intramural transportation facilities of the city.

The Cable is Performing Splendid Service in Chicago where it is called upon to meet an extraordinary demand for transportation facilities. The city up to the present time has been obliged to depend wholly upon the cable systems for rapid transit, and while the companies have been unusually enterprising in their willingness to make improvements, they have been almost overwhelmed by the vast increase in local travel. The demand has been such that the several power stations in two divisions of the city have been furnishing power almost to the extreme limit of their capacity. Work is now in progress for doubling their engine capacity, and brief statements of the improvements are presented elsewhere in this issue. Chicago street railway men are, almost without exception, thorough believers in the cable. They believe it has been a mighty factor in building up the city and their statement would not be materially different from that of a writer of a magazine article, which appeared last month, who says in speaking of the development of transportation facilities in Chicago: "Horse car lines have been used for many years, but the phenomenal growth of Chicago dates from the changing of these lines to cable lines, some six or seven years since." In their opinion this system only is adequate to cope with the crowds which assail the cars in a business district which is extremely contracted. Still they do not deny that electricity may be employed to great advantage at points where the traffic is not so great; in fact, it seems to be the general opinion that when cable is introduced on all the main lines, and when electricity is installed on all subordinate lines, Chicago will be provided with as complete a system of rapid transit as can be furnished by surface cars.

A Sympathetic Strike, so called, forces home to the minds of all those engaged in the employment or management of labor the conviction that there is something radically wrong in the present "scheme of things." An ordinary strike, where it relates to a single industry, is serious enough even though it does not affect the public, but where a large body of men become suddenly arrayed against their employers, especially when the work on which they are engaged is of a public character, the consequences become disastrous and far reaching. A case in point is where thousands of pavers and granite handlers in New York, Brooklyn and other cities have quit work, not that they had any particular grievance, but merely because they sympathized with their fellow workmen the granite cutters and quarrymen of New England where a lockout had been ordered. The reason for the lockout was not one of wages but because the employers wished to substitute January 1 for May 1 as the time for arranging the scale of wages for the ensuing year because their contracts were usually closed before May 1, and it thus became necessary for them to determine the scale of wages as a basis on which to take contracts. The men objected to the change, claiming that work being peculiarly slack at the beginning of the year, the employers would be better able to dictate their own terms. What makes the matter especially serious is not that so many men are idle, but it is the stoppage of many public works, particularly that of street paving in New York, where a large number of streets are in the hands of the contractors, many of them being torn up, and paving blocks being stored along the curbs, much to the inconvenience of merchants and the operations of some of the street car lines. It would seem as if the time were ripe for some concerted general remedial action throughout the country to prevent, if not strikes, at least sympathizing strikes.

The Melbourne Method of raising money for building tramways, the plan on which the business is conducted and the financial results that have attended the operation of the cable lines in that city are worthy of the careful study of all parties who are interested in the vast rapid transit schemes with which the authorities of several of our largest cities are now wrestling. For this reason we give in another column an article which explains quite fully the relation between the Tramway Trust and the Tramway Co., together with the amount invested, and the income thus far secured. The Tramway Trust is composed of members selected from the councillors by the municipal corporations of Melbourne and the various suburban towns through which the lines pass. This trust borrowed money in London at 4½ per cent. with which to build the lines, and as soon as they were finished and fully equipped they were turned over to the Tramway Co., an association of business men which undertakes to operate the lines under a thirty years' lease. The capital of the Tramway Co. is represented by stock, and now amounts to $2,332,800, about half of it being what is termed watered stock, for which the original shareholders paid nothing. The first charges on the profits of the Tramway Co. from the operation of the lines is the interest paid to the Tramway Trust on the original borrowed money, and a sinking fund sufficient to pay off the entire amount at the end of the thirty years. The balance of the profits is available for dividends among the shareholders of the Tramway Co. At the expiration of the lease (thirty years) the entire system including the engine houses, real estate and equipments reverts to the Tramway Trust (virtually the corporations of Melbourne and surrounding towns) without cost. So profitable has been the operation of the system, which includes forty-three miles of double track cable lines and three miles horse lines, that the operating company is paying 20 per cent. per annum on the watered stock even, and one year on the old stock, before the amount was increased, it paid 72 per cent. The article shows that the cost of construction per mile of double track including the full equipment was $179,820. Not only is the system a profitable one to the moneyed investors, but so far as we can learn it is admirably managed and the lines are operated to the entire satisfaction of the traveling public.

The Advantage of Good Pavements in city streets, especially along the lines of street cars, is not as fully appreciated in this country as it is in the cities of Europe, although the necessity of good pavements is quite as great here as it is in most of the foreign cities. In some localities, however, our people are waking up to the importance of this subject, and have become convinced that it is economical to lay and maintain good pavements on city thoroughfares. Wherever a beginning has been made the evidence is conclusive that good pavements not only benefit those actively engaged in commercial pursuits and the abutting property owners by increased values and rents, but they have added largely to the general welfare

in the way of sanitation and public health. We say good pavements, for pavements so called are not a new thing in any of our large cities, but the result of inferior pavements has been a great tax on business men, a waste of labor and loss of time and wear of public vehicles. In contemplating improvements of this kind, however, careful study should be given to determine the character and quality of pavements which are best suited to the varying conditions of street traffic in order to secure the best results. Generally, for streets subject to very heavy traffic, stone block pavements laid on a concrete foundation and grouted with tar and gravel are the most durable, the material being granite, trap rock, or sandstone rated in the order stated. For streets where the traffic is less heavy, the same class of pavements, laid on a sand foundation and grouted with sand, may be employed, while on residential streets, where the traffic is comparatively light, asphalt, or vitrified brick pavements, are the best. Detailed methods of construction with the cost of different types of pavements, will be found in another column.

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In this connection considerable attention should be given to the relation which the car tracks bear to the street pavement of which they form a part, for when these are out of repair they are just so much defective pavement. Heretofore, when animal traction only was employed, it has been the custom in granting street railway franchises to require that the operating companies pave between and for a short distance just outside the tracks and keep the same in repair. Such a regulation was allowable under the old method of animal traction, cobble pavements and inferior track construction, because these portions were rapidly worn by the incessant tramping of the animals, but with the new methods and more substantial construction it is not a proper regulation, and should not be incorporated as a condition in a franchise. In order to secure good pavements the city authorities should construct and maintain the entire pavement outside and between the rails, and should keep full authority and absolute control over them, and should make all repairs whenever the pavement is necessarily disturbed by the operating company. Unless this is the case there will be more or less conflict between the companies and the public works department in any attempt to compel the former to conform their tracks to an established grade or to lay and maintain in and about their tracks pavements of as good quality as those laid by the city. In case a change in grade or in pavement is necessary, the city should bear the cost, but if it is thought desirable to require that the railway companies bear part of the expense, this is better collected in the way of a tax. It is not necessary in order to secure this desirable end that the city own and maintain the street railway tracks and lease them to the operating companies as is the custom abroad, but we think a regulation to this effect should be incorporated in every franchise where the line is to be mechanically operated, and if necessary a stipulation should be made in regard to employing a rail with good paving qualities. Not only do good pavements and a suitable rail benefit the public, but they are of advantage to the operating company as well, for if, owing to suitable construction, it is easy for vehicles to get in and out of the line of tracks, drivers of these vehicles will not attempt to hold the right of way and thus detain the cars, but will more readily turn out, thus giving more headway for the street cars.

The Vital Test will be given the plans of the New York Rapid Transit Commission when the franchise is offered for sale. If capitalists come forward and undertake the contract, then such a road as has been laid out by the Rapid Transit Commission will undoubtedly be built. Can the money be found to build and equip such a road, it being granted that it will cost several million dollars per mile? Manifestly not; hence from this point of view the labors of the commission must go for naught. The whole thing is a kind of farce that reminds one very much of the experience of a would be soldier who was very anxious to enlist during the war. He presented himself for examination before an army surgeon who, as he says, examined him interiorly and anteriorly, fore and aft, but the very thing for which he was rejected—for he was rejected—his eyes, the surgeon could have seen at first, were defective. We would not in any way reflect upon the commissioners, for their labors have been ably and conscientiously performed, and with a strict regard to the law as interpreted by the best legal talent, and were doubtless necessary to prove conclusively to the public (who are supposed to be adverse to the development of the elevated system) that the plans are *not feasible*. Some little time must yet elapse before a point is reached when all will know what can be done or until the programme of the commissioners is fully developed.

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The work already accomplished, as appears from their report, is about as follows: Having considered every possible plan, they were inclined to favor, first, an open air solid viaduct road, but this plan was abandoned owing to the excessive costs of right of way. The next choice was for an elevated system through the streets, but from fear of public clamor, and because Broadway below Thirty-fourth Street and certain other streets are especially exempted by law from such use, they did not dare to recommend this means of rapid transit. There then remained a choice between a deep tunnel road through the solid rock, and a shallow tunnel road as near to the surface of the street as practicable. A choice of the latter was finally made and for the main line a route up Broadway continuing up the Boulevard and more or less directly to the city limits on the west side was adopted. An east side line was also laid out, a part of which has since been exempted by an act of the legislature. The general plans were then submitted, as required by law, to the city authorities and by them approved in October last. In addition, the Rapid Transit Act required that the consents of a majority of the property owners along the whole line, and the amount of a majority in value of property bounding that portion of each particular street along which the proposed railway was to run, should be obtained. After making a complete canvass it was found that a consent of a majority of owners on each street could not be obtained. In case of such failure, however, the Act and Constitution allow of making application to the Supreme Court of the State for the appointment of three commissioners, who, after due hearing of all interested parties, shall decide whether the proposed road shall be constructed or not. This application was made and a commission composed of gentlemen of the highest standing was appointed. This commission is at present sitting and apparently is near the point of reaching a conclusion. Their report, which is to be made direct to the Supreme Court, will doubtless be favorable to the plans of the Rapid Transit Commission, and when confirmed by the court is

to be taken in lieu of the consents of the property owners. When such approval by the court is made, the Rapid Transit Commission may prepare more detailed plans for construction and operation, and seek capital for their consummation or offer the franchise for sale. The result, as indicated above, is already anticipated and the commissioners must either resign and a new commission be appointed or they must continue in office and lay out a complete, adequate and comprehensive elevated system with the present system as a basis. If the laws at present exempt any necessary portion of the routes required, then the laws must and will be changed. The demands are imperative, and a complete elevated system, as we have advocated from the start, must be undertaken and pushed with all speed to its final completion. As a beginning, additional facilities should be granted to the management of the present elevated railroads. Let them have the loop around Battery Park with or without price and sufficient room at City Hall Park. Allow them to lay a third track for express trains on their present structures. Allow or require them to widen the present stairways and give such other facilities as it is possible to give that would serve the convenience and comfort of the traveling public and would not be burdensome upon the company. We trust that it will take only a few months longer to convince everyone beyond question that nothing is left for adoption but an elevated railway system.

The Real Root of Mal-administration, such as we often see in anti-corporation legislative bills,is the tendency of legislators to vote in accordance with what they suppose to be popular prejudice against corporations, a prejudice founded upon the old superstition of corporations having no souls. On what this blind charge, or prejudice against corporations is founded, is not made manifest, for there are no facts, so far as we are able to learn, in its justification. Corporations, as a class, have just as much "soul" as any business firm, that is they have just as much consideration for their employes, which is the supposed interpretation of the idea of "a soul" in these cases. The issue of providing for the well being of employes is a strictly business matter, and the subject of feeling, is not necessarily allied with it. If a firm or corporation cannot see that its interests are more or less identified with its employes, and makes no provision for their suitable comfort, it is a mark of short sightedness rather than any want of consideration or soul. The best corporations are always prudent in such matters, and we have yet to learn that there is any worse management among corporations in the described particular than among any other forms of business organization. Therefore, if there is no further cause of animosity, the hostile legislative acts referred to are a gross injustice which ought to cease without unnecessary delay. Mr. G. Hilton Scribner in one of his papers before the American Street Railway Association clearly shows that no sooner is a corporation established, than it is stigmatized as a monopoly, and the state, instead of protecting its own acts in the franchise permitting the corporation to do business, through a majority of its legislators, restricts, hampers and unjustly obstructs the very acts which the state granted permission to do. Just as Mr. Scribner says, the state should either do one thing or the other, and not stultify itself by inconsistencies which are altogether outside of the most ordinary kinds of common justice. It is admitted that many of the adverse acts of legislators, acts which wholly antagonize preceding laws, are the work of the other party, which other party pretends to oppose everything not done by its party, on principle. This particular, undoubtedly, is one of the prime causes of many legislative absurdities ; and so serious has it become in the national as well as the state governments, that frequently the charge is justified that partisanship is of more consequence to the state than justice. Partyism may have its good uses, but certainly opposition to just acts, merely because those acts are the work of the other side, is not among them. It would seem an excellent plan for the legislature to appoint one individual at least, whose time should be devoted to the exposure in Congress, or the legislature, of all attempts to do what nullifies any preceding business of the assembly. Of course, we have no reference to amendments to laws, or any other regular work where improvement in government usages is possible. We allude to cases where the act or bill under consideration falsifies preceding acts, either in their spirit or their letter without the full knowledge of all members. If there should be such an individual or if some legislator took upon himself such a post, which might be likened to that of a legislative policeman, there would be plenty of business to be done. For it must be confessed that many anti-corporation bills pass through the legislature without any particular comprehension of the subject on the part of the legislative voters. This is due to the enormous amount of work required of the average legislator, in order that he may have a thorough comprehension of the questions up for debate ; in consequence many vote thoughtlessly, or because a friend votes that way, a matter which might be checked almost entirely, if a conscientious legislator, such as we described exposed any contradiction in the proposed legislation of the original act permitting a corporation to do business in a specified way. Consistency is lauded high enough, but its average application in legislative halls, yields sufficient food for wonderment to keep a student of political economy busy about all his life ; and we strongly suspect that this state of things is more due to ignorance, than any direct thought to stultify preceding conduct. But as matters rest, what is everybody's business is nobody's business, and those among the legislators who observe such contradictions, think, perhaps, that it is none of their "pic-nic," so allow the act to go on record unchallenged. A striking feature of this anti-corporation legislation is the sudden way in which many bills are passed through both Houses, as if a conspiracy was afoot ; or, that the supporters of the movement really feared to have too much attention drawn toward what they were doing. There are many cases where the outside public hardly hear the matter mentioned until it is in the hands of the governor for signature. Improper bills, for some unexplained reason, possess a remarkable amount of haste in procedure, and unless the legislator is constantly on his guard, he finds himself committed in support of a measure which he often confesses that he had not properly considered.

WHAT becomes of worn out street railway cables, is a question often asked. The most extensive use to which the old cables have been put is in the manufacture of wire nails. This is not done in this country, but the old cables are sent to China and Japan, where the wires are untwisted and the nails cut and formed by young boys and girls, who beat them out cold on little anvils with small hammers. Many of these wire nails are used in tea chests, and the old wire comes again to this country through this means.

Our New Book Ready.

"Street Railways (Trams): A Practical Handbook for the Use of Street Railway Men," will be ready July 1. We trust the book will contain all its title promises and more. It illustrates with about six hundred engravings the mechanical designs that are employed in this particular industry, as well as giving incidentally a great deal of historical matter, while it is to a large extent made up of the actual practice of the most successful street railway men and those of kindred industries, and thus becomes a safe guide to beginners and in fact to all who are in any way engaged in this most important field.

In its preparation the author has enlisted the service as co-workers of many of the most prominent engineers and practical men interested in the business in this and other lands, for which our hearty thanks are due. It is true in every industry, and especially in this, that the knowledge that is of most worth is that which relates to the practical experience of reliable men, whether their experience resulted in success or failure, and when we know the history of a device, or a method of construction and management, and the views of the men who employed them, and the circumstances under which their views were formed, we have a safe guide in planning for the desired end, without the expense of experimenting. Hence the the object of the work is helpful, for it is intended to assist inquiring minds towards a right understanding of the business in all its details, and in a right selection of the best appliances to be employed.

Instead of affixing in all cases a positive endorsement to certain devices and methods it has been thought better to furnish the inquirer with the means of doing so for himself by showing the origin of the design, how it is constructed, and how it has been employed. In like manner the different chapters have not been written with a view of advocating any particular system of traction, but rather with a view of leading to free inquiry, extended inspection and careful selection as the surest course for determining the system best suited under the conditions imposed.

The work covers every department of the entire street railway field, and the matter is presented in thirteen chapters with an appendix. The different chapters treat fully of electric, cable, horse and other surface roads, including those operated by steam and gas motors, also of incline planes, rack rail systems and elevated roads. The matter relating to electric railways explains in a simple manner the theory of electric phenonema so much as is necessary for any one to know in order to fully understand how this subtle fluid is harnessed and made to do mechanical service. One chapter is devoted to car building, which treats not only of methods of construction and decoration but also of car shops and gives particulars relating to some of the allied industries such as the manufacture of wheels and axles. Another chapter treats of track construction in all its details, particular attention being given to methods of paving. The other chapters, in their order, relate to discipline, with an elaborate code of rules for the guidance of conductors and drivers; franchises, with corporation laws relating to the same; accounts which explain the best method of classifying the operating expenses of a street railway line, giving valuable forms to serve as models for ruling the journal and cash book; auxiliary appliances, which is an illustrated chapter without matter, in which a large number of track and other appliances are presented; an appendix which contains matter relating to such electrical motors as have come into prominent service since the first chapter was prepared.

The price of the book will be $4.00, and it is designed for use not only by superintendents, managers and engineers, but also for the foremen and assistants of all the different departments; for such employes as may wish to perfect themselves for higher positions, and for the student of economic subjects.

WE are in receipt of an ornamental glass paper weight from the Reliable Manufacturing Co. of Boston. We find it a useful addition to our "kit" of tools.

St. Louis Notes.

The bill authorizing the Cass Avenue & Fair Grounds Railway, which includes the company of that name as well as the Northern Central and Union railways, to change its motive power from horses to electricity, was passed some time ago by the City Council. There were several amendments to the original bill, one of which requires the company to run all its cars from terminus to terminus, not allowing any special schedule for extension, and another compelling the lines to start the cars from their western terminus not later than 5.30 A. M. The bill met with opposition at first, but for some reason or other was suddenly passed, to the surprise of all. Reconstruction of the roadbed was commenced on May 16, more than five hundred men being employed to do the work. A large amount of grading will have to be done on part of the line. We were told by an official of the road that the Johnson girder rail would most likely be employed. 5,000 tons of seventy-eight pound girder rail will be required. The power house will be situated where the present Northern Central car sheds and stables are located, fronting on North Market Street, and running from Spring Avenue to Prairie Avenue. The electric system to be used has not yet been decided upon. The present intention is to make 1,000 H. P. the engine unit, and have each one of these drive two 500 H. P. generators. The company contemplate having the entire system finished in September of the present year. The estimated cost is $1,800,000.

The Lindell Railway Co. has had introduced into the City Council a bill for granting a franchise to the Compton Heights, Union Depot, & Merchants' Terminal Railway. This is the most important railroad bill now before the council. If the franchise is granted, as in all likelihood it will be, the Central Electric Railway, another newly organized company, will be headed off. The eastern terminus of the road is in the vicinity of two new railroad passenger stations and several freight depots, a most important district. The route makes a direct short cut to the southwestern part of the city, and, in consequence, a great deal of opposition is expected from the several competing lines which reach this territory indirectly. Almost all the travel to the new Union Depot from the business and residence districts will go by this line, as it is the most direct. The cost of building the road is placed at $700,000. Everything towards its equipment will be first class in all respects. The promoters agree to have the road finished east of Grand Avenue in eight months. As soon as Van Deventer Avenue is cut through, the line running on that street will connect with the new road, and thus make a continuous route from Tower Grove Park and the Fair Grounds. For many reasons the franchise cannot be granted without some deliberation on the part of the City Council.

Several months ago a bill was passed by the City Council empowering the St. Louis Railroad Co. to operate the St. Louis & Baden Railway, running to Baden, at the extreme northern limits of the city, and operate the road by electricity. It appears now that Capt. McCulloch refuses to accept the franchise, on account of certain provisions contained in it. If the arrangement were effected by the two railroad companies any one would be able to ride about twelve miles for five cents.

The Bellefontaine Railway began the operation of its cars by electricity on April 30. Until May 6, current was derived from a 350 H. P. Thomson-Houston multipolar generator at the plant of the Municipal Electric Light & Power Co., but the company's power station being now sufficiently completed, current is obtained therefrom. There is at present installed one 600 H. P. engine operating two "M. P. 250," four pole type, Thomson-Houston generators, of 275 H. P. each. The company has in operation about forty cars. Of these four are eight wheelers. Each car is equipped with two 15 H. P. Thomson-Houston S. R. G. motors.

A flywheel recently burst in the power station of the Union Depot Railway, doing considerable damage. Some of the machinery was disabled by the flying pieces, but,

fortunately, no one was hurt. The wheel was eight feet in diameter, and very heavy.

At first little confidence was shown in the electric road to run between St. Louis and Chicago. The scheme is said to be now assured, the surveys being finished, and the construction of the bridges and viaducts having commenced. The road will cross steam railways at twenty different points by means of bridges. The approaches to each bridge will be 1,000 ft. in length. All of the 246 highways crossing the road will each be provided with a viaduct, having an approach of 246 ft. The motor to be used is of a new design, brought out by Dr. Wellington Adams, the company's electrician, and will be placed on the axle of the driving wheels, each of which is to be six feet and a half in diameter. The speed will not be controlled by means of the ordinary switch used on street railways, but by means of a new device, the invention of Dr. Adams, and the details of which he would not divulge. Terminals have been secured in both St. Louis and Chicago. The route between the two cities is only 248 miles long, thirty-six miles less than the shortest steam road. There will be no curves, and no grades except at steam railway crossings. Otherwise the road will be level. The contracts for the grading and track laying will be let shortly. It is expected to have the road finished in time for the World's Fair. S. L.

Washington Notes.

Among the bills relating to the operation of street cars in the District of Columbia which are at present before Congress, having passed the House, is one which prohibits the use of one horse cars within the limits of the city of Washington after January 1, 1893. The bill provides that after the above date all cars, if drawn by horse power, must be of the style known as two-horse cars, and each car shall be in the care of a conductor who shall not act as driver, and the penalty for violating the provision is fixed at $25 per day per car. In connection with this bill an amendment was adopted allowing street railway companies to equip such portions of their lines as were outside the city limits with the trolley system.

A second bill requires that all street railway companies operating in the District of Columbia must file with the Commissioners of the District a schedule to be approved of by the Commissioners, according to which the cars of each company shall be operated, which shall show the number and character of the cars in use, the kind of power used for their operation, the number of trips per day for each car and the length of time between the cars at each hour of the day or night when such cars are being run. The District Commissioners are anthorized to revise and alter the requirements fixed in the schedule whenever, in their judgment, the reasonable demands of the public service may require it. The Commissioners are to satisfy themselves that the number and quality of cars provided, and the time on which they are to be run, as well as the management of the same when being run, gives ample and proper accommodation to the patrons of the road. As a penalty for violating this act which is to take effect thirty days after its passage, the company are subject to a fine of $100 per day for every day the violation continues. In considering the measure the House rejected a "no seat no fare" amendment that was offered, and also an amendment requiring the street railway companies to provide shelter for the "tow boys" at the different hill stations.

The Washington & Georgetown Railroad Co. have recently paid to the District Commissioners a check of over $61,000 in settlement of an old judgment against the railroad company, which was gained by the District in 1884. In the same connection a claim of $200,000 was made against the Metropolitan Railway Co., and they were given eighteen months to settle.

These claims, which are now nearly twenty years old, were for the payment of work done by the Board of Public Works on the streets along which the lines of the railroad companies operate. The companies contested the claims before all the lower courts, and finally the case was tried by the Supreme Court of the United States, which rendered a decision in favor of the companies, but in face of this Congress attached a provision to the general deficiency bill in the last days of the last session requiring the companies to pay the same with interest. In considering the question no opportunity was given the companies to be heard. The above bills show that the position of a street railway company in the District of Columbia, subject to the erratic action of Congress, is not an enviable one.

The Lynn & Boston Electric Equipment.

In the summer of 1888, before the West End Street Railway Co., of Boston, had decided upon the adoption of electric power upon their system, the Lynn & Boston Railway Co. were experimenting with electric motors for surface railway use, and had a car in operation on the Crescent Beach branch of their system. This was the first Thomson-Houston street car ever put into regular commercial service, and to the officials of the railway company belongs the credit of thus early recognizing the advantages of electricity for street car propulsion.

In spite of this early use of electric power the Lynn & Boston Railway Co., have only recently decided upon its adoption upon their complete system. Work is now being rapidly pushed upon all parts of the equipment, and the company hope to have in operation by September of this year their main line which extends between Boston and Lynn by the way of the old Salem turnpike. The company have in all about sixty miles of track, embracing a comparatively large section of country from Boston east to Marblehead and Peabody, including the cities of Lynn and Chelsea, and smaller places.

Two power stations are being built, each of which will have an ultimate capacity of 5,000 H. P., one being in Lynn on the Martin Wharf property, Washington Street, and the other in Chelsea at Pratt's Wharf. The stations, which were designed by L. H. McIntire, consulting engineer of the road, will be practically identical in exterior appearance and internal arrangement. Being on tide water, the facilities for receipt of fuel are the best, and salt water will be used for condensing purposes. The stations will be of brick with granite trimmings, buttressed walls and monitor roof. The engine room of each is 150 x 68 ft., occupying the front of the building. The engines are four in number at each station, from the works of the Watts-Campbell Co., of Newark, N. J. The boilers will be supplied by the Babcock & Wilcox Co., and will be of 1,500 H. P., aggregate capacity, in three batteries of 500 H. P. each for each station. The condensers will be furnished by the Watts-Campbell Co., the pumps by the Deane Co. of Holyoke, and the engines for operating the condenser by C. & G. Cooper & Co, of Mount Vernon, O. The piston rod packing for all engines will be furnished by the Tripp Manufacturing Co., of Boston.

The generators will be of the Thomson-Houston four pole type and will have a capacity of 300,000 watts. They will be belted directly to the engines by thirty-six inch belts.

The cars will be of the sixteen foot type and will be built by the Lynn & Boston Railway Co. themselves. Each of the motor cars will be equipped with two Thomson-Houston waterproof, fifteen H. P. motors. For track construction the company are employing seventy pound girder rail The overhead construction has now been almost completed on the main line between Lynn and Boston. For the greater part of this distance wooden poles supplied by Geo. McQueston & Co. of Boston have been employed. Within the city limits of Lynn iron poles have been used to a large extent. At the Boston terminus of the line the company will run over the West End Street Railway Co.'s tracks and will use their power.

The company anticipate a large increase in traffic with the change of motive power, and will probably do considerable business in the transportation of light freight in addition to their passenger traffic. They are satisfied that they can carry light freight not only more quickly and promptly than by the present methods, but also at a cheaper rate.

Views in the Works of the Lewis & Fowler Manufacturing Co.

In this country of over 60,000,000 of inhabitants the percentage who have never ridden on or seen a street car must be almost insignificant. To many, the street car furnishes the regular means of transit between their places of business and their homes, yet, how few among this number—how few even among street railway men themselves—realize the amount of designing and detail work, and the number of operations through which each piece must be put before the entire car is finally completed.

As undoubtedly many of our readers have probably never visited the interior of every department of a car factory, the following description of the extensive works of the Lewis & Fowler Manufacturing Co., of Brooklyn, will not be without interest.

Like many other important enterprises, this company began business in a modest way, Mr. Daniel F. Lewis and Mr. John W. Fowler, who had both long been connected with the Brooklyn City Railroad Co., being the promoters. The business grew so rapidly, that it soon became evident that it required the undivided time and attention of either one or the other, and changing from a firm to a corporation the important office of president fell to Mr. Fowler. This gentleman resigning from the employ of the Brooklyn City Railroad Co., assumed the entire management of the business, and to his practical experience and energy is largely due the success attained by the company.

The company's first shop, after their incorporation in 1883, was a small building at No. 8 Columbia Heights, and their total force of employes numbered but fifteen men. The present works are located on Walworth Street, Brooklyn, between Park and Flushing Avenues, and extend through two blocks to Nostrand Avenue, covering in all thirty-six city lots of 25 x 100 ft.

Commencing at the Walworth Street end of the works is a substantial brick structure about 50 x 125 ft. and four stories in height. In this building are the offices, machine shop, register and brass finishing departments, stove department and buffing room.

The machine shop, part of which is shown in Fig. 1, occupies a large, well lighted room on the ground floor,

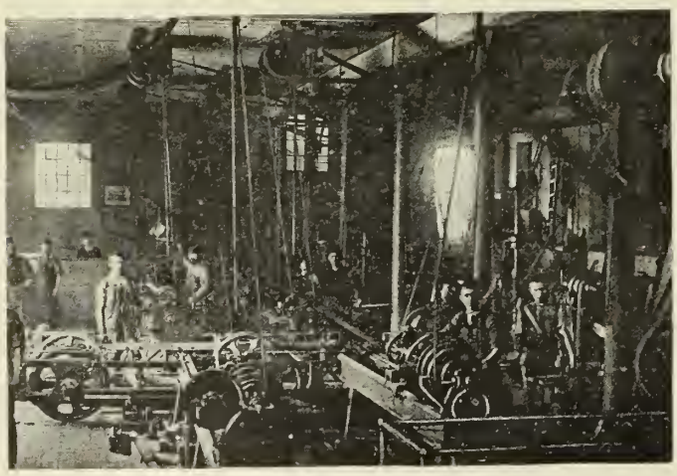


FIG. 1.—MACHINE SHOP.

measuring 50 x 125 ft. In this department are lathes, planers, drills, etc., of the latest type which are used in finishing every class of iron work used in street car construction. There is also a large hydraulic wheel press of 150 tons pressure capacity. At one end of the room is a 75 H. P. Buckeye engine which furnishes power for the entire building. Friction clutches are provided, by means of which each department may be operated separately.

On the floor above are the well lighted and attractive offices of the company, the president and secretary being provided with private rooms. On this floor is also the draughting room.

From the offices we ascend to the floor above where are located the register and brass finishing departments, shown in Fig. 2. This room is 125 x 50 ft., and is provided with numerous windows which afford plenty of light for the delicate work necessary in the manufacture of fare registers. On the opposite side of the room is the brass finishing department. This department is thoroughly equipped with the machinery necessary for finishing the ornamental brass work used in trimming cars.

The stove department, illustrated in Fig. 3, occupies



FIG. 2.—REGISTER AND BRASS FINISHING DEPARTMENT.

one large room on the fourth floor, measuring about about 75 x 50 ft. This room is used entirely for the manufacture of street car heaters. On the same floor is the buffing room measuring about 50 x 50 ft.

At the rear of the building, and adjoining the machine shops is a building one story in height and about fifty feet wide, which extends through to Sanford St. Here are located the blacksmith shop, boiler room and brass foundries.

Fig. 4, gives a fair idea of the arrangement of the blacksmith shop. As will be seen, there are two rows of forges extending the entire length of the shop, with ample room between for handling the work. In this shop are also steam hammers and power machines for bending and straightening girder rails. Adjoining the blacksmith shop on the left is the boiler room. The boiler equipment consists of two horizontal tubular boilers of 125 H. P. capacity each, built by the Logan Iron Works. These boilers also furnish steam power for the wood-working shops which will be described later.

The iron foundry, which is at the rear of the blacksmith shop, occupies a space 125 x 40 ft., and is perfectly equipped with cranes for convenience in handling the material. The foundry is at present running about six tons per day.

Next comes the brass foundry, 40 x 15 ft. Here are cast all the hand rails, brake handles, register trimmings and ornamental work for interior car trimming. Only the best quality of English block tin, Lake copper and spelter are used. These last named departments are well lighted by large skylights, extending the entire length of the building.

On the opposite side of Sanford street is a building two stories in height, 100 x 200 ft., extending through to Nostrand Avenue. In this building are all of the wood-working departments excepting the pattern shops. Power is furnished for the different departments by one 75 H. P. Buckeye engine which is located in the Sanford Street end of the building. The remainder of the ground floor is occupied by the mill and erecting shop.

The mill, which is shown in Fig. 5, measures about 100 x 50 ft., and is equipped with an almost endless variety of wood working machinery of the most improved patterns. Next comes the erecting shop, occupying 200 x 50 ft., a small part of which is shown in Fig. 6. Numerous tracks and one large elevator are provided for quickly and conveniently moving car bodies to any part of the building. The company are at present building some very handsome large open cars for the Brooklyn City Railroad Co., to be used on their Fort Hamilton line.

On the second floor are the cabinet and paint shops,



FIG. 3.—STOVE DEPARTMENT.



FIG. 4.—BLACKSMITH SHOP.

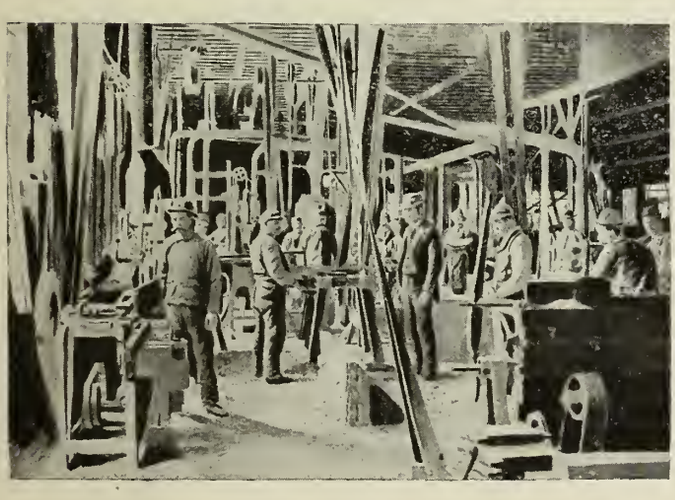


FIG. 5.—MILL.



FIG. 6.—ERECTING SHOP.



FIG. 7.—CABINET SHOP—SASHES AND DOORS.



FIG. 8.—CABINET SHOP—WOOD CARVING.



FIG. 9.—CABINET SHOP—FARE BOXES.

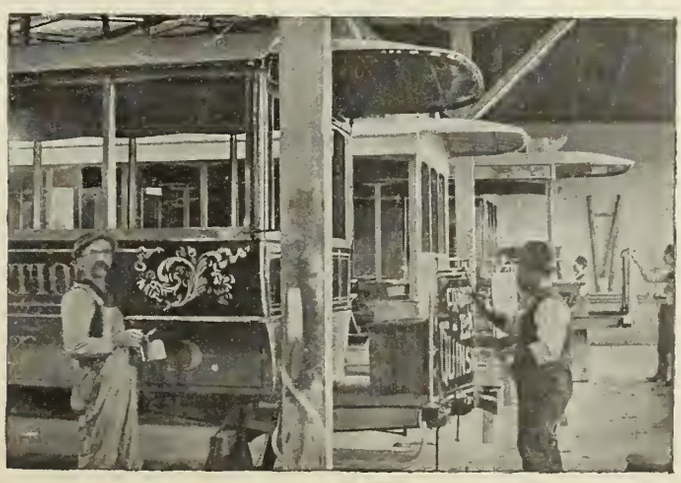


FIG. 10.—PAINT SHOP.

the varnishing room and the upholstery department. The cabinet shop, which is shown in Figs. 7, 8 and 9, is 100 x 100 ft. In this department the very important subject of light was carefully considered. As shown in the illustrations large windows are provided on three sides of the room. In addition to these are large skylights extending the total length of the building. In this department the wooden frames of fare boxes are made and all the delicate joinery work required in the making of sashes, doors and the handsome interior paneling is performed.



FIG. 11.—VARNISHING ROOM.

In the Nostrand Avenue end of the building are located the paint shops and varnish rooms. The paint shop is partly shown in Fig 10. The cut, however, gives a very imperfect idea of the size of the department, which is 75 x 100 ft., with ample room for twenty-five cars. The room is very well lighted and is equipped with all the necessary appliances for quickly shifting the cars to any desired position. In one part of the shop is a large cabinet completely filled with elegant designs for interior and exterior decoration. Partitioned off from this main shop is a room used for mixing colors. Here all the delicate tints used in decorating the cars are prepared.

Adjoining the paint shop is the varnish room, Fig. 11, occupying 25 x 75 ft. In this department the sashes, doors, fare boxes and the hand painted panels which are used for interior decoration receive their final finish.

Mention has now been made of all of the different departments in the main building. In addition, there are two buildings on Sanford Street, 25 x 100 ft., and 50 x 200 ft., used for storehouse and lumber shed purposes, and the pattern shop 50 x 50 ft., which is situated on Walworth Street, opposite the main office building.

The employes of the company number about 350 and the officers are John W. Fowler, president. Daniel F. Lewis, treasurer, and A. H. Dollard, secretary.

The Baltimore Belt Line.

The Belt Line tunnel, which has recently been constructed under the city of Baltimore to provide better terminal facilities in that city for the Baltimore & Ohio Railroad, is 6,000 ft. long. The idea of operating trains through this tunnel by electric locomotives, to obviate the unpleasantness of burning coal in the tunnel, was presented to the Baltimore & Ohio Railroad Co., the lessees of the tunnel, with the result that they have recently closed with the Thomson-Houston Electric Co. for three eighty ton electric locomotives for this purpose. It is believed that these locomotives will have power enough to push a 1,200 ton freight train, including the locomotive, through the tunnel from the south end up a grade of one per cent. at the rate of fifteen miles per hour, and a 500 ton passenger train, including locomotive, through the tunnel at the rate of thirty miles per hour. The locomotives will, of course, be operated from a central station, but the devices and line service will necessarily have to be of special construction.

A Die Slotter.

The die slotter shown in Fig. 1 is claimed to combine in an eminent degree the special features desired in a tool of this kind. The two cross motions and the rotary table provide for following any outline, and the arrangement of handles is convenient and avoids mistaking one for the other. The handle for the rotary table has provision for using dials for dividing purposes, which is convenient for such work as that shown in Fig. 4. For small numbers of divisions and for rapid work the worm shaft can be pulled right out, and a lock pin arrangement used for indexing the table, the handle for which is shown at the left hand side. The handle for raising and lowering the knee is conveniently placed on the side of the knee (not shown in the cut). The stroke of the machine, after due consideration, has been fixed at two and a half inches, which is more than sufficient for the class of work intended, and affords a more solid arrangement than the usual adjustable pin.

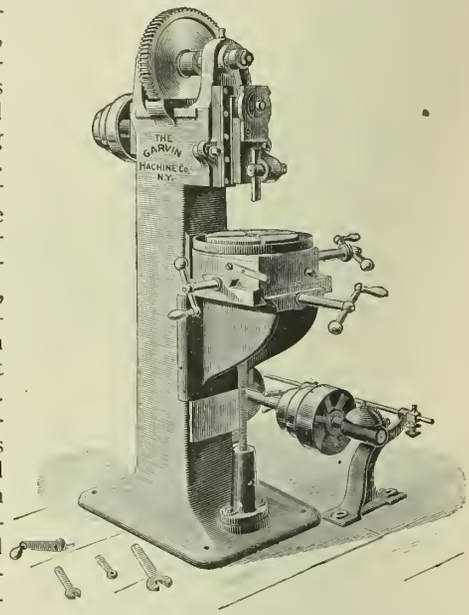


FIG. 1.

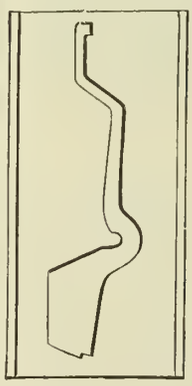


FIG. 2

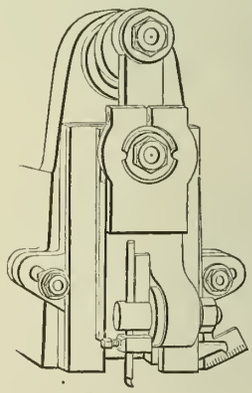


FIG. 3.

The tool block is well adapted to hold special tools, such as the one shown in Fig. 1, made of Stubb's steel, clamped in a holder. The tool is cleared on the return stroke by an ingenious arrangement, shown more clearly in Fig. 3. The tool block swivels on a centre near the lower edge; and at the upper end, carried in a yoke, are two hardened plugs which bear on a cam, which is bushed in to the lower end of the connecting rod, and derives a partial rotary movement from the action of the rod, and by this motion locks the tool block. As an instance of what can be done on the machine, a typewriter key of form shown in Fig. 2, ten inches long and three-sixteenths of an inch wide at the narrowest part, was machine finished in six hours. A die for armature rings, five inches in diameter, with thirty-six notches, one-eighth of an inch wide. a quarter of an inch deep, such as shown in Fig. 4, was done in two hours. The makers are the Garvin Machine Co., New York.

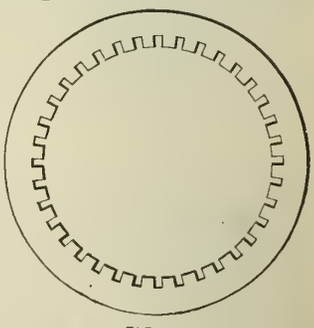


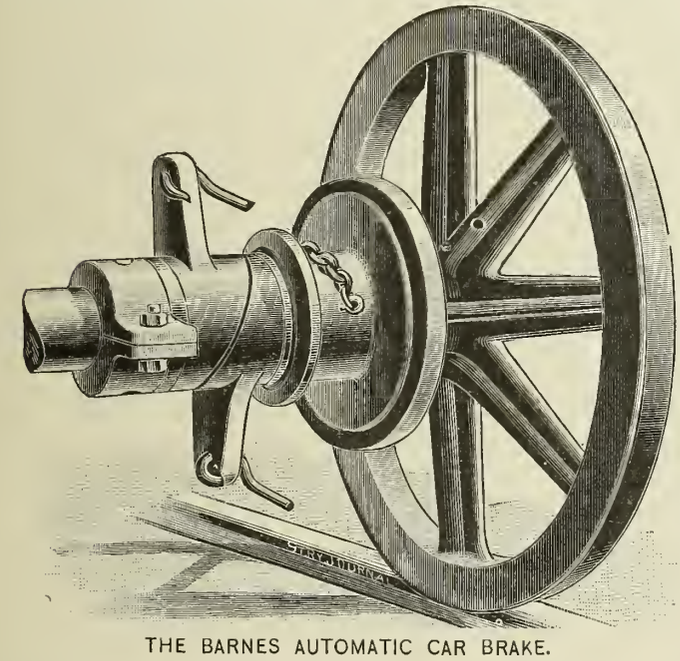
FIG. 4.

J. S. HOLLENBECK, of Chicago, and others, have received a franchise for an electric railway in South Austin, Tex.

The Barnes Automatic Car Brake.

Reference was made in our last issue to a new car brake which has been installed on the cars of the Brooklyn (N. Y.) Heights Cable Railway Co. These cars operate on a 9½ per cent. grade, so that the conditions to which a brake on this line is subjected are most severe. Nevertheless cars have been stopped by it in a length of eight feet while descending the grade at a speed of eight miles per hour. The brake is equally adapted to cable and electric roads.

On one axle are two friction plates separated from each other by a leather washer, one plate being keyed to the axle, the other mounted loosely upon it and carrying a drum for winding up a chain which sets the brake shoes. Also mounted on the axle is a collar attached rigidly to the axle, and between this and the drum is a pair of cams, or circular wedges, loose on the axle, and separated from both collar and drum by split brass rings. Each cam is provided with a short lever to which are run two rods, operated by the platform lever or brake handle, so that the cams can be spread by a movement of the latter. The operation of the brake is then easily understood. The spreading of the cams forces the drum plate against the leather washer and friction disc keyed to the shaft, and



THE BARNES AUTOMATIC CAR BRAKE.

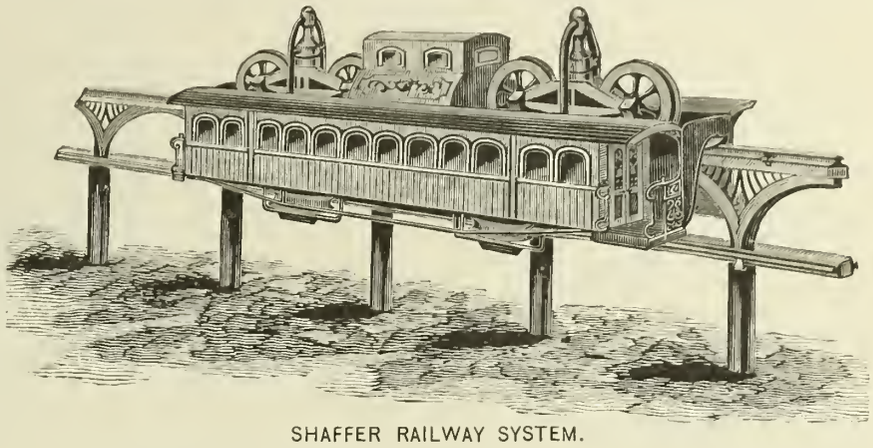
the wheel being in motion takes the drum around with it and winds the chain, pulling the brake levers and setting the brakes.

To reduce the friction between the drum and axle when the brake is not in use, brass bushings are used with felt linings in the centre. These linings are kept saturated with oil, and this arrangement has been found to work very successfully. The entire weight of the attachment is less than 200 lbs., it can be adapted to electric cars so as to take up a space of less than eight inches on the axle, and its parts are so simple that they can be readily understood and cared for by an ordinary mechanic. The only part to wear is the leather washer, and this it is claimed by the manufacturers of the brake, The Barnes Brake Co., of Cleveland, O., will last at least six months and can then be replaced at a small cost. By a very simple arrangement the driver or motorman of the first car of a train can operate the brakes on one or two trailers equipped with this device.

AN incline cable railway is proposed between Meadowville, N. Y., and a summer resort on the Heilderberg Mountains.

An Elevated Railway System.

The Shaffer single column railway system, illustrated in the accompanying engraving, was designed with the idea of constructing an elevated structure which would



SHAFFER RAILWAY SYSTEM.

occupy but little ground space. The posts, or supporting pillars, are connected near the top by a substantial framework surmounted by a top plate which sustains the single rail. On each side of the posts is located a girder rail, the bearing surface of which is at right angles to the face of the top rail.

As will be seen by the illustration, the car is in two main compartments, suspended on either side of the upper rail. These two main compartments are connected by a cupola which forms a third small compartment.

For passengers the car has one row of double seats next the windows, and the aisle or passage way is next to the inner wall. This aisle, in each main compartment, is connected with the cupola by a short stairway on either side, thus giving free access to all parts of the car.

The weight of the car is carried by two trucks, of two wheels each, as shown in the illustration. These main carrying wheels are double flanged, the space between the flanges being a trifle wider than the face of the rail, to allow for rounding curves. These trucks are provided with regular journal boxes, oil cups and springs.

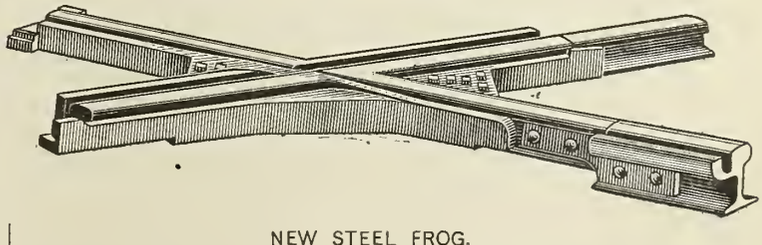
The trucks are surmounted with a pivoted turret which allows all side motion necessary in rounding any ordinary curve, and over and through these turrets heavy wrought steel arms are suspended, and to these arms the car is firmly attached and suspended.

Underneath the car, on each side, are two guide wheels, which stand at a right angle with the upper wheel and run upon the two lower or guide rails, to steady the side motion of the car. These guide wheels press firmly upon their respective rails, but are provided with short, strong springs in their boxes, so as to allow them to yield slightly in rounding the curves.

The inventor of the system, William T. Shaffer, of Evanston, Wyo., states that while steam may be applied as motive power, he regards electricity as best adapted to the purpose.

New Steel Frog.

The accompanying illustration shows a new steel frog made for regular diamond or side turnouts as well



NEW STEEL FROG.

as for special locations, manufactured by Barbour, Stockwell & Co., of Cambridgeport, Mass.

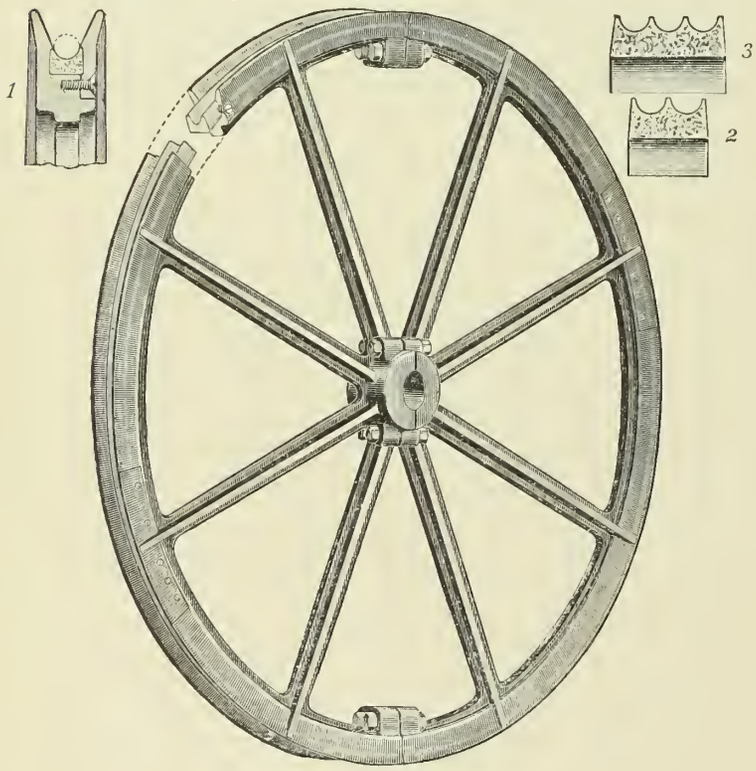
The frog is made from any seetion of girder, T or tram rail and cast into a bed plate of gun metal, as shown in

cut. The rails are punched at short intervals and the gun metal flows through from side to side, uniting the two metals, and holding the rails rigidly in place. The ends of the rail project to receive the fish plates, which connect the frog with the track, giving a continuous steel rail to receive the wear of the wheels, and having no bolts to work loose.

A New Cable Sheave.

In the accompanying engraving is shown a new cable sheave which has recently been brought out by Wm. F. Buswell, of San Francisco. The object of the invention is mainly to avoid wear on the main parts of the sheaves by making the parts subject to wear changeable, and also to obviate that wear on the cables which occurs when they bear on soft iron which retains sand or grit. The inventor informs us that with carefully made patterns the hard segments made of chilled cast iron, steel, or other similar material can be inserted in a very complete manner in the rim of a sheave and that when filled and closed by the side plates are safe from accident.

In the engraving 1 is a section of the rim for a single rope, 2 and 3 show sections of the inserted sections for a number of ropes or wraps, the construction of the sheave



A NEW CABLE SHEAVE.

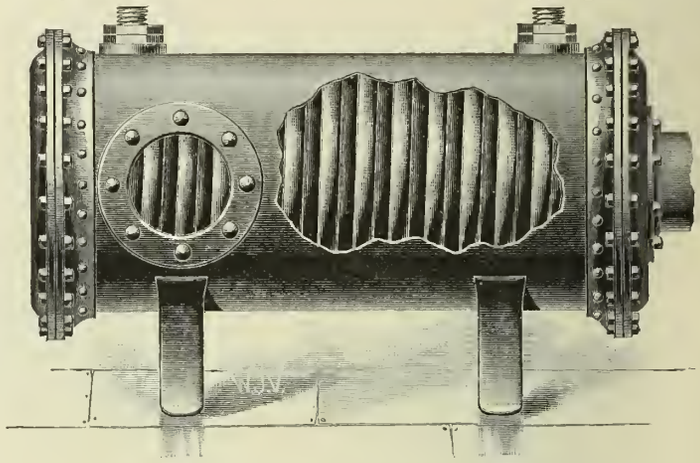
being, otherwise, the same as for a single rope. These hard sections can be removed or replaced while the wheel is in position and without removing the ropes, by taking off the side plates which are a little longer than the inserted sections.

AN interesting test of the relative resistance of a new trolley wire joint and the same length of straight wire was recently made in Boston. The wire in both cases was copper, eight inches long and No. 0000 B. & S. The joint was made in the usual way with three or four turns at each end, about two and a half inches between, and the whole thoroughly soldered. The test showed about 10 per cent. less resistance in the jointed than in the straight wire.

A LADY on entering an electric car observed that an iron bolt projected slightly above the floor, and remarked to the conductor: "I suppose if I were to put my foot on that bolt I would receive a shock." To which that official scientifically replied: "Not unless you put the other foot on the trolley wire; fare, please."

A Horizontal Feed Water Heater.

A horizontal feed water heater, which can be successfully and economically used with condensing engines, and

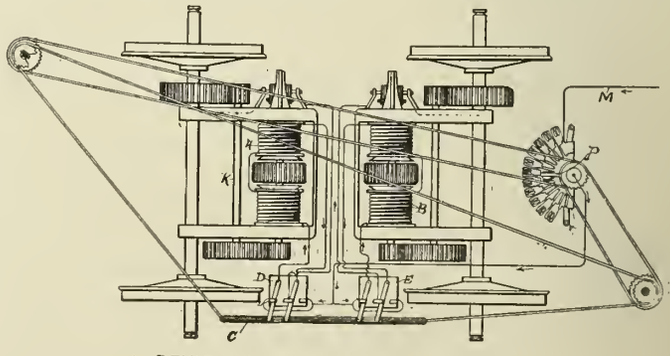


A HORIZONTAL FEED WATER HEATER.

is already in use in a large number of such plants, has been recently brought out by the National Pipe Bending Co., of New Haven, Conn., manufacturers of the National feed water heater. The exhaust can be arranged to enter at the ends of the heater, or through the side as may be desired, and this point is quite valuable in places where there is but little room for a heater. In many electric stations the heater is placed under the engine room floor and hung from the floor joists, and the ease with which the National heater can be placed in small spaces between engine and condenser makes it much sought after and used. We present a view of the appliance.

A Device for Braking Electric Cars.

A method of stopping or braking electric cars, by means of connecting the motors in a local circuit and causing one motor to act as a generator, has recently been patented by Prof. Sidney H. Short, of Cleveland, O. As will be seen from the accompanying engraving, which gives a diagram of the connections used by Professor Short, the motors are provided with a circuit breaker and a double reversing switch, or a pair of double connected reversing switches, so arranged that the supply circuit is shut off when the reversing switches are operated. The switch levers are mechanically connected by the insulator arm, C, so that they can be moved together. In the engraving the connections are as they would be when the car is in operation and the motors are drawing their supply from the main circuit through the wire, M, and the switching arm of the rheostat is upon a middle block. The current then passes through the rheostat in the direction of the arrows, separating just before it comes to the reversing switches which are indicated by D and E. The part of the current which passes to the right first goes



A DEVICE FOR BRAKING ELECTRIC CARS.

through the field magnets of the motor, B, then returning to the reversing switch passes through the armature to the car axle where it is grounded. As the motors are connected in parallel, the current through motor, A, takes a similar course. The switching arm, P, of the rheostat

can be operated from either end of the car by means of gear wheels and sprocket chains as shown.

To stop the car, the motorman turns his regulator handle until the arm, P, has traveled over all the contacts and finally breaks the main supply circuit. Without shifting his position the motorman also reverses the contacts of the motors by means of a movement of the arm, C. Then, by tracing out the connections, it will be seen that the motors are in a local circuit. In this local circuit, when it is first formed, the two motors now being revolved by the momentum of the car generate opposing electro-motive forces, depending in amount upon the residual magnetism in the field magnets of each. One of these electro-motive forces, being naturally the stronger, owing to the usual, if not inevitable, difference of residual magnetism in the two machines, even when the motors are made like each other, as customary, prevails over the other and establishes its current in the local circuit. Assuming that the machine, B, becomes the stronger generator, the current will flow in the local circuit through the field magnets of B in the same direction as before, owing to the change in terminal connections, increasing B's field magnetism and consequently its electro-motive force, at the same time decreasing the field magnetism, and consequently the counter electro-motive force of the motor, A. As this counter electro-motive force decreases, the current from B rapidly augments and reverses the polarity of the field of the motor, A. As soon as the polarity of the field motor, A, is reversed the current from generator, B, tends to revolve the armature of motor, A, backwards and stop the car. Thus the car is stopped by the resistance caused by motor, B, acting as a generator in conjunction with the reversal of the motor, A, under the influence of the current from the generator. As the movement of the car ceases, the current from generator, B, ceases also, and if the car is on a down grade it will creep slowly down the grade.

If the machine, A, acting as a generator, should be of greater electro-motive force than the machine, B, the effect will be the same.

In order to propel the car in the opposite direction the current can be admitted again through the rheostat while the switches are reversed.

Railway Power House at Grand Rapids.

The system of the Consolidated Street Railway Co., of Grand Rapids, Mich., is one of special interest to street railway men, and it has attracted no little attention, for the reason that the present management on assuming control discarded the cable and substituted electric motors. The company believed thoroughly in electric power, and last month the single road operated by horses became an electric line. The city of 80,000 residents is admirably supplied with transit facilities by the fifty-two miles of lines within the corporation limits.

It should, perhaps, be stated by way of preface that the cable was abandoned by the management not because they were prejudiced against it as a means of propelling street cars; but because they considered it ill-adapted to the conditions existing in Grand Rapids. It did not pay, for example, to maintain by cable a ten minute service on a line on which seven cars were operated; the expenditure of power was too great. Since the introduction of electricity on the lines formerly operated by cable the cost of operation has been greatly reduced; just how great the reduction has been the management is not willing to state. It may be remarked, however, that one pair of engines formerly used for cable service is now able to carry the ordinary load on the entire power station.

Sixty-one Edison motor cars, seven of which are of fifty H. P. and ten motors of thirty H. P., made by the Detroit Electrical Works, are operated by the company.

The motors are giving entire satisfaction in spite of the fact that they are subjected to severe service. There is one grade of 9.1 per cent. covering a distance of 1,200 ft., and on a second line a grade of 8 per cent. is encountered. The lines on which these grades are found were formerly operated by the cable, and as two brakes are necessary as a matter of precaution the company have adopted a slot brake. This consists of a heavy chilled steel shoe which is forced into the slot by wheels located on both the front and rear platforms, so that it can be applied by both the motorman and conductor. So effective is the brake that the car can be fairly lifted by means of it from the track.

The company believes in laying good track. Johnson girder rails, weighing sixty-six and one-half pounds, and seventy-eight pounds are used. The latter are spiked directly to the ties.

The power station of the company, located near the centre of the system, is a very complete plant and it contains features of unusual interest. Steam is generated in boilers of an aggregate capacity of 1,550 H. P., as follows: 4 Babcock & Wilcox, each of 200 H. P., one marine, constructed by the Lansing Iron Works, of 300 H. P., and 3 double-decked, internally fired boilers built by the Lansing Iron Works, of 150 H. P. each.

The engines are arranged in two pairs. The first pair is Hamilton Corliss, 24 x 60, making 60 revolutions. The aggregate weight of the flywheels and driving wheels is 80 tons, which is sufficient to balance any variations in the load. This pair of engines is rated at 800 H. P. but is capable of developing 1,000 H. P. The engines have independent condensers.

The other pair of engines was made by the Wheelock Engine Co., of Worcester, Mass. They are 24 x 48, making 80 revolutions, and are rated at 800 H. P. At present they are operated non-condensing.

The transmission from engine to countershaft is effected by rope transmission, and here is found a particularly interesting feature of the plant. The Wheelock engines were formerly used for cable work in a different power station, but were removed to the present location when the change in power was decided upon. When power was transmitted to the cable there were two sheaves employed, one 5 ft. in diameter with 5 ft. face attached to the engine shaft and the other 15 ft. in diameter with 5 ft. face. Both sheaves are cut with twenty grooves, each designed for a two inch independent rope.

When it became necessary to drive generators, and use the same sheaves, it was necessary, in order to secure the desired speed, to reverse their position, putting the fifteen foot pulley on the engine shaft. A difficulty was at once encountered, resulting from the fluctuating character of the load. One or two ropes would tend to carry all the load while the others were doing comparatively little. To hold the ropes down to this work, therefore, it was found necessary to use an idler, by the introduction of which almost all difficulty has been removed. When a new rope is put on, no matter how tightly under the idler, it will stretch a foot in a few hours, and it is found that there is ultimately a stretch of four feet in the entire loop. The rope cannot be cut and respliced at the same point, for at the juncture there is so much chafing that the ends cannot be spliced. The rope cannot be cut in a new place and joined, for while there is four feet of stretch it requires twelve feet for the splice. This difficulty has been so pronounced that the management has decided to try the American system of rope drive, in which a continuous rope is employed on the pair of Hamilton-Corliss engines. The pinion for transmitting the power in this case is five feet in diameter, and the ropes lead over a sheave twenty feet in diameter, each having twenty-two rope grooves. The single ropes previously used will be utilized for filling the places of those on the other pair of sheaves, as they wear out. As the American and English systems of rope drive, of which both have their enthusiastic advocates, will be in use in the station, those interested will have an excellent opportunity to compare their relative merits.

The countershaft, which was installed by the Hill Clutch Works, of Cleveland, O., affords a most flexible means of transmitting and distributing power. The shaft is not continuous, but is divided in sections. Each outer end of the shaft drives two generators, and these sections of the shaft can be cut off. The five foot sheaves, already

referred to, are not attached directly to the shaft, but are fastened to quills which have their own bearings. The quills lying concentric with the main shaft are attached to it by heavy friction clutch couplings. A third quill is used to drive a third pair of generators, permitting the operator to run a part of the machinery, while the shaft is not encumbered with the weight of friction clutches. One of the generators is driven from a clutch pulley. This arrangement affords a flexibility in operation which is found to be highly convenient and economical.

The generators are seven in number and are all Edison, No. 60 machines of 175 K. W. capacity, each. A generator of the Detroit Electrical Works type has recently been installed, which is driven by an automatic cut-off engine. This machine is operated to supply the electric light system and to furnish current for "owl" cars.

The current from the generators is carried to the switchboard where the total output is measured on a meter of 2,000 amperes capacity. The current is then carried to a second board where it is distributed among the several lines.

In examining the power station a visitor will be struck particularly by the sprinkler system arranged as a precaution against fire. Not only has the system been applied to the interior of the building, but the rear of the structure is protected in the same way. No buildings adjoin the station at the sides, but several factories are located at the back, separated by a narrow alley. The sprinkler system has been so applied that this passageway can be thoroughly drenched in case of fire in the vicinity. As a result of these precautionary measures the company is able to secure insurance rates that are entirely satisfactory.

THE Jamestown (N. Y.) Street Railway Co. are adding considerably to their power plant as well as to the equipment of their line. This plant was illustrated in our August, 1891 issue, and the new cars for additional equipment, which were furnished by the J. G. Brill Co. in our April, 1892, issue. These new cars have been received at Jamestown and are now equipped for service. This road is one of the best illustrations to which we can point of the difficulties that can be overcome by the electric motor. It is one of the most successful of all the smaller roads. The motors in use are the "Standard" motor, manufactured by the Short Electric Railway Co. of Cleveland, O., and are spoken of in the highest terms by the management of the road. A. N. Broadhead is president, and George E. Maltby manager.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Rochester Boiler Test.

ROCHESTER, May 24, 1892.

EDITORS STREET RAILWAY JOURNAL:—

On April 2 last, I was requested as head fireman of the Rochester power house, with the assistance of Mr. McNamara, to make a test of the Heine Safety Boiler Co.'s boiler. A statement has been made in the STREET RAILWAY JOURNAL and other papers by the Heine people that the firemen were unable to get a good start, got excited, etc. I desire to brand that statement as a deliberate falsehood, and state that everything that possibly could be done under the circumstances was done to fully demonstrate the capabilities of the Heine boiler, and I am willing now to challenge any firemen that work for the Heine company to run one boiler of the Babcock & Wilcox company for a ten hours' run, against two boilers manufactured by the Heine people.

Trusting that you will give this letter the publication which it deserves, I remain,

Yours respectfully, WILLIAM E. ROOTH,
Head Fireman Rochester Railway Co.

Minneapolis Power Station.

Work has been pushed forward during the last few months on the new electric power station of the Minneapolis Street Railway Co. at Thirty-first Street junction and contractors, DeLancey & Cook, have finally finished their work. The original design was to install five engines and five generators, but with the increased demand for street car facilities, it was decided to double the capacity of the power house. This required a remodeling of the original plans. The plant will furnish power to the portion of the street car system which is located south of Washington Avenue and between Minnehaha Falls and Lakes Calhoun and Harriet.

The area of the engine room is 87 × 70 ft. The engines are of the Westinghouse compound type with a high pressure cylinder sixteen inches in diameter, and low pressure cylinder twenty-seven inches in diameter by sixteen inch stroke, and are designed to generate from 250 to 300 H. P. Each is connected to a generator by a twenty-four inch leather belt running around an eighty-two inch pulley on the engine and a thirty-six inch pulley on the generator.

The generators are of the 275 K. W., multipolar type, manufactured by the Thomson-Houston Electric Co. The boiler room is nearly as large as the engine room and contains seven Stirling boilers of 287 H. P. each. These rest upon a solid wall which extends eight feet below the floor, and the whole will be enclosed by brick walls when finished.

The fuel to be used is crude oil which will be pumped in from two tanks as it is needed. The floor of the boiler house will be concrete and supported by arches. The stack is 165 ft. high. The water supply for the plant will be furnished by an artesian well which will be over 1,000 ft. deep.

The General Electric Co.

This is the title, already familiar to our readers, which has been adopted for the company formed by the consolidation of the Edison General Electric Co. and the Thomson-Houston Electric Co. Articles of incorporation for the company have been taken out at Albany, N. Y., and the capital stock authorized is $50,000,000.

The following directors were elected May 4: H. McK. Twombly, chairman; F. L. Ames, C. A. Coffin, T. J. Coolidge, C. H. Coster, T. A. Edison, E. Griffin, F. S. Hastings, H. L. Higginson, D. O. Mills, J. Pierrepont Morgan. Officers of the company were then chosen as follows: President, C. A. Coffin; vice president, E. Griffin; second vice-president, S. Insull; third vice-president, not filled; treasurer, A. S. Bevis; first assistant treasurer, B. F. Peach, Jr.; second assistant treasurer, W. F. Pope; secretary, E. I. Garfield; assistant secretary, A. S. Bevis; comptroller, J. P. Ord; auditor, E. Clarke.

As will be seen, both the Edison and Thomson-Houston interests are represented, the president, first vice-president, first assistant treasurer, second assistant treasurer, and secretary having been connected with the Boston company, and the second vice-president, treasurer, assistant secretary, auditor and comptroller from the Edison company.

Street Railway Affairs in Milan, Italy.

Milan, Italy, has a population of 420,000 souls and is, next to Naples, the largest city in the peninsula. The actual paid up capital of the Anonymous (or limited) Tramways Co, of which we gave some facts in our last issue, and who own all the street cars and most of the omnibuses in the city, is 1,500,000 lire, or about $300,000, and the amount paid in dividends last year amounted to 500,000 lire.

Street railways were introduced into Milan in 1876, by the same company which then had the monopoly of the omnibus traffic. The average term of service in and about Milan of the Italian street car horse is four years; that is, this is the average period elapsing between the time that a horse is purchased and the time when it is sold. The company, however, have one horse, still in active service, which was bought and first put to work in 1863. There are still three which have been on the road since 1875 (seventeen years' service), six since 1876, six since 1877, twenty-seven since 1878, thirty-four since 1879 and

forty-eight since 1880. This will show how well the stock is taken care of, or they would not otherwise have lasted so long.

The Milan Street Railway Co. are proprietors of the fields where each horse takes its yearly hard earned holiday. This land is situated at about four kilometres from the centre of the city, at a suburb called Castagnedo.

Of the 220 street cars, half a score of the closed cars have roof seats; these vehicles were all made abroad and bought by the company. 176 of the closed cars have no roof seats, the upper story not being popular in the Latin countries outside Paris. Of these, 152 were made in the company's own workshops, and twenty-four were purchased from foreign firms. The 'gardener' or completely open cars number fourteen, of which half were made by the company's employes, and half were procured from abroad. During the past few years, no less than 230 cars and vehicles have been broken up and sold, but not one thus treated was among those manufactured in America or Britain, the doomed ones being all of native make.

The company have 1,000 employes of all kinds, the highest number being coachmen, who number 276. There are 237 stable hands and 223 conductors. The company have recently established a pension fund, finding that the number of deaths every year among their staff (about a dozen) caused demands to be made on their charity. Every employe pays twenty centimes or four cents per week to the fund, and in the event of his illness he receives $1.40 weekly from the fund, or in case of death his widow or other dependent relative is entitled to fifty cents weekly for a certain stipulated time.

The Melbourne Tramway System.

The following interesting statements relating to the street railway lines of Melbourne, Aust., are quoted from the *Argus* of that city under date of January 21, 1892. The different amounts have been changed from English to American money, one pound being estimated at $4.86 of our money.

The balance sheet of the Melbourne Tramways Trust for the half-year ending December 31, 1891, has been issued with customary promptness by Mr. Hugh T. Jordan, treasurer to the trust. The principal work of construction carried out during the six months was the completion of the last line of cable tramway embraced within the scheme, namely, the branch line to the St. Kilda Esplanade. The expenditure upon this line during the half-year amounted to $65,571.12, besides a sum of $27,954.72 spent upon the engine house and machinery. The sum of $11,075.94 was also spent in completing the works at Prince's Bridge, rendered necessary by the subsidence of the embankment of the new roadway. The total disbursements for the half-year amounted to $137,980.26, of which $3,771.36 was spent in administration, $8,184.24 in the engineer's department, and $123,283.62 in general works. Some alterations remain to be carried out at Market Street and elsewhere, and the construction of the tramways, which has extended over a period of about eight years, will then be complete. The cost of these works will be trifling, so that some figures may now be given respecting the cost of the scheme as a whole.

The total expenditure of the trust up to December 31, 1891, amounted to $8,082,529.92. *The money was borrowed* at various times *at 4½ per cent. interest*, and the following table shows the amount of each loan and the premium obtained upon it:—

Year.	Loan.	*Premium.*
1884	$2,430,000.00	
1885	2 430,000.00	$ 42,525.00
1887	972,000.00	50,635.84
1888	1,215,000.00	105,387.80
1889	243,000.00	20,146.74
1891	631,800.00	46,364.82
Totals . . .	$7,921,800.00	$266,372.20

The gross amount realized from these loans was therefore $8,188,172.00, the actual cost of which to the trust is reduced to about 4¼ per cent. The aggregate borrowing power of the trust is $8,011,000.00, so that it is in a position at any time to obtain $89,200.00 if further funds should be requisite. On December 31, however, the trust had a credit balance at the bank of $123,045.48.

The *total length of cable lines* completed (double track) is forty-three miles fifty-three chains, and of *horse lines*, three miles six furlongs. The cost of constructing the cable lines has averaged $179,820.00 per mile. The original estimate was something under $155,520.00 per mile, but the excess has been caused in a large degree by circumstances quite apart from the actual construction of the lines. In the first place the haulage power provided is greater than was originally contemplated. The results of the first year's work on the Richmond line, which was the first to be opened, indicated that the traffic on the system as a whole would be heavier than had been anticipated in framing the estimates, and the power of the machinery had to be increased accordingly. As the lines now stand, power is available for nearly treble the present traffic. Again, the prices paid for sites for engine-houses were in some cases much beyond the estimates, for as the choice of the trust was restricted in each case to a very small radius, and prominent corner allotments were in nearly every instance required, the trust had often to pay very stiff figures for the land. At the present time, therefore, the trust owns a number of valuable sites, for which it has paid a total of $372,621.06. The cost of the drainage works necessitated by the cable tunnels was another disturbing element, the expenditure under this head alone having amounted to the sum of $316,386.00. Alterations to gas pipes intersecting the tram lines involved an outlay of $133,164.00, and $89,424.00 was spent in altering water pipes. The widening of the Kew and Hawthorn bridges, another unforseen contingency, cost in the one case $50,544.00, and in the other $34,992.00. Among other items of expenditure the purchase of redgum blocks for paving cost no less than $613,545.84, of which the saw millers of Gippsland reaped the benefit. Cement was bought at a total cost of $487,647.54, and $31,347.00 was paid for the use of patents.

The work of constructing the tramways has been carried out, as is well known, under the supervision of a trust elected by the municipalities upon whose security the money has been borrowed, and it is interesting to to notice the cost of engineering and administration during the eight years over which the undertaking has extended. The total expenditure in the engineer's department up to the end of the year amounted to $144,614.16, which is equivalent to a small fraction *over 1¾ per cent. upon* the total outlay. The cost of the administrative department during the same period was $41,577.30, or a little over ½ per cent. Engineering and administration together have therefore amounted to about 2½ per cent. upon the total expenditure, a result which indicates that there has been no extravagance in the operations of the trust. The presiding genius in the entire work has been, of course, *Mr. C. S. Duncan, the engineer-in-chief*, and the excellence of his handiwork is proclaimed by the tramways which as a piece of engineering alone are the admiration of all who see them.

The *Melbourne Tramway Co.*, which works the line, undertakes to pay the interest on the total cost, amounting at 4½ per cent. to $356,481.00. In addition to this, it *undertakes to provide a sinking fund* which *will pay off the entire cost of the scheme by the expiration of the company's lease* of thirty years. The Tramways Act provides that during the first ten years the company, in addition to paying the interest as it falls due, shall pay 1 1-2 per cent. per annum upon the total amount borrowed; during the second ten years 2 per cent. per annum, and during the third ten years 3 per cent. The first contribution to the fund was made on July 1, 1885, so that the increase to 2 per cent. will commence in 1895, and the increase to 3 per cent. in 1905, the lease terminating in 1915. The contributions to the sinking fund up to December 31, 1891, amounted to $764,721.00, and the annual payment required from the company during the next three years is $118,827.00. At the present time, therefore, the *payments out of profits which* the company make to the trust for interest and sinking fund amount to a total of $475,308.00 a year. After July, 1895, and until July, 1905, the total will be $514,917.00 a year, and from 1905 till the termination of the lease the sum due annually to the trust will be $594,135.00. It is calculated that by this means when the lines revert to the municipalities in July, 1915, they will be perfectly free from debt. *The rolling stock, car sheds (but not the engine-houses), factories, and repairing shops, with the land appertaining, belong to the company.* The sinking fund is invested in 5 per cent. municipal debentures, but to prevent any difficulty arising from the scarcity of such securities, power was given to the trust by the last amending act to lend money on first mortgages, if deemed desirable. The administrative charges up to the end of the current year will continue to be defrayed out of loan moneys. After that time they will be borne jointly by the municipalities and the Tramway Co., but the contribution of the latter is limited to $4,860.00 a year.

The following is a statement of the assets of the trust as on December 31, 1891:

By public works department		$25.53
By Melbourne and Metropolitan Board Works		1,098.24
By South Melbourne City Council		717.08
Total		$1,840.85
By bank balances (including London accounts)—		
Commmercial bank	$62,969.00	
City of Melbourne bank	60,076.96	
		$123,045.96
Total		$124,886.71
By petty cash in treasurer's hands		$204.50
By contractor's deposits		3,529.57
Total		$128,620.78

Street Railway News.

General.

Bridgewater, Mass.—Each employe of the electric road has been presented by General Manager Rogers with a $1,000 life insurance policy in the Mutual Life of New York, the first payment of which is paid.

Brooklyn, N. Y.—The Brooklyn, Bushwick & Queens County Railroad was to have been sold under a judgment of foreclosure, April 29, but the sale was postponed until May 26.

CARS were run on the Third Avenue line on Friday, May 20. President Lewis and a party composed of officials of the road and other gentlemen made a trip from Twenty-fifth Street to Fort Hamilton where lunch was served, and thence to the power station. On May 23 the dummies were taken off and twenty-eight electric cars were placed in service.

Chester, Pa.—The contract for rails for the new electric railway here has been awarded to the Lewis & Fowler company. About five miles of box rail will be laid.

Chicago, Ill.—The West & South Towns Street Railway Co. have not yet commenced construction on their electric road. This company have a franchise to use almost any power except steam, with

the proviso that if electric power be used the feed wires will be placed underground. The company will probably combine a light freight business with their passenger business.

THE property of the insolvent Belding & Manufacturing Co. whose factory was at Hermosa, Ill., has been sold by auction to T. J. Indermille for $71,800. His purchase is subject to a $40,000 mortgage.

THE ordinance of the Arcade Rapid Transit Co. for an underground railway on West Monroe Street has been favorably recommended.

THE Chicago City Railway Co. last month paid their quarterly license fee to the city treasurer, amounting to $4,403.75. The fee paid by the North Chicago company was $2,518.75.

THE Jackson & Sharp Co. have delivered twenty-five passenger coaches to the Rapid Transit Co. for use on their south side elevated railroad. This is the first installment of fifty cars contracted for by this company.

A POOL has been formed in Philadelphia, so it is reported, to obtain control of the street railroads in this city.

A SATISFACTORY test of the Kinetic motor illustrated in the April issue of the STREET RAILWAY JOURNAL was recently made on the downtown tracks of the West Chicago company.

THE owners of the Lake Street elevated road have ordered material and propose to begin at once the work of extending the elevated structure of which a mile is now completed.

Cleveland, O.—Another attempt was made last month to consolidate the different street railway companies, but the project was finally abandoned.

THE Westinghouse company have secured the contract for the entire equipment of the Woodlawn Avenue & West Side Street Railway Co.

Concord, N. C.—The Concord Street Railway has been purchased by the Odell Manufacturing Co. The road will at once be re-equipped.

Detroit, Mich.—When the Fort Wayne & Elmwood Street Railway Co. decided lately to procure tenders for a complete electrical outfit, it was decided to reorganize, since the state charter expires in 1895 aud the city franchise in 1900, as it was necessary to have the contemplated issue of bonds for the new equipment extend beyond the date given. Accordingly the name of the company has been changed to the Fort Wayne & Belle Isle Railroad Co., with a new directorate.

THE Board of Public Works, under instructions of the Common Council, has taken up the tracks of the East Detroit & Grosse Pointe Railway Co. on the Cadillac Boulevard. For nearly two years no cars have run over the line, and there has been a strong demand made by property owners in the vicinity to have the tracks removed. The Council has several times notified the company to remove them, but nothing was done. The company claim that under their franchise it is not in the power of the Common Council to set aside their franchise. No doubt the matter will find its way into the courts in a suit for damages against the city.

Dubuque, Ia.—A second application for a receiver for the Dubuque Electric Railway, Light & Power Co. was brought up last month before Judges Shiras and Caldwell of the Federal Court in St. Louis, when Horace Poole was appointed as the receiver. The petitioners were the Thomson-Houston Electric Co., the Edison General Electric Co., Heine Safety Boiler Co. and other creditors.

Dunkirk, N. Y.—The Dunkirk & Fredonia Street Railway Co. has been organized by the Council to remove tracks from the side to the centre of the street on part of their line.

Elizabeth, N. J.—The Twin City Rapid Transit Co., of St. Paul and Minneapolis, with a capital of $20,000,000, held their annual meeting here last month. The following directors were chosen: Thomas Lowry and C. G. Goodrich, of Minneapolis; John Kean, Jr., Elizabeth; J. Kennedy Tod, New York; Charles Fairchild, Boston.

THE United States Steam & Street Railway Advertising Co., Carleton & Kissam proprietors, have recently closed a lease for the advertising privileges in all the cars of the Elizabeth Street Railway Co.

Fishkill, N.Y.—Ground has been broken for the Fishkill Landing & Matteawan Electric Railway. It is to be completed by July 1.

Fonda, N. Y.—Construction has begun on the new Fonda, Johnstown & Gloversville Electric Railway. The road will be completed October 1, 1892.

Fort Edward, N. Y.—The village trustees have directed the Corporation Council to commence action compelling the Glens Falls, Sandy Hill & Fort Edward Electric Railway to extend the road to the postoffice.

Fort Worth, Tex.—The line from the city to the Polytechnic College has been begun and is to be in operation in about thirty days.

Galveston, Tex.—The City Railroad Co. are pushing the work of equipping the Thirty-third Street line with electricity.

Gloversville, N. Y.—The Belt Line road of this city and the Cayadutta Electric road have consolidated and bear the name of the Cayadutta Co. The movement is for the mutual interest of both companies.

Hamilton, Ont.—The street railway company are making great headway in changing the system to electricity.

Haverhill, Mass.—The Haverhill & Groveland Street Railway has been sold to the Industrial Improvement Co. of Boston. The road, which includes fifteen miles of tracks, will be equipped with electricity.

Holyoke, Mass.—C. N. Blakeslee & Sons, of New Haven, have begun the construction of the Holyoke Electric Railway.

Iowa City, Ia.—The Iowa City Electric Street Railway Co. have surrendered to the city all rights granted them by franchise. This will leave the city free to negotiate with other parties, and it is understood steps will be taken immediately toward the securing of an electric system for that city.

Jamestown, N. Y.—The Jamestown Electric Street Railway Co. have built an electric light plant which will be used to illuminate sections of the line. The plant has a capacity of about 400 incandescent lamps.

Jersey City, N. J.—The Thomson-Houston Electric Co. have secured a contract for the equipment of six cars to be operated on the elevated railway of the North Hudson Railroad Co., which connects the ferry at Hoboken with Jersey City Heights.

Keokuk, Ia.—The street car line has been sold by Commissioner Kenney to S. P. Townsend & Son, of Hartford, Conn., for $21,000. It is said that the line will be put in first class running shape.

Lansing, Mich.—Gordon Macdonald, of New York, has been appointed receiver for the Lansing City Railway Co. The action was taken upon a bill filed by the Continental Trust Co., of New York, to foreclose the mortgage. The present lines will be improved.

Lexington, Ky.—On April 30, fire destroyed the car shed of the Passenger & Belt Railway Co. Three cars were burned.

McKeesport, Pa.—The McKeesport Street Railway Co. have increased the wages of the motormen and conductors from $1.50 to $2 a day. They have also increased the hours of the men from nine to twelve hours a day.

Macon, Ga.—The Macon street car system was sold at auction May 14, to the Thomson-Houston Electric Co., of Boston. The system includes about nine miles of equipped line. The price paid was $200,000. Improvements will be inaugurated at once.

Memphis, Tenn.—A. M. Billings, of Chicago, the owner of all the Memphis street railway lines, has offered to make the city an equal partner in the enterprise. He wants to issue bonds to the value of the street railway plant and franchises, say $1,250,000, which bonds he will take himself, and then issue stock for that amount and give the city half of it.

Minneapolis, Minn.—William J. Hield has succeeded C. G. Goodrich as manager of the street railway.

Mobile, Ala.—The Mobile street railway has been purchased by the New Orleans bondholders.

New Bedford, Mass.—A syndicate of New York capitalists, represented by James Irvine, is endeavoring to purchase the Union Street Railway.

New Haven, Conn.—The West Haven Street Railway Co. expect to have the electric system in full operation by July 1.

New Orleans, La.—The new system on the Carrollton Railroad will be in running order by August 1.

Oakland, Cal.—The formal opening of the Oakland, San Leandro & Haywards Electric Railway took place on the 7th of last month.

Old Town, Me.—The consolidation of the Old Town Street Railway Co. aud the Old Town, Orono & Veazic Rallway Co. has been arranged, and it is expected that work on the new electric railway from this city to Bangor will be begun within a short time. Hon. J. M. Haynes of Augusta, is president of the Old Town, Orono & Veazie Railway.

Orange, N. J.—A contract for the completion of the construction of the cable road on Orange Mountain, between Orange Valley and St. Cloud, has been made by the Orange Heights Improvement Co. and John A. Roebling's Sons Co. The road is to be completed by August 1.

Owosso, Mich.—The street railway between Owosso and Corunna is completed and operating successfully.

Peoria, Ill.—The Fort Clark Street Railway electric equipment is complete.

Peterboro, Ont.—The contract has been awarded to the Edison General Electric Co. here for the electric equipments of the Toronto and Montreal street railways.

Philadelphia, Pa.—The contract for the extensionof the Chelten Avenue railway from Chew Street to Stenton Avenue, has been awarded to William Wharton of this city.

Piqua, O.—The Piqua Electric Railway Co. have their new brick power house well under way. The company have purchased a 175 H P. Hamilton-Corliss engine for their dynamos. They have also purchased additional electrical machinery.

Pittsburgh, Pa.—The Federal Street & Pleasant Valley Passenger Railway Co. have purchased ten new cars from the New Castle Electric Car Works, a new concern started within the past year. This company have now a trackage of twenty-eight miles.

THE contract for the equipment of the entire system of the West End Electric Railway was let last month to the Westinghouse Electric & Manufacturing Co. That for the construction has been given to Booth & Flinn.

THE Citizens' Traction Co. have put in new machinery in their Thirty-fourth Street station, including a traveling crane of twenty tons capacity.

Tampa to Ballast Point. The directors of the company are J. Rush Ritter, Alfred G. Clay, Joseph Wright of Philadelphia, Henry Bradstreet of New York and Mr. J. H. Ahren, president of the Florida Electric company of Tampa. The capital to $500,000.

Tonawanda, N. Y.—Application for franchises have been made by both the Buffalo, North Main Street & Tonawanda Electric Railway Co., and the Buffalo, Kenmore & Tonawanda Electric railroad Co.

University Park, Ore.—A movement is on foot for another car line down the Peninsula, independent of the City & Suburban Railway Co. It will be an electric line.

Uxbridge, Mass.—M. P. Burbank is engaged soliciting stock for his proposed electric railroad between Uxbridge and Whitinsville. Mr. Burbank is confident that it will prove a paying investment.

Westchester, N. Y.—Five street railway companies have been incorporated, as follows: The Suburban Traction Co. to construct a road in Westchester County five miles in length. The termini of the main line will be at the junction of the Bronx River and Harlem Road, and the junction of Main Street in the village of West Chester and West Chester Creek. A branch road will be constructed, with termini at the junction of the southern turnpike and the road leading to Crossers Point and the East River. The capital is $150,000.

THE West Farms & Westchester Traction Co., with a capital of $80,000, to construct a road three miles in length in Westchester County. The termini of the road will be the junction of Bronx River and the New West Farms Road, and the junction of Main Street in the village of West Chester and West Chester Creek.

THE Williamsbridge & Westchester Traction Co., with a capital of $80,000, to construct a road four miles in length in Westchester County. The termini of the road will be the junction of Bronx River and Olin Avenue in the village of Williamsbridge, and the junction of Main Street in the village of West Chester and West Chester Creek.

THE Van Nest, West Farms & Westchester Traction Co., with a capital of $150,000, to construct a road in Westchester County five miles in length. The termini of the main line will be the junction of Main Street in the village of West Chester and West Chester Creek. Two branches will be constructed from this main line, the termini being the intersection of the West Farms Road with Bear Swamp Road and a point opposite the Mullaly property on Bear Swamp Road and the intersection of the road leading from Van Nest Station to Bronxdale and the new road now being constructed through the Saggermant farm and the intersection of Avenue C and Second Street in Unionport.

THE Wakefield & Westchester Traction Co., with a capital of $125,000, to construct a road in Westchester County seven miles in length. The termini will be the intersection of Fifteenth Avenue and Third Street in the village of Williamsbridge and the junction of Long Island Sound with the new road between the Eastern Boulevard and Long Island Sound. The directors of each of the five companies are: Howard Carroll, Thurlow Weed Barnes, George C. Clausen, James McNaughton, Frank M. Pierson, George H. Lawrence, Frank P. Statt, William H. Jasper and Charles E. Coddington, all of New York City.

West Chester, Pa.—At a meeting last month of the capitalists interested in the electric railway from Lenape to Unionville, the West Chester, Unionville & Western Railway Co. was organized with a capital stock of $100,000. The affairs of the new company are to be managed by a president and eleven directors. John Henry Marshall of Unionville, was chosen president.

THE West Chester, Unionville & Western Electric Railway Co., with a capital stock of $100,000, is organized and a charter will at once be applied for. The road will run between West Chester and Unionville. John Henry Marshall, of Unionville, was elected president.

White Plains, N. Y.—The New York, White Plains & Mamaroneck Railroad Co. were incorporated lately, with a capital of $90,000, to construct a street surface railroad six miles in length. The termini of the road are in White Plains and the town of Mamaroneck.

THE New York, Elmsford & White Plains Railroad Co. are also incorporated with a capital of $60,000, to construct a street surface road about four miles in length. Each road will have the same directors, among whom are: James H. Morgan and James E. Campbell, of White Plains, and Theodore G. Gross, of New York City.

Williamsport, Pa.—A charter has been obtained for another electric street railway to be known as the Junction Passenger Railway Co.

Worcester, Mass.—The Board of Aldermen have granted the North End street railway company, location for their tracks, from Adams Square through Lincoln and Summer Streets, to the Union station.

Personal.

Mr. J. H. Rose, of the Lima Register Co., was in New York during May.

Mr. C. E. Newton, of the Jewell Belting Co., called at the *World* Building last month while in New York.

Mr. J. H. Shay, of the Charles Munson Belting Co., visited the office of the STREET RAILWAY JOURNAL during May, while on an Eastern business trip.

Mr. J. H. Mason, general manager Simplex Electrical Co., of Boston, spent some time in New York during May. While in the city he visited our office.

Mr. J. F. McGowan, formerly with the Thomson-Houston Electric Co., has accepted a position with the R. D. Nuttall Co., of Allegheny, Pa. and was recently elected secretary and treasurer of that company.

Mr. W. R. Mason, of the Railway Equipment Co., called at our office during last month, and said that the affairs of the Railway Equipment Co. were prospering, and that the company were doing a large amount of business.

Mrs. E. C. Pullman died in New York, May 21. Mrs. Pullman had reached the ripe age of eighty-four years. She was the mother of George M. and C. L. Pullman, to whom we extend our sympathy at their sad bereavement.

Mr. W. F. D. Crane, who has been well known as manager of the railway department of the Engineering Equipment Co., has recently become connected with the H. W. Johns Manufacturing Co., 87 Maiden Lane, New York, and will hereafter have charge of the electrical department of that company.

Mr. Louis Warfield, general manager and treasurer of the Detroit Electrical Works, was united in marriage last month to Miss Alice McMillan, daughter of Mr. Hugh McMillan, of Detroit. Mr. and Mrs. Warfield took a bridal tour in the Eastern states and will reside at 410 Jefferson Avenue, Detroit. We extend to the bridal couple our heartiest congratulations.

Mr. G. S. Duncan, engineer-in-chief of the Tramway Trust, Melbourne, Australia, owners of the extensive cable system in that city, has resigned from active connection with the trust and will make a trip around the world. Mr. Duncan expects to spend considerable time in this country, examining the American street railway systems. Before his departure Mr. Duncan was presented with a handsomely engrossed series of very complimentary resolutions adopted by the directors of the trust in recognition of his services in the installation of the Melbourne cable systems. Mr. Duncan will continue his connection with the trust as consulting engineer during his absence.

New Publications.

Electric Street Railways as Investments, by Lemuel William Serrell, M. E.

This publication contains in pamphlet form an article by Mr. Serrell which was published in the *Engineering Magazine* for May, 1892. It clearly shows that though electric railway securities present a comparatively new field to investors, they are rapidly becoming better known and their value is being better appreciated.

Report of the Boston Rapid Transit Commission to the Massachusetts legislature, transmitted April 5, 1892.

The report, of which we gave an abstract in our last issue, has been published in pamphlet form and presents much interesting and valuable data. Bound in with the report are the reports on foreign transit systems of Messrs. John E. Fitzgerald and Osborne Howes, Jr., the latter being especially complete. Thirty-one plans are also given showing many of the proposed changes and details decided upon.

The Brush Direct Incandescent System, published by the Brush Electric Co., of Cleveland, O.

As a specimen of handsome typographical work this publication would alone attract attention, but in addition it contains many interesting and valuable facts in regard to the direct incandescent system of the Brush Electric Co. After a short description of the direct current incandescent machine, there are given descriptions and illustrations of six complete isolated incandescent electric light plants installed in large office buildings in Kansas City, Omaha, Minneapolis, St. Paul, Montreal and New York, and in two hotels in Japan. Views of the exteriors and interiors of the buildings, interiors of the dynamo rooms and some details of the arrangement of lights are also given. The book also contains several views of different Brush electric machines and one engraving of the Short electric generator for street railway service.

Dictionary of Electrical Words, Terms and Phrases, second edition, by Prof. Edwin J. Houston. Published by the W. J. Johnston Co., Ltd., *Times* Building, New York City. Price, $5.00.

The work bears very little resemblance to the first edition, which was published in 1889 and contained single column pages 5 x 6¾ ins. The first edition is now familiar to electrical readers and has been very serviceable, but the second edition is practically a new book, as it has been entirely rewritten and revised. It will be octavo in size, containing 562 double column pages printed on heavy paper. The words to be defined are printed in black face type and stand out prominently on the page. The definitions are given in two sizes of type, the larger being used for the definitions proper, while the descriptive matter of more general nature is given in a smaller type. The illustrations, which cover a very wide range of electrical apparatus, are 570 in number, while the definitions are given under about 5,000 distinct titles, and nearly as many more titles are entered for the sake of giving cross reference to other titles under which their definition may be found This new work will prove of great value to electricians and not only show the wonderful growth and richness of the vocabulary of this science but also by providing reliable and current definitions to the words, terms and phrases. Many new terms relating to electrical knowledge are not to be found in the ordinary unabridged dictionaries, and this work removes a most serious obstacle to the general study of electrical science. The work has evidently been prepared with great care and reflects credit both upon the author and publishers, and we bespeak for it a rapid and extensive sale.

A Cable Coating.

Imperial cable coating which has been adopted on a number of cable railways, is made by a combination of natural products extracted from the pine tree. The pyroligneous acids are practically washed out of the tar, which is the body of the coating, and the natural oils are retained, the whole being held in solution by crude turpentine which evaporates when the coating is run on the cable, leaving an oily paste which adheres to the wire rope and penetrates to its core; never hardens, and only wears off from friction. The result is that the cable is furnished with a non-corrosive, waterproof coating and lubricant, which protects the wire as well as pulley wheels and drums.

As this coating is of an oily nature, it must be applied with judgment. It should be fed on the cable in a very thin stream for a couple of turns of the rope and then stopped for four or five turns until the turpentine has evaporated. If treated in this way, it builds up layer upon layer until the rope is filled. If a brush is used to spread the oil around the cable it will adhere more evenly and quickly, and fill the cable quite rapidly.

When this coating is put on an old rope already coated with tar, the latter will dry and flake off, and not until the rope has stripped and the coating can take hold of the wire, will it give perfect satisfaction. The manufacturers of Imperial cable coating are the Imperial Pine Product Co., of 109 West Broadway, New York.

Equipment Notes.

The New Departure Bell Co., Bristol, Conn., are meeting with a large call for their bells for street railway and other uses.

The Jewell Belting Co., of Hartford, Conn., have just filled an order for the Richmond Railway & Electric Co., Richmond, Va., consisting of one 56 inch double main driving belt and six 11 inch dynamo belts.

S. A. Day, of New York, manufacturer of Kerite insulated wires and cables, has removed his New York office from 16 Dey Street to the new *Mail and Express* Building, 166 Fulton Street. Mr. W. R. Brixey, general superintendent, has been appointed general manager *vice* Mr. W. H. Eckert, resigned.

G. F. Whitney, of Boston, manufacturer of soaps, is doing a large business among street railway companies, and manufactures a variety of soaps, wax, etc., which are especially applicable to street railways. He writes us that among his many customers his products are giving good satisfaction.

A. Whitney & Sons, of Philadelphia, are constantly receiving very gratifying letters from their customers all over the country which testify to the character of their wheels. The Whitney wheels have a wide reputation for durability earned, by excellent service during the forty-five years which the company have been in business.

B. W. Payne & Sons have moved their New York office from 45 Dey Street to 41 Dey Street. At this latter address may be found Messrs. Wate and Henry Payne who have charge of the New York branch, and who are always glad to welcome street railway men to their commodious quarters and give them the latest information in regard to belts. These gentlemen report business as excellent.

The Richard Vose Car Spring Co., of New York, are furnishing the J. G. Brill Co. 180 sets of Vose "graduated" springs, Chicago City Railroad Co.'s standard, to be used for the cars now being built for that company. They are also furnishing 150 sets, Vose "graduated" rubber iron cone springs, for the cars now being built by the American Car Co., St. Louis, for the West Chicago Cable Railway Co.

The Interior Conduit & Insulation Co., of New York have recently put on the market an electric motor fan for desk use which is entirely iron clad. There are no moving parts visible to collect dust and dirt, and everything is completely closed, even the commutator and brushes are out of sight. Ball bearings are provided throughout so that no oil is required, and the motor is compact and attractive in appearance. It is built in two sizes; one-twelfth H. P. and one-sixth H. P.

The Duplex Street Railway Track Co., of New York, have the contract for the equipment of over 6,600 ft. of line on the Atlantic Avenue Railroad of Brooklyn, instead of for half a mile as mentioned in our last issue. This track is giving good satisfaction upon the different street railroads where it has been installed, and the officers of the company tell us that their orders are constantly increasing. A mention of some of the recent contracts being executed by this company was given in our last issue, and each month brings new orders to this company.

James A. Trimble, of New York, well known in the trade for the excellent car work, plain and carved mouldings, etc., which he has supplied for the last twelve years, has recently added another department to his busy establishment, that of building cars complete. He writes us that he is now at work upon a number of orders from New York, Jersey City, Sioux City and other places. In addition, he is doing a large business in the sale of complete woodwork ready to go together to construct car bodies of any style or size as well as special parts for repairs.

The Morton Safety Heating Co., of Baltimore, have recently moved to their new offices in the Vansant Building, Baltimore, which has been recently erected and equipped with all modern office improvements. Their rooms are Nos. 12, 14 and 27, at which they are always glad to meet visiting street railway managers and explain their system of stored heat. They write us that they find business excellent, and that many street railway companies are installing the Morton heaters. They are compiling a catalogue which will be ready for distribution early in June.

John Stephenson Co., Ltd., of New York, are employed on many orders for cars in different sections of the country. Their works present a busy appearance to the visitor, and the various cars which are being prepared for shipment attract attention from their handsome appearance. Recent shipments include a number of both open and trail cars for the Watertown, N. Y., street railway. The Stephenson company are also building electric cars, both motors and trailers, for the new Prohibition Park Electric Railway at Staten Island, N. Y., and for the Rochester, N. Y. Railway Co., the Paterson, N. J. Railway Co., the Central Railway Co., of Baltimore, Md., and the West End Railway, of Pittsburgh, Pa

The Campbell & Zell Co., of Baltimore, Md., write us that notwithstanding the recent extensive additions to their works which more than doubles the capacity, they are crowded with orders for Zell improved water tube safety boilers, and have recently closed contracts for the following plants: The Central Railway Co., of Baltimore, Md., 675 H. P.; The Baltimore City Passenger Railway Co., of Baltimore, Md., 1,800 H. P.; the South Park Electric Light Co., of Chicago, Ill., 450 H. P.; the Michigan Brass & Iron Works, of Detroit, Mich., 150 H. P.; besides a number of smaller boilers, including two 40 H. P. boilers for Otto Sutro & Co., and one 25 H. P. boiler for the Thomas Wilson Sanitarium for Children, both of Baltimore. In addition to this they have also contracted with the World's Columbian Exposition at Chicago for 2,500 H. P. Zell boilers for supplying power at the Fair.

J. G. White & Co., of New York, have a large amount of work under way, and are equipping electric roads in all parts of the East and South. Among the contracts recently closed by this company are Wilmington, N. C., five miles track and overhead; Yonkers, N. Y., four and a half miles overhead work, part iron and part octagonal wood poles; Steinway, L. I., five miles of overhead work, and the New Orleans & Carrollton Railroad sixteen miles with iron poles. They are also equipping seven and a half miles of line, part iron and part octagonal wood poles, for the Baltimore Traction Co.; three miles octagonal wood pole construction for the Pawtucket Street Railway, Pawtucket, R. I., and eleven miles iron pole construction for the Central Railway of Baltimore. With the season as yet hardly commenced, such a showing should be very gratifying to this company.

Mr. P. M. McLaren, who has for the last ten years been connected with the Babcock and Wilcox Co. and who is well known among boiler users, is now located at 91 Liberty Street, New York, where he represents "Green's Economizer" for utilizing the waste heat from steam boilers. This economizer has been favorably known among steam users for many years in both Europe and this country. It consists of a set of cast iron pipes arranged in the chimney flue and through which the feed water is forced by the boiler pump or injector. Each pipe is provided with a scraper which is made to travel continuously at a slow rate of speed, the object being to keep the exterior surface clean, soot being a non-conductor of heat. Actual tests show a large saving in fuel by its adoption, and the users of the device include some of the largest manufacturing companies and mills in the country. The Fuel Economizer Co. has been organized with works at Matteawan, N. Y., to build the Green fuel economizer in this country.

The Goubert Manufacturing Co., of New York are making extensive alterations in the premises occupied by them at 32 Cortlandt Street, and have doubled the amount of floor space formerly devoted to the carrying on of their large business. They will hereafter occupy the entire second floor of the building in which they are located. In the new arrangement of things the company will have a large room for exhibition purposes, giving them facilities for the erection and exhibition of the smaller sizes of their well known feed water heater, both vertical and horizontal. The merits of the "Goubert" feed water heater, of which they are the sole manufacturers, are daily becoming more clearly understood and appreciated, the result being seen in a steadily increasing demand. A few of the more important sales which the company have lately made are: Three 1,000 H. P. heaters for the Broadway cable road; six 1,000 H. P. heaters for the Third Avenue cable road; one 1,000 H. P. heater for the New York Mutual Gas Light Co. They have filled orders as well for many smaller sized heaters.

The Berlin Iron Bridge Co., of East Berlin, Conn., have received the contract for the new rolling mill which the Waterbury Brass Co., of Waterbury, Conn., will build to replace the one lately destroyed by fire. It is said that this will be the finest rolling mill in the Naugatuck Valley, being 150 x 350 ft., with brick side walls and iron roof trusses covered with the Berlin Iron Bridge Co.'s patent anti-condensation, corrugated iron roof covering. The building will be absolutely fireproof. This company will also design the new power house for the The Newport News (Va.) Shipbuilding & Dry Dock Co. In order to have the building absolutely fireproof no woodwork will be used about the construction, as the side walls will be of brick, the floors of iron and concrete, and the roof will be made with an iron frame covered with the Berlin Iron Bridge Co.'s patent anti-condensation, corrugated iron covering. The steam, compressed air, hot air and electric light plant for the entire shipyard is concentrated in this one building, and it is therefore absolutely necessary that it be fireproof in every particular.

W. R. Fleming & Co., of New York, agents for the well known Harrisburg Foundry & Machine Works' Ide and Ideal Engines have recently moved their office from Fulton Street to the new *Mail and Express* Building on Fulton Street and Broadway. They have also been awarded the contract for installing four Ideal, self-oiling, automatic engines in this building. This firm are also installing two of the Ideal, self-oiling, high speed engines in the new naval observatory at Georgetown Heights, Washington, D. C. As is well known, there is

no more exacting customer than the government, and these engines were selected by Lieut. A. V. Zane, of the naval department at Washington. After bids were received, he visited several cities to investigate the merits of the different engines, and personally visited the engine rooms to see them run. His reason for ordering the Ide engines were, as he expressed it, for their perfectly noiseless running, as the officers in the observatory, in order to use their instruments with accuracy, can have no noise or vibration of any kind (which would affect their proper use) in the building, and on investigation, Mr. Zane thought these engines exactly suited to his purpose.

The Standard Paint Co., of New York, manufacturers of the well known P. & B. water and acid proof insulating compounds, armature and field coil varnish, insulating tapes, etc., report a largely increased demand for their materials. The P. & B. paint is used largely for preserving all kinds of iron work and for protecting iron or wood work to be placed underground, submerged in water or however exposed. The company have recently received a letter from one of the largest electric street railways in the United States, from which we quote the following: "We would say that we have used your regular P. & B. paint, the armature varnish and insulating tape, all of which have given us good satisfaction. On account of our recent fire we were compelled to use a quantity of your armature varnish in the rewinding of all of our armatures, and can only speak in the highest terms of it. This is the second letter of testimonial that we have ever given, and we are not in the habit of doing so, but if this will be of any benefit you can use it." The Standard Paint Co. deserve the success with which they are meeting, and are always pleased to furnish full information upon application of the materials they manufacture.

The Lamokin Car Works, of Philadelphia, have sent us a list of some of the recent orders closed by them, from which it can be easily seen that the cars of this company retain the popularity which they have always enjoyed. These orders include one for the Schuylkill Electric Co., of Pottsville, Pa., for two sixteen foot vestibule car bodies with vestibule observation windows and mounted upon Peckham trucks, a second order from the City Passenger Railway Co , of Altoona, Pa., for three eight seat open trail cars; one from the East Harrisburg Street Railway Co,, of Harrisburg, Pa., for four thirty-three foot closed car bodies to be mounted on Robinson radial trucks, and a second order from the Akron Street Railway Co,, of Akron, O., for five nine seat, closed end and open car bodies. This company have sent us copies of a number of letters recently received by them from customers speaking in the highest terms of the Lamokin cars. Among others are testimonials from the following: The Danville (Va.) Street Railway Co., the Derby (Ct.) Street Railway Co., the Williamsport (Pa.) Street Railway Co., the Akron (O.) Street Railway Co., the City Passenger Railway Co., of Altoona, Pa., and the Salem (O.) Electric Railway Co.

The Page Belting Co., of Concord, N. H., have sent us a list of some of their recent orders, from which it is very easy to see that the belting manufactured by this company retains the popularity which it has always enjoyed. Among their recent orders for Eureka dynamo belts we notice prominently nine belts to the Brooklyn City Railway Co., of Brooklyn, N. Y., four to the U. S. Electric Light Co., Washington, D. C.; two to the Staten Island Light, Heat & Power Co., Port Richmond, N. Y.; three to the Prudential Insurance Co., Newark, N. J. Among recent orders filled by them for their regular dynamo double belting is one for the People's Electric Light Co., Trenton, N. J., and one for the Red Star Line repair shops, Jersey City, N. J. Other sales have been as follows: A thirty-four inch main belt and several other belts for the Nordberg Manufacturing Co., Webster City, Ia.; a twenty-nine inch belt for the Pontoosuc Manufacturing Co., Pittsfield, Mass.; a complete new mill outfit, including a twenty inch main belt for the Point Pleasant Furniture Co., of Point Pleasant, W. Va. They have also recently furnished for a plant in South Dakota which has probably the largest link belt ever made, it being 181 ft. long and twenty-eight inches wide.

The Haskin Wood Vulcanizing Co., of New York, have a process of vulcanizing wood for ties which they claim greatly increases its life. It has long been known that the charring of lumber, if properly done, will greatly increase its ability to resist the deteriorating effect of the weather. The method adopted by the Haskin Wood Vulcanizing Co., however, is an improvement on the old charring method, inasmuch as the timber is placed in an airtight retort and subjected to a heavy pressure in superheated air, the temperature of which varies from 200 to 600 degs. By this means the entire body of the lumber is treated, accomplishing the same result which the charring process does within a short distance of the surface, and without losing any of the juice or chemical properties of the wood. In addition the extra heat tends to kill all the germs which may be found in wood, and whose presence and life are a menace to its life and fibre. Ties vulcanized by this process have been long in successful use upon a number of railways. Ten years ago 1,000,000 ft. of lumber treated by this process was installed on the elevated railway system of New York as an experiment, and placed alongside of untreated lumber put in at the same time. After four years the untreated lumber had to be renewed, while that which had been vulcanized is still in use, and, it is said, as sound as when first installed. Another item of saving shown on the same road was that the treated lumber resisted the tendency of the rail to cut the surface, for instance, at the top of the ties, and that it did not require to be painted as protection against the weather. The New York, Lake Erie & Western Railroad have employed some of these ties in Jersey City and they are still in service after nine and a half years of service.

The Ball Engine Co., of Erie, Pa., manufacturers of the Ball automatic cut-off engines, have furnished us with the following list of engines for electric railways which they have lately received orders for: Prohibition Park & Staten Island Railway Co., Staten Island, N. Y., one 130 H. P. engine; Baltimore Traction Co., Baltimore, Md., two 130 H. P. engines; North Avenue Street Railway Co., Baltimore, Md., two 130 H. P. engines; Shamokin Street Railway Co., Shamokin, Pa., one 130 H. P. engine; Sandusky Street Railway Co., Sandusky, O., one 100 and two 130 H. P. engines; Rome Street Railway Co., Rome, Ga., two 100 H. P. and one 130 H. P. engines, and complete steam plant; Erie Electric Motor Co., one 450 H. P. tandem compound condensing engine and complete condensing apparatus of 1,000 H. P.; Fresno Electric Railway Co., Fresno, Cal., two eighty H. P. tandem compound engines; Buffalo, Bellevue & Lancaster Railway Co., Buffalo, N. Y., one 150 H. P. engine; Niagara Falls Street Railway Co., Niagara Falls, N. Y., two 130 H. P. engines and complete steam plant; Wilmington Street Railway Co., Wilmington, N. C., two 130 H. P. engines and complete steam plant; North Hudson County Railway Co., Hoboken, N. J., one 250 H. P. engine; Portland Street Railroad Co., Portland, Me., one 250 H. P. engine; Santa Cruz Railway Co., Santa Cruz, Cal., one 200 H. P. cross compound engine; Stockton Street Railway Co., Stockton, Cal., three 200 H. P. tandem compound engines; Schuylkill Electric Railway Co., Pottsville, Pa., one 250 H. P. engine; Westminster & Vancouver Tramway Co., New Westminster, B. C., three 150 H. P. engines. Recent shipments by the Ball Engine Co. include the following: J. C. Hubinger Co., Keokuk, Ia., one 300 H. P. cross compound engine and condenser; Chesapeake Light & Power Co., Hampton, Va., two 150 H. P. tandem compound engines and transmitting machinery; Moundsville Electrical Co., Moundsville, W. Va., one 130 H. P. simple engine; Electric Light Co., Elizabeth, N. C., one 100 H. P. simple engine; Edison General Electric Co., State House, Trenton, N. J., one thirty-five H. P. simple engine; Schuylkill Electric Railway Co , Pottsville, Pa., one 250 H. P. simple engine; Electric Light Co., Doylestown, Pa., one 130 H. P. simple engine; Freeport Gas & Electric Light Co., Freeport, Ills., one 130 H. P. simple engine; Warrenton Electric Light Co., Warrenton, Mo., one fifty H. P. simple engine.

WESTERN NOTES.

The National Electric Manufacturing Co., of Eau Claire, Wis., are doing quite a large business in electric railway power plants.

The Griffin Wheel & Foundry Co., have moved their Chicago office from Room 602, Phenix Building, to Room 508 in the same building.

Kohler Bros., of Chicago, are now located in their new offices, 1,417 and 1,418 Monadnock Building, and report an active demand for Eddy motors.

The Short Electric Railway Co., of Cleveland, have moved their Chicago office from 225 Dearborn Street to the new Monadnock Building, corner of Dearborn and Jackson Streets.

The Fort Wayne Electric Co., have moved their New York office to 42 and 44 Broad Street, where they have secured large and commodious quarters. Their New York agent is H. C. Adams.

E. G. T. Colles & Co., of Chicago, are making heaters and purifiers which, on account of their substantial and well planned construction, are giving great satisfaction to operators of electric plants.

The Central Electric Co., of Chicago, are selling large quantities of Okonite cable, and are doing an active business in interior conduit specialties. The company's street railway goods are deservedly popular.

Louis Blatz of 107 West Monroe Street, Chicago, is making several specialties which are of interest to electric railway companies. They include trolley wheels, electric railway switches, graphite bushings, etc.

Frank Bakeman & Co., Rookery, Chicago, general agents for the Schuttler Manufacturing Co., are receiving large orders for the Schuttler ratchet drill which is a tool especially adapted to street railway work.

The Electrical Supply Co., of Chicago, are finding that their pocket edition of catalogues meet with a very favorable reception. These miniature books contain many valuable facts and form very interesting reading.

The Great Western Electric Supply Co., of Chicago, now occupy practically the whole of the second floor of the Springer Building, 195—207 South Canal Street and are selling a large amount of goods to street railway companies.

The Hill Clutch Works, of Cleveland, O., have secured, through their Chicago representative, Charles B. Coon, the contracts for furnishing the power transmission machinery in the Germania Theatre and Produce Cold Storage Co's. plant, Chicago.

The Patton Motor Manufacturing Co., of Chicago, recently shipped a pioneer motor of the latest improved type to Portland, Ore., as a sample car for the Pacific Coast territory. They also expect to ship two motors to Denver, Colo., for the Denver, Lakewood & Golden Railroad Co. about June 1.

The Nordberg Manufacturing Co., of Milwaukee, are receiving a large number of orders for the Nordberg poppet valve engine. They are used in a great many electrical stations. The demand for the Nordberg governor is active, and the factory is kept running day and night to keep up with the demand.

The Allen Paper Car Wheel Co., of Chicago, continue to receive orders from street railway companies for their well known wheels. Experience has shown that companies whose roads are mechanically operated need first class wheels, and increasing sales of the Allen wheels in the street railway field may be expected.

The Northern Car Co., of Minneapolis, lost a good part of their plant by fire on the morning of May 7. Many finished and partly finished cars were also destroyed by the flames, including a number of cars for St. Paul and Rockford, Ill. The loss was fully covered by insurance. Not discouraged by their disaster, the company determined to immediately rebuild, and expect soon to be in shape for business again.

The Laclede Car Co., St. Louis, are at present working day and night. Among their recent orders are 10 sixteen foot electric cars for the Lincoln Street Railway, Lincoln, Neb.; twenty of the same size for the Pittsburgh Traction Co., of Pittsburgh, Pa., and two for the Marion Street Railway Co., of Marion, Ind., to be mounted on McGuire trucks.

N. W. Harris & Co., of Chicago, have purchased $250,000 of the first mortgage, 6 per cent. bonds of the consolidated street railways of Sacramento, Cal. The system earned last year $41,848 over operating expenses and taxes. The principal part of the proceeds of the bonds is to be used in completing the electrical equipment of the road. Chicago is recognized as one of the best markets in the country for street railway bonds.

The Kuhlmann Co., of Cleveland, O., have just completed the construction of one dozen closed electric car bodies eighteen feet in length, for the East Cleveland (O.) Railroad Co., among their other orders. These cars are reported to be giving very good satisfaction. The Kuhlmann Co. make a specialty of building complete car bodies ready to receive the truck, and guarantee the lowest possible price consistent with good material and workmanship.

Cummings & McCoy, of Detroit, have just opened an office at 25 Cleland Building. They are general contractors, but make a specialty of laying all kinds of underground electric wires and cables. Mr. Cummings has had a broad experience in electrical work, as for five years he was connected with the Edison company, during which time he had charge of laying Edison mains, and also the installation of electrical apparatus. The firm have in prospect considerable work in Detroit.

The Lima Register Co., of Lima, O., have a register which they claim is simpler, more positive in action and more durable than any other. There is no glass to break, the register can be set to zero each trip, it embosses on a slip or card its number and the number of fares collected, and cannot be manipulated. The dial is ten inches in diameter, so can be readily seen. Among the street railway companies which have used it and sent testimonials to the manufacturers of its value are the White Line Street Railway Co., of Dayton, O., and the Toledo (O.) Consolidated Street Railway Co.

E. P. Allis & Co., of Milwaukee, are receiving a large number of orders for engines. During the last two months the demand for engines of large sizes has been extraordinarily great. Among the railway companies who have recently ordered engines of the company are the following: Washington & Georgetown Railway Co., two 1,000 H. P. and one 500 H. P.; Duluth Street Railway Co. one 1,200 H. P. compound; Baltimore City Passenger Railway Co., two 700 H. P. and two 500 H. P.; Houston City Street Railway Co., one 250 H. P. compound; Milwaukee & Wauwatosa Railway Co. two 125 H. P.; Atlanta & Chattahoochee Street Railway Co., two 150 H. P.; Brooklyn City Street Railway Co., four 900 H. P.

Frank B. Rae, of Detroit, has removed his office from the Hammond Building to Nos. 26 and 28 Cleveland Building. The change was necessitated by the growth of Mr. Rae's business, which is that of an expert and independent electrical engineer. He has many installations in which he is acting as consulting engineer, among them being one for the City of Detroit to supervise the installation of an electric light plant at Belle Island Park. He is also installing a 400 to 600 incandescent lamp light, and a 40 arc light plant in the new Union Depot at Detroit. Among other work he has been engaged in designing apparatus for the Nicholson Hoisting Co. Mr. Rae has had a broad experience in all classes of electrical engineering, and is well qualified to act as the confidential adviser of those intending to install electric railway light and power plants.

The Walker Manufacturing Co., of Cleveland, are extremely busy in supplying machinery for the many cable lines upon which they have received orders. They write us that they are just finishing the machinery for the Catskill Mountain road referred to in a recent issue, are engaged in building the new machinery for the Mount Auburn cable road at Cincinnati, which was recently destroyed by fire, and are at work on considerable cable machinery for Chicago and New York. As an instance of the popularity of the apparatus manufactured by this company it need only be said that they have orders at present for forty-eight of their patent differential drums, four of which are for Sydney, Australia. This company sent out a general invitation to their friends to inspect the thirty-two foot rope pulley which they have recently built for the Broadway (N. Y.) cable railway, which was on exhibition at their works during the first two weeks of May.

The Detroit Electrical Works, owing to the grest press of Eastern business, have found it necessary to open a New York office, which has been located in the Metropolitan Telephone & Telegraph Building, 18 Cortlandt Street, New York City. This office is in charge of Mr. T. W. Warfield as district manager. They have also opened an office in Boston in No. 23 Fiske Building. This company find the demand for goods of their manufacture in the East to be very great, and for the convenience of the Eastern trade have made provision as above, that information respecting their apparatus may be obtained on short notice. The opening of these Eastern offices, when taken in connection with the large extensions they are making to their factory, will enable them to handle a large business in a manner that cannot fail to be satisfactory to their patrons. In another column we give an account of an extensive contract which they have recently secured in Detroit, Mich. As this contract is only one of a number that have lately been awarded the Detroit Electrical Works in face of a sharp competition by manufacturers of other electric railway apparatus, it shows plainly that this company are fully substantiating their claims in regard to their equipment.

The Brightman Stoker Co., Cleveland, O., are equipping many plants with their mechanical stoker and smoke preventing furnace. Among other orders received are the following: From Carnegie, Phipps & Co., (second order) and Booth & Flinn, Pittsburgh, Pa.; Otis Steel Co., Cleveland, O., (second order); Goodrich Hard Rubber Co., Akron, O.; Western Iron Co., Butte, Mont., (second order); Ottumwa Electric Railway Co., Ottumwa, Ia., (second order); Evansville Street Railway Co., Evansville, Ind.; Jackson Electric Light Plant, Jackson, Mich. Superintendent Tharp of the water department, Cincinnati, O., is reported as writing to the Board of Administration that since 1,200 H. P. Brightman stokers and water tube boilers were introduced the same work is now being done that formerly required 1,600 H. P. with old style boilers and hand firing, the price being $248.37 now, against a previous price of $357.52, or a total saving for the year of $39,839.75. Regarding the prevention of smoke Superintendent Tharp writes: "Where 1,600 H. P. of old boilers were in service using the best and most expensive quality of coal to operate the Front Street station, each smoke stack contributing a volume of dense black smoke and soot to the discomfort and expense of the entire neighborhood, now, with the services of 1,200 H. P. new boilers, with improved furnaces, and using inferior quality and least expensive of coal, no smoke whatever can be discovered, except occasionally when cleaning the fires."

The Sioux City Engine Works, of Sioux City, Ia., have been running a full night and day force for the past two months, and have a large stock of engines on hand ready for prompt delivery. They have recently received orders for a 22 x 48 Corliss engine for the U. S. Electric Light Co., of Dubuque, Ia.; one 24 x 48 for the Rhomberg street railway line of Dubuque, Ia.; one 36 x 42 to be used as a twin compound with an 18 x 42 in the Sioux City Electric Light & Power Co.'s works; one 9 x 14 automatic for the Hotel Garretson of Sioux City, and one 9 x 14 automatic for the Hotel Delone of Omaha, Neb. They will soon ship to R. D. Hubbard of Mankato, Minn., one 150 H. P. compound, automatic engine. They are now erecting for the B. & M. Ry. Co., at their new shops at Havelock, Neb., one 18 x 42 Corliss engine, and also one 100 H. P. compound, automatic for the State University at Lincoln, Neb. They have recently started one of their 18 x 42 Corliss in the new factory of Sparr & Weiss, Milwaukee Avenue, Chicago; also a 12 x 36 Corliss in the new factory of Ole Berg, West Side, Chicago; also one 14 x 36 Corliss for Blakeman & Dobson, Rockford, Ill. These people have largely extended their selling department, having selling agencies in Minneapolis, Chicago, St. Louis, Omaha, Kansas City, Dallas and Denver, and have every prospect of the largest output by far of any previous year. They have recently been adding some very large tools to their equipment, and are prepared to make figures on engines up to 1,000 H. P. capacity.

The Railway Equipment Co.

It gives us pleasure to record the prosperous condition of the Railway Equipment Co., of Chicago. The advent of this company, about four weeks ago, has been quite generally mentioned by the trade papers. In the interest of our readers we review the purposes and features of the new company, as stated by the manager, Mr. W. R. Mason. The company will give their whole time and attention to furnishing electric railway supplies. At present their offices are at No. 11 Adams Street, the old quarters of the Electric Merchandise Co., but more convenient and pleasant warerooms are now being fitted up. A complete stock of electric railway material will at all times be carried, and all orders will be filled immediately therefrom. The trade will have increased confidence in the excellence of the material handled by the new company, from the fact that the Electric Merchandise Co. has been purchased by them and shipments will be made from the large stock of the old concern, the quality of which is well known.

Besides the Electric Merchandise Co.'s goods, the Railway Equipment Co. will handle many new and improved devices, the merits of which it is believed will be generally appreciated as soon as tried. The manager of the company, who for several years past has been connected with the Electric Merchandise Co. as president and general manager, holds similar relations with the new company, while his staff inciudes the experienced assistants of the former company. The trade will thus discover in the new venture many old friends upon whom they may place reliance. A new and complete catalogue of electric railway material, with much valuable information regarding the building of electric railways is in course of preparation and will soon be ready for distribution, and everything is being done to place the new house in good working order. A large number of orders have already been filled and the company solicit the correspondence of the trade, and offer their counsel and services to all who desire it in the selection of the latest and most approved railway specialties.

The Providence and Stonington Lines.

The Providence & Stonington Steamship Co. gave a trial trip of their new steel steamer "New Hampshire," May 7, and since that time this steamer has been put into commission between New York and Stonington. The same company on May 9 reopened the popular Providence Line between New York and Boston.

The Robinson Radial Truck.

The Robinson Electric Truck & Supply Co. have delivered all or nearly all of the forty Robinson radial trucks which they contracted to build for the Brooklyn City Railroad Co. and most of these have already been put under the forty cars built for them by the Lewis & Fowler Manufacturing Co., of Brooklyn and J. M. Jones' Sons, of Troy.

In addition to these, the Robinson company have a number of large orders for trucks from companies in various parts of the country for both open and closed cars.

Some important and interesting information has recently been gained in regard to the economy of the operation of the Robinson radial truck. In September last, a test was made on the West End Railway, Boston, of one of the Robinson radial cars in which the car, loaded with 15,000 lbs. of meal, was run over the line with one fifteen H. P. motor. No difficulty was found in making time over the line which included a long 6½ per cent. grade. This test was so satisfactory, that in January last, another of the Robinson radial cars had its two fifteen H. P. motors taken off and these were replaced by a single twenty-five H. P. motor geared to only one driving axle.

The result of these two tests has been that the West End road is changing over all the Robinson radial cars, putting one twenty five H. P. motor on instead of the two fifteen H. P motors heretofore used.

Up to the present time, some twelve or fifteen of the radials have been thus changed. It is found that a single driving axle on the Robinson radial gives all the traction necessary for driving the car under all conditions of summer traffic. The reason of this is apparent, since substantially the whole weight of the car and its load is carried on the two axles heretofore used as drivers; hence each driving axle has one-half the weight of the car and its load for traction. In an eight wheeled car, with two driving axles, the same proportion, *i. e.*, just one-half the weight of the car and its load, is available for traction, so that with one driving axle the Robinson radial secures as much traction as the eight wheeled cars with twice the number.

The ability of the Robinson radial car to run so efficiently with one motor geared to a single driving axle is a revelation to all conversant with the operation of motor trucks in general. There are at present fifty radials on the West End Railway, of Boston, and the company have been making a number of experiments with a radial truck of their own manufacture, patterned in many respects after the Robinson, proving their great confidence in the radial principle.

Detroit Electrical Works.

At the annual meeting of the stockholders of the Detroit Electrical Works, held April 26, the following named gentlemen were elected directors to serve during the ensuing year: Messrs. Hugh McMillan, W. H. Wells, T. H. Newberry, Gilbert N. McMillan, James H. McMillan, Strathearn Hendrie, Louis Warfield, all of Detroit, and Albert A. Pope and George B. Strong, of Boston.

The directors elected the following officers: Hugh McMillan, president; Louis Warfield, vice-president and general manager; Jos. E. Lockwood, secretary; Thomas Muir, treasurer; H. C. Van Husen, assistant secretary.

In a recent issue of the Detroit *Evening News* the following interesting statements were made about this company:

The original location of the works and general offices was at the corner of Seventh and Woodbridge Streets, but in the fall of 1890 was removed to the location now occupied. When the company was first incorporated a small factory was found sufficient for the requirements of the business, but this was soon enlarged until, when the factory was removed to its present location, a building covering ground space 150 x 120 ft., the greater portion of which is three stories high, was found necessary to meet the requirements of the business. To this is now being added a three story structure 100 x 120 ft., which will give this company the largest factory facilities of any electrical institution in Michigan, and one of the largest in the country. The machinery and appliances with which the factory is equipped are of the best and latest design; the arrangement of same and general details of the shop being such as will compare with any factory in the country. The steam engines, which furnish the power to operate this factory, instead of being belted to the shafting, on the old plan, are belted direct to electric generators, the current from which is distributed through the factory by means of wires and used to operate electric motors, each department being equipped with one of these, so that each is independent, and can start or stop its machinery at will, this plan being the most economical for the distribution of a large amount of power throughout a large factory. When the new building is completed there will be in use three engines aggregating 500 H. P. The official management is characterized by an enterprising and judicious direction, and the industry justly takes rank among the largest and most important of its character in the world. The business now includes manufacturing electrical supplies for every department of applied electricity, such as apparatus for electric street railways, electric lighting, electric motors, telephone equipments and general electrical supplies. The electric railway machinery and appliances that this company manufacture are in use upon twenty-nine street railways, which are distributed from Michigan to Texas and from Maine to California. The company are preparing to take up every special application of electricity and furnish machinery and appliances to meet any requirements. The operation of such an immense industry in Detroit means to this city a valuable acquisition, and one which must appreciably advance and fortify its leading and general commercial situation.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, APRIL 26, 1892, TO MAY 17, 1892, INCLUSIVE.

APRIL 26.

Cable Railway Switch, Ira Bishop and Arthur F. L. Bell, San Francisco, Cal. ... 473,652
Car Brake, Horace P. Bassett, Warren, O. ... 473,606
Brake Mechanism for Street Cars, Harry H. Kelly, Willoughby, O. ... 473,510
Electric Locomotive, Sidney H. Short, Cleveland, O. ... 473,674
Electric Locomotive, Joseph I. Conklin, Brooklyn, N. Y. ... 473,693
Fare Box, Samuel O. Tuerk, Fulton, N. Y. ... 473,680
Mechanism for Operating Brakes, George Harrison, Cleveland, O. ... 473,553
Mechanism for Propelling Vehicles, Isaac B. Jones, Xenia, O. ... 473,843
Rail Joint, Milton C. Niles, Oak Park, Ill. ... 473,638
Safety Catch for Inclined Railways, Davis James and Thomas James, Wadsworth, O. ... 473,842

MAY 3.

Bicycle Electric Car, Eben M. Boynton, West Newbury, Mass. ... 474,331
Cable Grip, Theodor Otto, Scheuditz, Germany ... 474,185
Car Brake, John W. Neumann and John R. Pflanz, Louisville, Ky. ... 474,261
Car Heater, Cyrus S. Dean, Fort Erie, Canada ... 474,225
Combined Rail Brace and Truss Fastening for Rail Joints, Frederick H. Heath, Minneapolis, Minn. ... 474,128
Conduit Trolley, James J. Cosgrove, Jr., Philadelphia, Pa. ... 474,218
Electric Motor Mechanism, Samuel E. Mower, New Haven, Conn ... 474,328
Grip Mechanism for Cable Railways, William Hewitt, Trenton, N. J. ... 474,249
Insulating Support for Electric Railway Wires, Abraham A. Shobe, and William Embley, Jerseyville, Ill. ... 474,049
Mode of Arresting Electric Locomotives, Sidney H. Short, Cleveland, O. ... 474,031
Rail Chair, Tie Plate, Truss Joint and Joint Fastening, Frederick H. Heath, Minneapolis, Minn. ... 474,127
Rail Joint, Frederick H. Heath, Minneapolis Minn. ... 474,129
Trolley Wire Circuit Breaker, Johan M. Andersen, Boston, Mass. ... 474,037
Truss Rail Joint Fastening, Frederick H. Heath, Minneapolis, Minn. ... 474,126

MAY 10.

Cleaning Brush for Electric Railways, Rudolph M. Hunter, Philadelphia, Pa. ... 474,472
Electric Railway, Charles H. Baker, Lake Geneva, Wis. ... 474,355
Rail Brace, George H. Mason, Rochester, N. Y. ... 474,560
Railway Car, John Hammond, San Francisco, Cal. ... 474,736
Rail Joint, James C. Gentry, Monroe City, Mo. ... 474,499
Trolley for Electric Railways, Charles E. Friel, Boston, Mass. ... 474,552
Trolley Wire Support, Owen F. Evans, Columbus, O. ... 474,375
Truck for Electrically Propelled Vehicles, Louis Pfingst, Boston Mass. ... 474,402

MAY 17.

Anti-Friction Bearing for Cars, Carl F. Buschner, New York ... 475,007
Cable Car Grip, David D. Nolley, Wilson, N. C. ... 475,143
Cable Railway Grip, John C. H. Stut, San Francisco, Cal. ... 474,875
Device for Bending Electric Trolley Wires, Henry D. Winton, Wellesley, Mass. ... 475,261
Electric Locomotive, Charles Brown, Naples Italy, and Gustav J. Melms, Chicago, Ill. ... 474,984
Electric Motor Mechanism, Elbert B. Phillips, Cleveland, O. ... 474,857
Electric Railway, John W. Grantland, Philadelphia, Pa. ... 475,107
Electric Railway Motor, Sidney H. Short, Cleveland, O. ... 475,160
Grip Car Brake, William Byrnes, Chicago, Ill. ... 474,900
Insulated Gear Wheel, George F. Lockwood, Saginaw, Mich ... 474,913
Railway System, Hugh T. Dunne, New York ... 474,951
Street Car Curtain, Arthur D. Cochran, Indianapolis, Ind. ... 474,902
Tramway Brake, Friedrich Adler, Prague, Austria-Hungary ... 475,171

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

In Memory of Jacob Barnsley.

At a special meeting of the Charles Munson Belting Co., May 17, the following resolutions were adopted:

WHEREAS, it has pleased an all-wise Providence to remove from our midst, after a short illness, Mr. Jacob Barnsley, late director and superintendent of the Charles Munson Belting Co.; and

WHEREAS, It is but just to the memory of our departed friend and co-worker that a fitting recognition of his many virtues should be had; therefore, be it

Resolved, That in the death of Mr. Jacob Barnsley this company has lost an officer to whose energy and keen business foresight is principally due the great success of our enterprise; that we bear willing testimony to his many sterling qualities of head and heart by which he had endeared himself to all with whom he came in contact, and, while missing his good counsel and advice hereafter, we shall always cherish his memory.

Resolved, That our heartfelt sympathies be extended to his family in their affliction.

Resolved, That these resolutions be spread upon the minutes of this company and a copy thereof be transmitted to the family of our deceased friend and co-worker.

Resolved, That the employes of the company attend the funeral in a body.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, May 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co ...	50	1,250,000	Q.—J.	1½	.....	107	.....
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	185	.....
Brooooklyn City R. R. Co. ...	10	6,000,000	Q.—J.	2	.....	176	178
Coney Island & Brooklyn R. R. Co.....	100	500,000	.....	...	.....	125	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.....	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	106
Broadway R. R. Co.....	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds.....	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates.....	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st.....	.....	125,000	F. & A.	7	Aug. 1897	107	.....
South Brooklyn Central R. R. Co., 2d.....	.....	150,000	F. & A.	6	July, 1941	103	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	108	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., May 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.....	100	750,000	Q Feb.	1½	1890	113	115
Watervleit Turnpike & R. R. Co.....	100	240,000	.....	...	1863	10	15

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort...	1865	40,000	J. & J.	5	1905	103	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	102	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	105	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	105	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	105	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103	104
" " " Debenture..	1891	200,000	M. & N.	6	1901	109	110
Watervliet Turnpike & R. R., 1st Mort.....	1889	350,000	M. & N.	6	1919	110	.....
Watervliet Turnpike & R. R., 2d Mort.....	1889	150,000	M. & N.	6	1919	105	.....

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, May 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	27	29
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1	.....	120	123
Christopher & Tenth..... ..	100	650,000	F. & A.	1¾	.....	134	135
Central Crosstown.....	100	600,000	Q.—F.	1¾	.. ..	140	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	115	118
42d & Grand St. Ferry.....	100	748,000	Q.—F.	3	.....	250	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	47	50
Eighth Avenue.....	100	1,600,000	Q.—J.	2	.....	240	.....
Houston, W. St. & Pav. Ferry. Leased to B'way&7ave.....	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	J. & J.	5	.....	106	108
Sixth Avenue.....	100	1,500,000	M. & S.	3	.....	190	200
Third Avenue.....	100	2,000,000	M. & N.	6	.....	230	.....
23d St.....	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue.....	100	800,000	.....	3	.....	128	133

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	113	116
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	104	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	105	.....
Additional.....	.....	1,000,000	J. & J.	5	July, 1905	95	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	116	120
Christopher & Tenth.....	.....	250,000	A. & O.	7	Oct., 1898	108	110
Central Crosstown.....	....	250,000	M. & N.	6	Nov., 1922	115	117
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	100	101
Scrip.....	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry.....	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.....	.....	1,200,000	J. & J.	5	1915	55	57
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	100	107
Second Avenue.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	103
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	112	114
23d St.....	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. May 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.....	50	$6,400,000	J. & J.	4	1887	88¾	89
West End Com'n.....	50	$7,150,000	J. & J.	5	1890–1891	74⅞	75

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, May 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co.....	100	$270,000	New.	...	Oct., 1887	94	96
Union R. R. Co., Prov.....	100	2,000,000	Q.—J.	2	1862–1863	196	200
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. May 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issuc.	Bid.	Ask'd
Springfield Street R. R. Co....	100	$360,000	J. & J.	4	.....	245	250
Holyoke Street R. R.....	100	200,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., May 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.....	50	$100,000	J. & J.	3	.....	.....	65
Enterprise Ry. Co.....	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.....	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., May 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co	100	800.000	Quart.	1½	1867	135	139
Crescent City R. Co.....	100	1,150,000	"	1¾	.866	97½	98¾
Canal & Claiborne R. R. Co..	40	240,000	.....	...	1888	22	26
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	130	131
Orleans R. R. Co.....	50	185,000	"	2	1868	55	62
St. Charles Street R. R. Co ..	50	600,000	"	3	1866	8·¾	91

Bonds.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	102¼	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93–'99	.....	.....
do do new	1886	40,000	M & N	6	1896	.. .	.....
N. O. City R. R. Co.....	1879	495,200	J & D	6	1903	121	.....
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92–'06	113½	.....
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89–'01	.....	.....

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. May 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$30),000	J. & J.	4	.....	25	.....
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	25	.....
New Haven & W. Haven R. R. Co	25	. .....	.....	...	.....	26	.....
New Haven & Centville H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	.... .
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1899	100	.....
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued).....	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, May 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	199	210
BONDS.	Date of Issue	Amount Out-standing.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry	1885	£60,000	.....	5	1965	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., May 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1.000.000	A. & O.	5	Jan. 1891	79	80
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	22	23
BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	94	95
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	113	.....
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	113	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., May 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	347	350
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	97	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	194	194½
West Division City	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	142	142½
BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	98½	99
Chicago Passenger	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,640,000	M. & N.	4½	1927	95¾	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100⅜	.....
West Division Railway	.....	3,790,000	J. & J.	5	.....	101	.....
" " " Ext....	.....	250,000	J. & D.	6	.....	100	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101¼	101¾
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	95½	.....

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, May 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co....	50	1,500,000	.....	...	.....	29½	30
Citizens' Traction R. R. Co ..	50	3,000.000	J. & J.	3	.....	62½	62¾
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	27½	27⅞
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	57	.....
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	25	25⅛
Pittsburgh, Allegheny & Man	50	3,000.000	.....	...	.....	.....	44¼
West End R. R. Co	50	200,000	J. & J.	...	.....	.....	.....
Duquesne Traction Co	50	3,000,000	J. & J.	3	.....	.....	50
Second Avenue R. R. Co.....	50	300,000	.....	...	.....	29¼	29¾
Penn Incline Plane Co	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	.....	.....
Pittsburgh Incline Co	100	150,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co ..	1887	1,250,000	A. & O	5	1927	108½	109½
Pitts. & Birmingham Traction Co	1889	1,500,000	M. & N.	5	1929	101¼	101½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	105	.....
Pleasant Valley Ry	1891	1,250,000	J. & J.	5	1919	.....	102
P., A. & M. R. R. Co	1891	1,500 000	J. & J.	5	1931	104½	105½
Duquesne Traction Co	1890	1,500,000	J. & J.	5	1930	101⅝	101⅞
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co	1887	75.000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort	1883	125,000	.....	6	1903	102½	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	.....	.....
Monongahela Incl'e Plane Co.	1887	50,600	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 410 California Street, San Francisco, Cal., May 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable C'o	100	1,000,000	Monthly	5	.....	115	116½
Central R. R. Co	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R.R.Co	100	1,000,000	.....	1	.....	95	.....
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	50	75
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	37	40
Omnibus Cable Co	100	2,000,000	Monthly	4	.....	58	60
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	22	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	100¼	110
Market Street R. R	.....	3,000,000	J. & J.	6	913	122½	124
Omnibus R. R	.....	2,000,000	A. & O.	6	1918	113½	.....
Powell Street R. R	.....	700.000	M. & S.	6	1912	110½	.....
Park & Ocean R. R	.....	250,000	J. & J.	6	1914	113¾	.....
Park & Cliff House R. R	.....	350,000	J. & J.	6	.....	94	99
Cal. St. Cable R. R	.....	.....	.....	...	.....	103⅝	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., May 18. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine	100	$324,000	Q.—J.	3	1864	102	103
Cass Ave. & Fair Grounds	50	300,000	.....	...	1876	44½	45½
Citizens'	100	1,500,000	A. & O.	1½	1887	100	105
Jefferson Avenue	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	56	60
Missouri	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central	100	200,000	.....	...	1884	100	105
People's	50	1,000,000	M. & S.	6	18-9	40	45
St. Louis	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal	50	150,000	Jan.	.50	1872	15	25
Union	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban	100	2,500,000	.....	...	1891	48	50
BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine	1880	$500,000	F. & A.	6	1900	102	102½
Cass Avenue	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	107	108
Lindell	1890	1,500,000	J. & J.	5	1895-1910	99	100
Mound City	1890	525,000	A. & O.	6	1900-1910	105	106
Missouri Cable	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort	1882	125,000	J. & D.	6	1902	102	105
" 2d mort	1886	75,000	M. & N.	7	1902	104	105
People's Cable	1889	800.000	J. & J.	6	1889-1914	97½	100
Northern Central	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union	1885	150,000	M. & N.	6	1895-1915	102	103
Union Depot	1890	1,600.000	A. & O.	6	1900-1910	105	106

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, May 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'	50	$500,000	Q.—J.	4	1858	260	270
Continental	50	1,000,000	J.—J.	6	1873	120	122
Frankford & Southwark	50	1,250,000	Q.—J.	5	1854	210	212
Germantown	50	1,500,000	Q.—J.	2¼	1858	99	100
Green & Coates	50	500,000	Q.—J.	3	1858	118	120
Hestonville	50	2,050,000	.....	...	1859	34	36
Lombard & South	25	500,000	A.—O.	8	1861	55	58
People's Common	25	1,500,000	M.—S.	2½	1873	49	50
" Preferred	25	750,000	M.—S.	2½	.....	49	.....
Philadelphia City	50	1,000,000	J.—J.	7½	1859	150	151
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	65	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	82	86
Ridge Avenue	50	750,000	Q.—J.	5	1872	220	230
Second & Third	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	196	200
Union	50	1,250,000	J.—J.	9½	1864	170	180
West Philadelphia	50	750,000	J.—J.	10	1857	185	190
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	112	114
Baltimore Traction	25	5,000,000	.....	1	1889	20½	21
Buffalo (N. Y.) Railway	100	6,000,000	.....	...	.....	34	36
Newark (N. J.) Passenger	100	6,000,000	.....	...	.....	29	30
BONDS.	Date of Issue	Amount Out-standing	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	109	110
" " Imp.	1892	1,250,000	M.—S.	6	1901	102½	.....
Germantown, 1st mort	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., May 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, May 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	110¾	111
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	110	110½
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	118	120
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	40
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	77	78
" " " Pref.	100	100,000	.....	6	.....	98	99

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	102	.....
" "	.....	50,000	J. & J.	7	July, 1894	104	.....
" "	.....	50,000	J. & J.	7	July, 1895	.....	110
" "	.....	50,000	J. & J.	7	July, 1896	108	112
" " extended	.....	100,000	J. & J.	4	July, 1896	....	101
	.....	50,000	J. & J.	5	July, '96	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	.....
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D	6	Je. '94-1924	105½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104½	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	115	.....
" " " "	.....	300,000	J. & J.	6	Jan. 1914	107	108
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap.'93-1908	95	100
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., May 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	21	21½

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	113	114
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " cons. mort.	.....	1,500,000	.....	5	.....	93	100
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	109¾	110
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	110¾	111

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., May 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	275	.....
Metropolitan R. R.	50	750,000	Q. J.	...	1864	95	105
Columbia R. R.	50	400,000	Q. M.	...	1870	60	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	40	45
Eckington & Soldiers' Home	50	352,600	.....	...	.....	40	43
Georgetown & Tenallytown	50	200,000	.....	...	.....	.....	55
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	102	.....
do. do. convert.	'83-'91	3,000,000	J. & J.	6	1899-1929	149	150
Eckington & Soldiers' Home	.....	156,000	J. & D.	6	1896-1911	100	.....
Capitol & North O St. R. R.	1891	240,000	J. & J.	5	1921	105	109
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	110	119

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, May 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	35	37
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	38	40
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	.....	25
Newark (N. J.) Pass. Ry	100	6,000,000	.....	...	1890	24	26

BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	90	95
Buffalo (N.Y.) Ry.	1891	5,000 000	F & A	5	1931	94	97½
Paterson (N. J.) Ry.	1891	850 000	J & D	6	1931	....	100
Newark (N. J.) Pass. Ry	1890	6,000 000	J & J	5	1930	89¾	90

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., May 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	170	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	82½	85
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

Financial.

THE Niagara Falls (N. Y.) Street Railroad Co. have voted to increase their capital stock from $100,000 to $250,000.

$ $ $

THE St. Joseph (Mich.) & Benton Harbor Street Railway Co. have decided to issue bonds to the amount of $150,000, to be secured by a trust deed covering all the company's property.

$ $ $

THE stockholders of the Braintree (Mass.) Street Railway Co. have voted to petition the Railroad Commissioners for permission to increase the capital stock to an amount not exceeding $100,000.

$ $ $

THE West End Street Railway Co. of Boston, sold during the first week of May 8,000 shares of new common stock at auction for $577,506, the prices ranging from $72.12 to 72.37 per share. The par value is $50 per share.

$ $ $

THE stockholders of the Fort Wayne & Elmwood Street Railway Co. of Detroit, Mich., have voted to reorganize, as the company has a corporate life of only three years more, while their franchise runs for seventeen years or longer.

$ $ $

THE New York State Board of Railroad Commissioners has approved the application of the Seneca Electric Railway Co. for permission to increase their capital from $40,000 to $50,000, the increase to be used in bettering and increasing the road's equipment.

$ $ $

LAST month the Central Railway Co. of Baltimore (Md.) arranged for a mortgage of $700,000 with the Mercantile Trust & Deposit Co. to cover the issue of 700 $1,000 bonds. 250 of these will be used to take up existing mortgage bonds and the balance will cover the expense of the electrical equipment.

$ $ $

THE quarterly report of the Brooklyn (N. Y.) City Railroad Co. for the quarter ending March 31, 1892, reads as follows: Gross earnings, $803,135.03; operating expenses, $692,465.32; net earnings, $110,669.71. Fixed charges as follows: Interest on funded debt, $50,346.90; taxes on property, $30,000.00; taxes on earnings and capital, $8,100.00; net income, $22,222.81.

$ $ $

THE stockholders of the Federal Street & Pleasant Valley Passenger Railway Co., of Pittsburgh, Pa., voted last month to issue $100,000 new stock with which to take up the $400,000 stock of four of its lateral branch lines, and $325,000 bonds with which to complete its system. The capital stock will now stand at $1,400,000, while the bonded indebtedness will be only $1,250,000—$2,650,000 in all.

$ $ $

THE Consolidated Street Railway Co. of Sacramento, Cal., have sold to N. W. Harris & Co., bankers, $250,000 of the first mortgage, 6 per cent. gold bonds.. The net earnings of the system for the past year are stated to have been $41,848 over operating expenses and taxes. The principal part of the proceeds of the bonds is to be applied to completing the system as an electric street railroad.

THE annual stockholders' meeting of the Southington (Conn.) & Plantsville Tramway Co. was held last month and the report of Secretary L. E. Southworth showed: Total car receipts, $5,166.98; received for lights, $3,759.53; from rental of power, $59.00; number of lights, 462; number of passengers carried in 1890, 110,740; number of passengers carried in 1891, 103,339; net financial gain for the year, about $600.00.

$ $ $

THE Essex Electric Street Railway Co., of Salem, Mass., have petitioned the State Railroad Commissioners for leave to increase their issue of bonds from $100,000 to $180,000. The road is capitalized at $50,000. Civil Engineer Thomas Doane presented a statement of the present property of the road, amounting to $178,849. It is proposed to add electric equipment, buildings, etc., making the entire value $233,038.

$ $ $

THE directors of the Worcester, Leicester & Spencer Street Railway Co. declared, May 4, a dividend to the stockholders of $3 a share, based on the profits of the road during the eight months of its operation. The treasurer's report showed for the period: Total receipts, $53,402.62; total expenses, $36,129.13; profit, $17,273.49. The company are considering the question of increasing the capital stock $125,000.

$ $ $

THE Boston (Mass.) & Revere Electric Street Railway Co. have petitioned for leave to issue $75,000 new capital stock, and $75,000 additional bonds, bringing their total capitalization up to $250,000.

The money is needed to make a through road to connect at Winthrop Junction for Boston proper. The present road is operated only three months of the year. It is now intended to operate the year round. The bonds will bear interest at 5 per cent.

$ $ $

THE Sixth Avenue Railroad Co. of New York City, report for the quarter ending March 31: Gross earnings, 1892, $57,266; 1891, 177,736; decrease, $120,470; operating expenses, 1892, $36,658; 1891, $117,827; decrease, $81,169; net earnings, 1892, $20,608; 1891, $59,969; decrease, $39,301; other income, 1892, $333; 1891, $233; increase, $100; total income, 1892, $20,941; 1891, $60,142; decrease, $39,201; fixed charges, 1892, $5,116; 1891, $17,000; decrease, $11,884; surplus, 1892, $15,825; 1891, $45,323; decrease, $29,398. The company report the cash on hand $92,161, and a profit and loss surplus of $94,433.

$ $ $

AT a meeting of the directors of the Pittsburgh Traction Co., of Pittsburgh, Pa., held May 6, the vacancies on the Board caused by the resignations of Thomas S. Bigelow and Joseph G. Wainwright were filled by the election of C. L. Magee and Wm. Flinn. A dividend of 3 per cent. on the capital stock of the company, which amounts to $1.50 share, was declared payable on and after May 15. P. A. B. Widener and Willlam L. Elkins were present, and the directory, as now constituted, is as follows: George W. Elkins, C. L. Magee, P. A. B. Widener, William Flinn, William L. Elkins and George W. Wilson.

It was decided to largely increase the facilities of the Forbes Street portion of the Duquesne traction line, and more cars will be placed on that branch.

$ $ $

THE Lake Street Elevated Railway Co., of Chicago, have certified to an increase of capital stock from $3,000,000 to $5,000,000. The West Division railway of the same city are, it is understood, contemplating the issue of a 4½ per cent. first mortgage bond to take up their outstanding 5 per cent. debenture bonds, which were issued in 1887, and are optional after July, 1892, amounting to $4,040,000. Such an issue would decrease the annual interest charges of the company to the benefit of the West Chicago Street Railroad Co., who day the interest on the bonds under the lease agreement. A financial paper of Chicago says: "The bonds would undoubtedly meet with a ready sale, and be a favorite with the public if made as contemplated—twenty-five to forty years without option and payable in gold."

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WANTED.—A position as Superintendent or Assistant with an Electric Road, by a young man thoroughly competent in all branches. Address J. E. M., P. O. Box 792, Syracuse, N. Y.

WANTED.—Position as electrical engineer for street railway or electric light plant. Seven years experience; can give best of references. Address "J. W.," care STREET RAILWAY JOURNAL, New York.

WANTED.—Position as M. M. or Superintendent of an Electric Railroad by man who has had large experience in steam and electric railroading. At present superintendent electric railway equipment factory. Address "RAILROADER," care of STREET RAILWAY JOURNAL, New York.

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Inquire of "Attorney," care of Street Railway Journal.

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125 tons second-hand 38 lb steel tram rails, in excellent condition.
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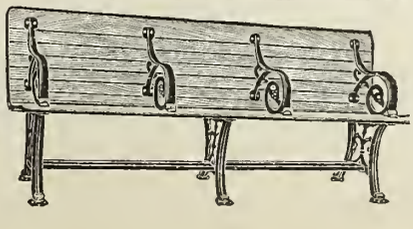
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A New Electric Railway Company.

The Carbondale Traction Co. is the name of a corporation recently organized and building a road 8½ miles long in Carbondale, Pa. The contract for the entire roadbed construction, girder and T rails and all curves and special work has been given to the Johnson Co. The Thomson-Houston Electric Co. will supply the motors. Six Brill cars will each be equipped with two W. P. 30 H. P. Thomson-Houston motors, and two Edison generators with Frick Corliss engines will supply the power. The Thomson-Houston company will also do all the construction work. Nearly three miles of track are completed and the road will be running by June 20. The company was organized by A. H. Chadbourne, who represents the Thomson-Houston company in their Philadelphia office. The road runs from Simpson, through Carbondale, Mayfield, Mayville and Jermyn to Archbald and will supply 30,000 people with a much needed rapid transit. The capital has been supplied largely by gentlemen outside of Carbondale who are interested in various other roads in the state.

A Luxurious Car.

Speaking of the Private Compartment Cars, we quote from the San Francisco *Daily Report* of January 20, 1892, the car being identical with those in daily service on the New York & Chicago Limited over the Lake Shore Route :

" Isn't this too lovely for anything !" exclaimed a very pretty Oakland girl yesterday afternoon as she entered the Wagner compartment car attached to the Wagner vestibule train of sleepers which brought out the Eastern press delegates last week.

A D. R. reporter, standing near, at once became interested, for whatever receives so favorable a comment from an æsthetic damsel residing in the Athens of the Pacific must needs be lovely. The girl was right. Standing in one of those luxurious compartments, with everything so bright, attractive and comfortable, an irresistible desire to travel in a Wagner car seized the reporter. "All the comforts of home" and everything that the heart of the traveler could desire was there. Hot and cold water within two feet of him as he reclined indolently on what in the daytime was the most comfortable of lounges and at night is miraculously changed into the softest and most sleep inducing kind of bed. Cut off from the curious stare of his fellow travelers, the tourist can gaze his fill at the passing scenery and, when wearied of that, he can turn his gaze inward and amuse himself by wondering how the ingenuity of the Wagner people must have been taxed to devise so many comfortable things and put them in so small a space.

Even the most æsthetic tastes could not find subject matter for offense in a Wagner compartment car. All the colors blend nicely, the dark, handsomely stained wood of the car harmonizes with the elegant frieze covering of the seats.

The compartment car is in the same style as those run on the famous limited train between New York and Chicago. It has ten connecting staterooms, furnished in different styles of woods, upholstered with silk damask to correspond with the wood. The seats are covered with the finest kind of frieze plush.

The car is steam heated, and each compartment is lighted by gas and contains a lavatory, hot and cold water, closet, etc.

Oh, yes—the reporter forgot about that pretty Oakland girl. He was just in time to catch her last sentence as she stepped off the train, and this was it, honor bright : " I vow, I'll never travel in a Pullman sleeper again."

A Choice List of Summer Resorts.

In the Lake regions of Wisconsin, Northern Michigan, Minnesota, Iowa and the two Dakotas, there are hundreds of charming localities pre-eminently fitted for summer homes. Among the following selected list are names familiar to many of our readers as the perfection of Northern summer resorts. Nearly all of the Wisconsin points of interest are within a short distance from Chicago or Milwaukee, and none of them are so far away from the "busy marts of civilization" that they cannot be reached in a few hours of travel, by frequent trains, over the finest roads in the Northwest—the Chicago, Milwaukee & St. Paul Railway, and Milwaukee & Northern Railroad :

Oconomowoc, Wis.	Marquette, Mich.
Minocqua, Wis.	Clear Lake, Iowa.
Waukesha, Wis.	Lakes Okoboji, Iowa.
Palmyra, Wis.	Spirit Lake, Iowa.
Tomahawk Lakes, Wis.	Frontenac, Minn.
Lakeside, Wis.	Lake Minnetonka, Minn.
Kilbourn City, Wis. (Dells of the Wisconsin).	Ortonville, Minn.
	Prior Lake, Minn.
Beaver Dam, Wis.	White Bear Lake, Minn.
Madison, Wis.	Lake Madison, So. Dakota.
Delavan, Wis.	Big Stone Lake, So. Dakota.
Sparta, Wis.	Elkhart Lake, Wis.
Pewaukee, Wis.	Ontonagon, Mich.
Wausaukee, Wis.	Mackinaw, Mich.

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THE STREET RAILWAY JOURNAL

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The Yonkers (N. Y.) Electric Railway.

The increase in the earning capacity of a street railway caused by a change from horse to electric power is often considerable, and sometimes changes an annual deficit in the balance sheet to the showing of an annual surplus of earnings over expenses. An instance of how a line in the hands of a receiver, and with operating expenses greater than receipts, can be transformed by the adoption of electric power into a profitable enterprise is shown in the case of the Yonkers street railway. The road was purchased from the bondholders about four months ago by a syndicate who believed in the economy of electric compared with animal power for street car propulsion, and at present electric motors are running on two of the three divisions, and the entire line is being equipped as rapidly as possible.

The electric franchise at Yonkers was secured in the face of great opposition, owing partly to the telephone interests and partly to that element existing in every community in greater or less degree, which is always opposed to improvements of every kind; but it is interesting to note that the divisions equipped with electric power are carrying from two to two and a half as many passengers as when horses were used to draw the cars, and that many of those who at first opposed the installation of overhead wires are now most anxious to have the electric line extended in the direction of their property.

On the portion of the route equipped with electric apparatus the same rails are in use as when the line was operated by horses. The construction consists of centre bearing tram rails of about thirty-five pounds weight, spiked directly to the stringers and held to gauge by tie rods placed at intervals. The return circuit is made by bonding the rails, and also by the use of the Sabold return system, previously described in these pages. This consists in driving between the rails at intervals of sixty feet a galvanized iron rod, seven feet long, and electrically connecting these rods to the rail bonds on each side. Although there is a deep layer of broken stone under a considerable portion of the track, this method of return seems to give good satisfaction, and no trouble has been experienced with the telephone service, although the latter also uses a grounded return.



FIG 1.—STREET SCENE—YONKERS ELECTRIC RAILWAY.

The overhead construction was installed by J. G. White & Co., and the trolley wire is supported by tubular span wire poles for a considerable distance within the city. In the outskirts octagonal wooden poles, neatly painted, are employed.

The station is located, with the offices of the company, near the railway station of the New York Central Railroad Co., from which the street railway tracks extend in several directions, and which is about the central point of the street railway system.

The boiler equipment consists of three eighty horse power boilers of the Stirling water tube type, so arranged

that the coal is delivered directly in front of the furnace doors. The feed water heater was supplied by the National Pipe Bending Co. of New Haven. A Worthington pump is also located in the station, but as the pressure from the city main is about 125 lbs., no feed water pump or injector is usually required.

The engines employed are two in number, of 125 H. P. each, single acting, non-condensing, and were supplied by the Ball & Wood Co., of New York. The cylinder dimensions of each are 15×16 ins. The engines give very good satisfaction and maintain a practically constant speed in spite of extreme variations in load. During a short circuit which occurred at one time on the line and caused the generator belt to be thrown off while one engine was running, the latter did not increase its speed perceptibly with entire removal of load. Only one engine is used at one time, and the engines with generators are run on alternate days. It is the intention of the company to always have one engine, generator and boiler in excess of the number actually required to operate the plant in case of an accident to any part of the power apparatus. The present arrangement of the engine room is shown in Fig. 3. The generators are of the Edison make, 100 K. W. capacity each, and were compound wound. The belts were supplied by the Jewell Belting Co., of Hartford, Conn.

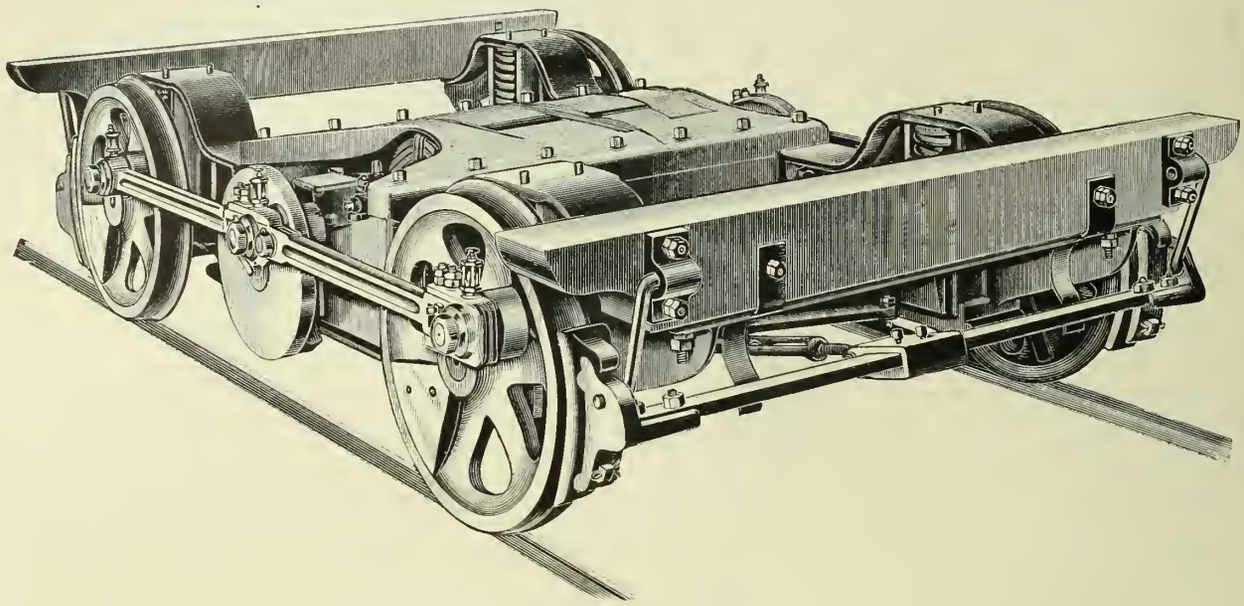


FIG. 2.—EICKEMEYER MOTOR TRUCK—YONKERS ELECTRIC RAILWAY.

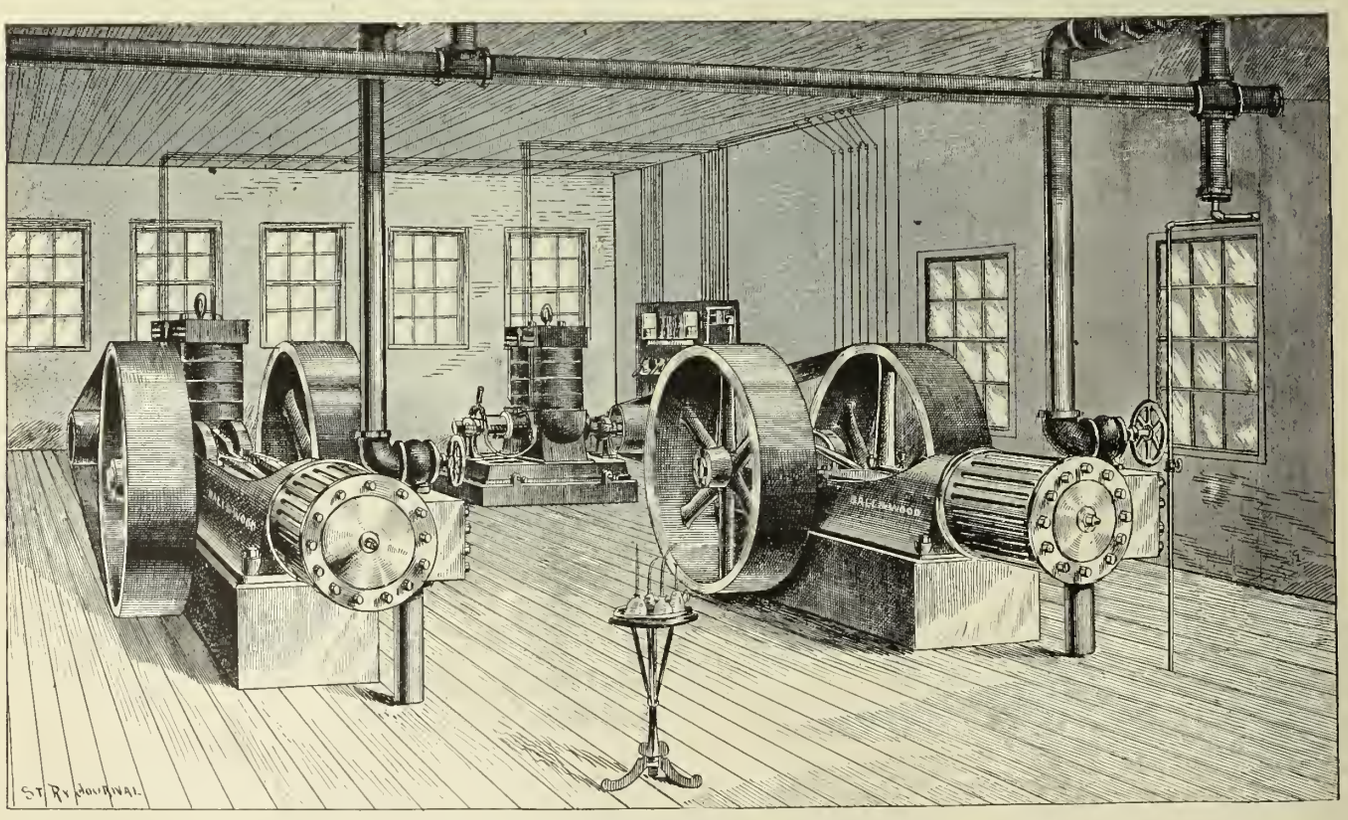


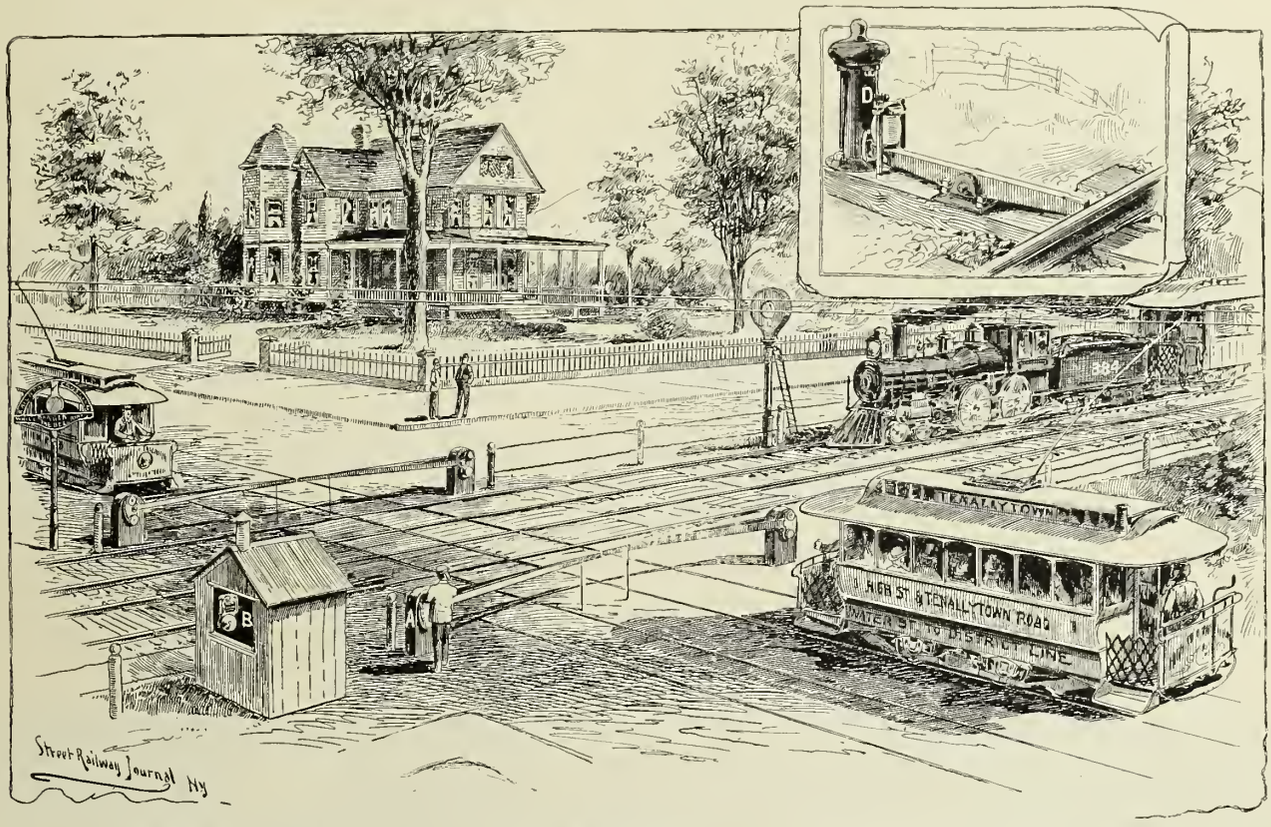
FIG. 3.—INTERIOR OF POWER STATION—YONKERS ELECTRIC RAILWAY.

The electric cars, of which there are at present six in operation, and two being equipped, are extremely neat and tasteful, and were supplied by the John Stephenson Co., Ltd., of New York. The registers were made by the Standard Index & Register Co., of New York, and Smith headlights are used. The motor equipment immediately

attracts attention, and is of the Eickemeyer-Field type, already described in these columns in connection with the plant of the Toledo Consolidated Street Railway in our April issue. The single gearless motor used for driving the car is placed midway between the car axles, and is flexibly supported on them by a frame of special design, so that while the motor is rigid in the direction of travel its entire weight, with that of the frame, is cushioned on springs vertically. As shown in Fig. 1, which gives a street scene in Yonkers, and in Fig. 2, which shows the arrangement of the motor on the truck, the armature of the motor drives the car axles by means of connecting rods, jointed and provided with swivel boxes at their extremities, to provide for any slight vertical motion of the motor owing to its flexible support.

Although the entire weight of the motor truck with twenty horse power motor for a sixteen foot car is about 9,000 lbs., the manufacturers claim that, owing to the fact that its entire weight is cushioned, the pounding on the track is much less than with a lighter equipment, where part, or all, of the weight of the motor is supported directly by the car axle. This enables them, they claim, to operate on a much lighter rail, if necessary, than with other equipments, and upon a roadbed which, like that of the Yonkers electric railway, was originally built for horse traction.

Another important feature of the equipment is that car wheels of small radius can be used, owing to the position of the motor between the axles and the small amount of vertical space required. The car wheels at Yonkers are but twenty-six inches in diameter, making it very easy for passengers to enter or leave the car.



STREET AND STEAM RAILWAY CROSSING PROTECTED BY THE HALL AUTOMATIC DANGER SIGNAL.

Electric Crossing Signals.

The Hall Signal Co., of New York, have devised a type of highway crossing signal which is especially adapted for use on cable and electric lines where there is a possibility of the power failing while a car is crossing a steam track. The automatic signal may be used alone or in connection with safety gates operated by a gate tender.

Ordinarily, an audible signal is all that is necessary, and this usually consists of a signal stand with a bell suitably housed, which is caused to ring by an approaching train, thus warning the car driver in time to prevent crossing in the face of danger. When used in connection with gate, A, it is arranged that a bell in the gateman's cab, B, rings, giving notice of the approaching train in time for the gateman to close the gates before the crossing is reached. In case the gateman fails to close the gates, a signal instrument, C, placed at a suitable distance from the crossing, and which stands at danger when the gates are open, stops the train before it arrives at the crossing.

The operation of the signal will be readily understood by an inspection of the accompanying engraving. The principal, or track, instrument is shown at D and consists of a wooden lever properly balanced and so placed that it will be depressed by the wheels of a passing train, its outer end at the same time forcing upward a piston which moves in a closed chamber, and communicates motion to a lever of the circuit closing apparatus. The piston operates in an air chamber having two apartments connected by a port and so arranged that the confined air constitutes a cushion which prevents the piston rod from being thrown forcibly against the top cap, and also retards its fall and prevents injurious shocks. The track lever is confined between two rubber springs which are so compressed that any weight less than that imposed by the car wheels fails to operate the piston. The circuit being normally open, the operation of the lever conducts the current by means of a wire to the bell, which starts it ringing, and at the same time locks the instrument so that the bell continues to ring until the train shall have reached a second instrument on the other side of the crossing, which breaks the contact and silences the bell. The battery and interlocking instrument are usually located at the crossing. By a simple arrangement of interlocking and track instruments, the bell may be made to ring by the approach of a train from either direction on a single track.

These safety appliances have been in successful operation on a number of lines and seem to present an effectual way of reducing a serious danger element.

The Baldwin Locomotive Works are at work for the North and West Side Chicago street railway companies on a number of steam motors similar to the one imported from Belgium, and which has been recently running on their lines. The motor cars when finished will draw one trailer each and will operate on the feeder lines.

Chicago City Company's New Loop.

The new downtown loop of the Chicago City Railway Co. has been completed and cars have been operated over it during the last three weeks of June. The fact that the company needed a second loop in the centre of the city has been repeatedly stated in these columns; but the City Council while ready and anxious to criticise the company for failing to increase their facilities, still persisted in refusing a new loop. The old loop was badly overcrowded, as cars from both the State Street and Wabash Avenue systems traveled over it. The public demand finally became so persistent that the council yielded and made such a grant that the company now have a loop for each of their two systems.

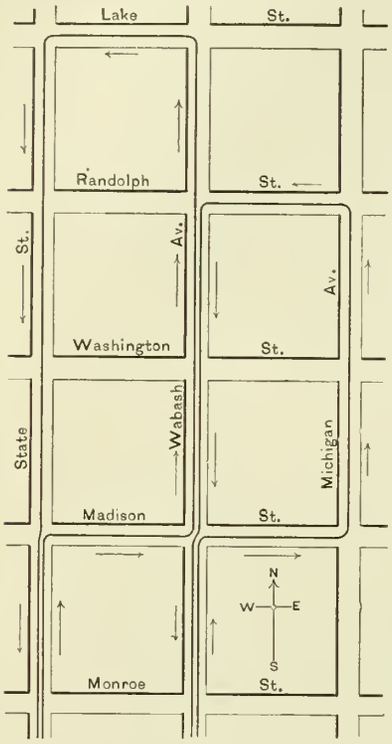


FIG. 1.—MAP SHOWING OLD AND NEW LOOP.

Work was started in the early part of May, and while the company were anxious to complete the undertaking by the middle of June this was feared to be impossible. Thanks to Superintendent Bowen's energetic efforts, the work was finished on the eleventh and cars were running over it the following day. It was a matter of no little public interest, as the Democratic Convention, June 21, Derby Day, June 25, and July 4, promised to make great calls on the resources of the company.

Fig. 1 is a map of that section of the business centre in which the loops of the Chicago City Railway Co. are located. The cars on the State Street line running north, loop on Madison Street, Wabash Avenue, Lake Street and back on State. The new loop, which is traversed by all cars running north on Wabash Avenue, commences at Madison Street, turns east and is completed on Michigan Avenue, Randolph Street and Wabash Avenue. Its length is 3,750 ft.

For five or six days prior to the completion of the new loop it was found necessary to stop all north bound cable trains at Madison Street in order that work might be prosecuted at the curves without interruption. It was therefore necessary to provide complete switching facilities on Wabash Avenue and State Street. It was by no means an easy problem to solve, as the use of a sufficient number of horses to do the work was out of the question as they would have blockaded the street. It was determined to make use of the grip cars to switch the trailers, connecting the two with a long rope. A pair of stout horses were able to do such work as was not performed in the manner indicated. This plan, though adopted with some fear, as there was danger of tripping people, if care was not exercised, worked admirably.

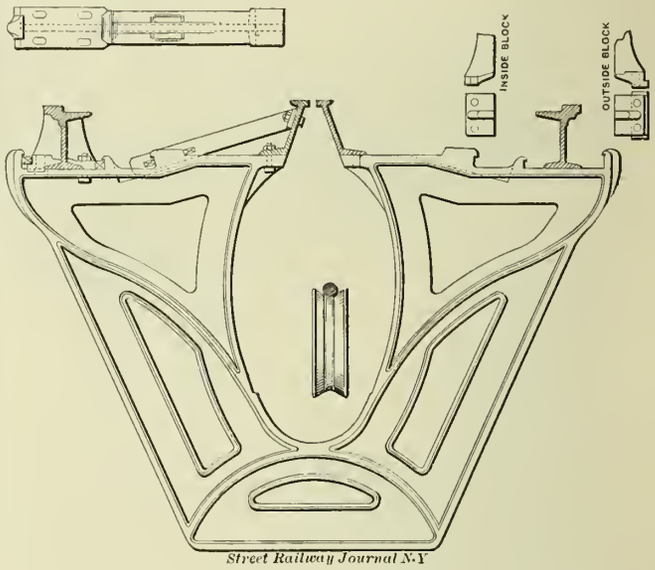


FIG. 3.—CABLE YOKE

For the most part work was prosecuted day and night. Fig. 2 shows the curves at the corner of Wabash Avenue and Madison Street looking north on the former thoroughfare. The photograph was taken on the day before the loop went into use, and it is noticeable that a considerable amount of work remained to be done at that time. It, perhaps, should be stated that work at the curves progressed as rapidly as at any point along the line. The material came to the spot all ready to go together and it merely was necessary to fit it into position.



FIG. 2.—CHICAGO CITY COMPANY'S NEW LOOP, CORNER OF WABASH AVENUE AND MADISON STREET.

The construction work on the loop embodied a number of special features, and the curves were entirely new in design. The design of the yokes (Figs. 3 and 4), the adjustment of the rail and the slot and the pulley are all

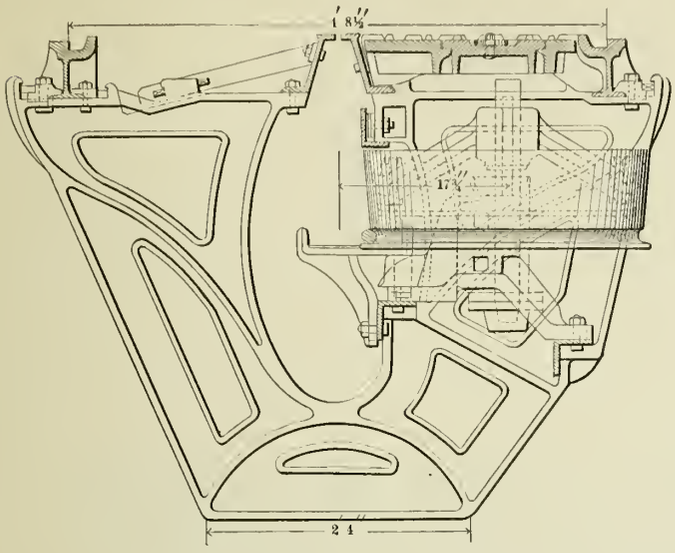


FIG. 4.—CURVE PULLEY AND YOKE.

new. The pulley is especially worthy of note on account of the departure from ordinary construction. It was designed by Mr. Elmer A. Hovey of the company and patented by him. Several months ago a test of the pulley was made on the curve at the corner of Fifty-fifth Street and Cot-

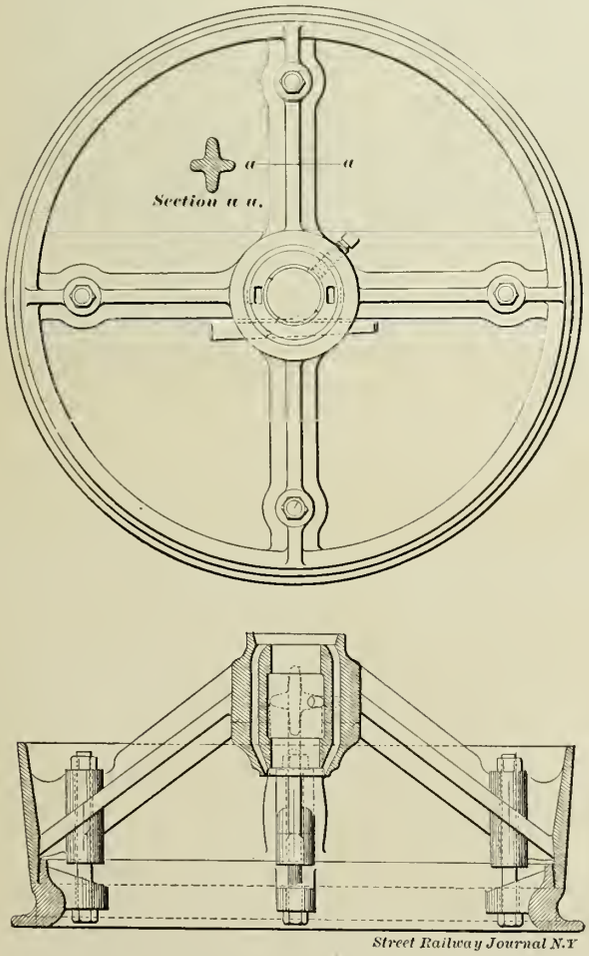


FIG. 5.—DETAIL OF CURVE PULLEY.

tage Grove Avenue. It has been in operation ever since and has given such satisfaction that it was decided to use it in the new loop curves. It is a pulley with dished or beveled spokes and carrying a hub high enough to permit the bearing to come just in the centre of the box (Fig. 5). By its use friction is materially lessened, it is claimed. A pulley thirty inches in diameter can be used and be readily taken out between the rail and the slot. The yokes are set four feet apart, and two angle irons from yoke to yoke are so fitted as to carry a hanger. The box is so held by the latter that it can be readily removed and another substituted. Just a little below the line of the cable is a cast iron guard upon which the cable rests if it becomes slack. It falls back into position again when it is tightened. Over each pulley is a cover reaching from yoke to yoke and resting on them, having in its centre a hand hole (Fig. 6). By means of passages or oil ways through the hub the box below can be oiled without stopping the pulley. The box is babbited, and the shaft,

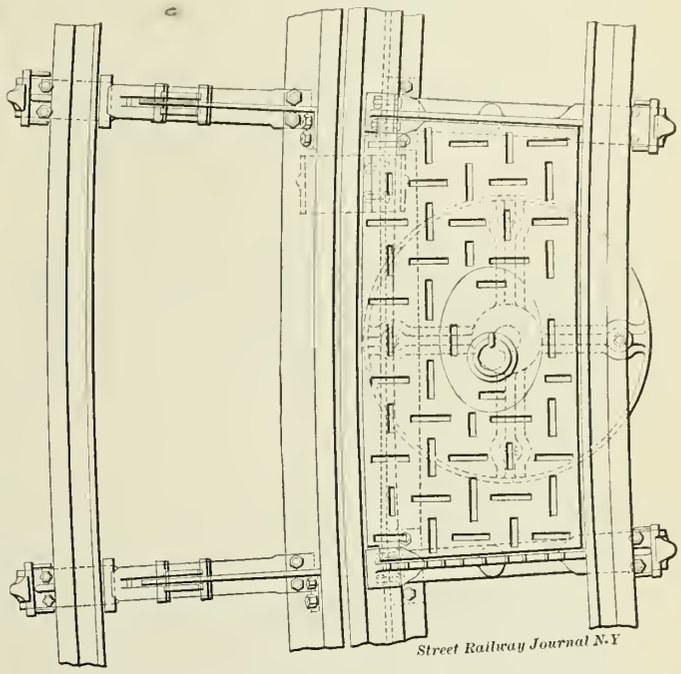


FIG. 6.—CURVE PULLEY COVER AND HAND HOLE.

which is two and three-quarters inches in diameter, cold rolled steel, rests on a step brass bearing. The pulley is provided with a chilled grooved ring which can be easily removed and another substituted. No wear, therefore, comes on the main body of the pulley. This feature of interchangeable rings for cable pulleys has been employed by the company since 1887. In the new loop 127 pulleys of the type here described have been used.

St. Louis & Suburban Railway's Plant.

The career of this company has been one of the most interesting of any in this country. In the year 1885 what was then the St. Louis Cable & Western Railway began the operation of the first cable road in St. Louis. The best streets for traffic being occupied by the horse railways, the company had to take what was at hand. The route selected did not affect the patronage, however, and the cars were crowded all the time. There were defects in the system, as in all others of the earlier cable roads, and one of them, the most antagonistic to the employment of the cable, was an unusual number of curves. Then a novel method of construction was employed, the yokes being joined to sheet iron, shaped like the conduit, and then laid in sections of about thirty feet each. The first girder rail ever used in St. Louis was laid on this road. The yokes were of the old railroad rails correctly shaped. The power equipment was very soon found to be insufficient, and the two 375 H. P. engines were replaced by two of 750 H. P. each. The latest cable winding machinery was employed in the second plant. This has since been sold to the original builders.

In after years electricity came to the front, and was adopted by the Lindell Railway, the cable road's greatest competitor. Travel gradually declined, and this led finally to the adoption of electricity, and the abandonment of the cable and steam divisions. In the meantime the old St. Louis Cable & Western was christened the St. Louis & Suburban. The power station, car shed and

main offices of the company are located at De Hodiamont, and are partly in the city and partly in St. Louis County.

The power station is a substantially built brick structure, running east and west, and measures 199 × 131 ft.

ENGINE AND DYNAMO ROOM.

The engine and generator room (shown below) measures 153 × 131 ft. It is well lighted, having an unusually large number of lantern windows. The engine equipment consists of three 750 H. P. Hamilton-Corliss engines. Two of these were used in the old cable station, and are always run together in the electric station. The cylinder dimensions of the three engines are 30 × 72 ins., and the stroke seventy-two inches. Each engine is equipped with an automatic oiling device. There are two fly band wheels, one belonging to the two (old cable) engines, and the other to the third. The former has a 72 in. face and the latter 60. The weight of each wheel is 40 tons, and each makes 64 revolutions per minute. The engines being slow speed, clutches of the Hill make and shafting are used. The shafting is 9 ins. in diameter, makes 189 revolutions per minute and is equipped with self oilers. The main belts are 72 ins. and 58 ins. wide. Of the pulley belts, two are 34 ins. and ten 16 ins. wide. The belts were made by the Shultz Belting Co., of St. Louis.

The generator equipment consists of twelve compound wound machines of the Thomson-Houston type. Of these ten make 750 revolutions per minute, and two 450. Eight are 75,000 K. W., two 80,000, and two 270,000. The two latter are new machines of the multipolar type, and are of 360 H. P. capacity each. The voltage maintained is 540. On the two large machines is the new device of the Thomson-Houston company for cooling the armatures.

The switchboard is very handsome, being built of antique oak. The switches, rheostats, resistance coils, etc., are all of the Thomson-Houston make. The lightning arresters are at the rear of the board, and are sixteen in number. The entire road is divided into five sections on the board. There are twenty feeders, nineteen of which run east from the power house. All the wiring in the room is placed in a conduit.

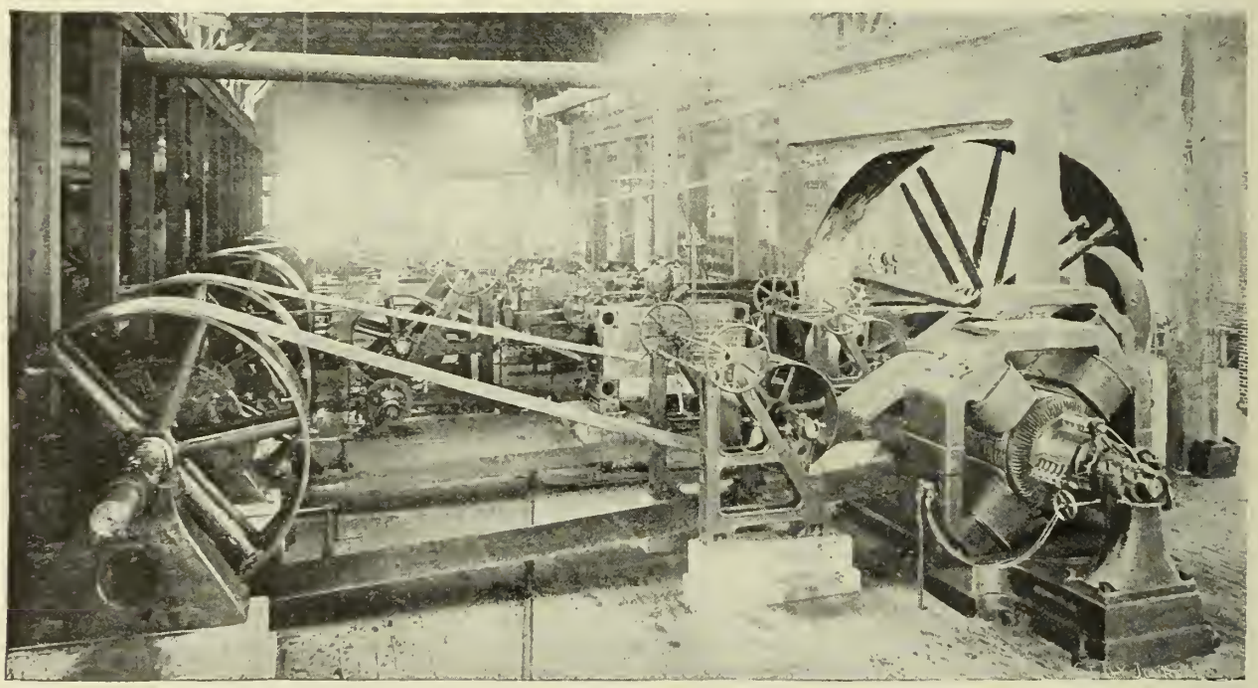
BOILER ROOM.

The boiler room measures 131×46 ft. The equipment consists of four batteries of two boilers each, and each battery is of 375 H. P. capacity. Each boiler is 20 ft. long, has a diameter of 70 ins., and has 25 flues each of 6 ins. diameter. The boilers were made by Rohan Bros. of St. Louis. A pressure of 120 lbs. is maintained. Water is supplied by two No. 10 Hooker pumps. There are two Rohan feed water heaters of 1,200 H. P. capacity, 16 ft. in length, and 54 ins. diameter each. The water is heated to 210 degs. Fah. There are two large cisterns in the boiler room capable of supplying water for a fourteen hours' run.

The coaling facilities are excellent, a railroad switch running into the boiler room, and requiring that the coal be handled twice only. The ashes are removed by means of an overhead traveling bucket with trap door bottom. The steam piping from the boiler room to the engine and dynamo room is partly overhead and partly underground. Each of the four batteries of boilers has an iron smokestack, ninety feet high and fifty inches in diameter. A fifteen ton overhead crane traverses the engine room, thus enabling the easy transfer or uplifting of heavy pieces of machinery.

TRACK CONSTRUCTION.

The company now has in operation 28.22 miles of track. Of this amount a little over eight miles is laid with a special rolled Wharton girder rail, 70 lbs. to the yard, laid in 4 in. steel chairs spiked to sawed white oak ties 5×7ins.×7 ft. The curve rails are of the Wharton girder type, 86 lbs. to the yard, and are placed on oak ties measuring 6×8ins.×7 ft. From 6th and Locust Streets, the eastern or downtown terminus to Van Deventer Avenue, the old cable roadbed is utilized. The concrete forming the conduit was allowed to remain and serves as ballast. The yokes were also retained, and being too far apart for heavy electric railroading, channels were cut between them, and in each a tie was inserted. The rails are fastened to the ties only by means of Wharton high rolled steel chairs, and simply rest on the spokes. The joints are imperceptible on account of their evenness. The Forest Park line, connecting with the main line, and running across Union Avenue to the park, is laid with the same rail and chair. The ties are here placed 24 ins. between centres. From Van Deventer Avenue westward to Florrissant the company uses their private way, acquired in the days of the narrow gauge steam road. Here a 40 lb. T rail is laid, placed on 6×8in.×8 ft. rough hewn oak ties, and spaced 24 ins. between centres. From Van Deventer Avenue to Wells the road is double track, and from Wells to Florrissant, a distance of ten and a quarter miles, single track. A large amount of the double track portion is stone ballasted. The grades on that line are not heavy, none exceeding 7 per cent. On the T rail portion the radii of the curves vary from 400 ft. to 2,607 ft., and on the



INTERIOR OF POWER STATION—ST. LOUIS & SUBURBAN STREET RAILWAY CO.

girder rail portion from 30 ft. to 80 ft. The difficulty in getting around the 30 ft. curves presented to the cable cars may be imagined. The strain was sometimes so great on the grip that stoppage in the middle of the curve was consequent.

OVERHEAD CONSTRUCTION.

The overhead construction is a fine piece of work. That portion of the road now extending from Sixth and Locust Streets to Van Deventer Avenue is equipped with 300 iron poles measuring 30 ft. in length, and of three sections whose diameters are 6 ins., 5 ins. and 4 ins. There are twenty Phœnix pattern corner poles. On the Union Avenue line are used forty-five centre poles of the Phœnix pattern. From Van-Deventer Avenue to Florrissant, 940 ft. and 410 ft., white cedar poles are used. All the iron poles were sunk in concrete placed in holes six feet deep. The trolley wire in use is No. 0, guaranteed 97 per cent. pure. The span wire is No. 4 galvanized steel, the supplementary wire No. 4 soft drawn copper and the feed wire No. 00, three braid, hard drawn copper wire. The span wire for the guard wires is No. 8 annealed steel, and the guard wires themselves are No. 9 of the same material. The guard wiring only extends from Sixth and Locust Streets to Van Deventer Avenue.

The track wiring extends along the wagon tread of the rails, in the girder rail construction, and is connected to every joint. At every 125 ft. it is connected with the

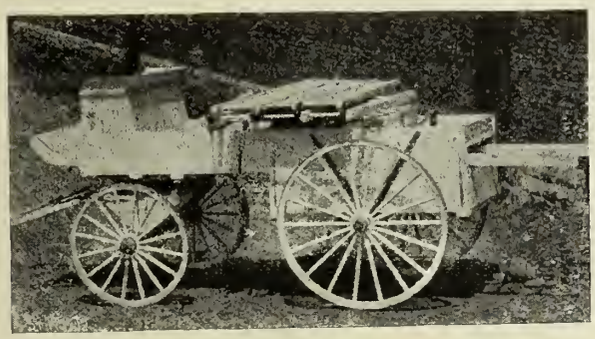


FIG. 1.—"HURRY UP" TOWER WAGON.

old cable yokes, which in turn connect with the sheet iron which formed the old conduit. In the T rail construction from Van Deventer Avenue to Wells, each rail has a No. 4 copper wire, connected at each joint with bond wires. The two supplementary wires are laid thirty inches helow the track and joined every quarter mile. From Wells to Carsonville there is one supplementary wire, and from Carsonville to Florrissant, none. There are two lightning arresters along the line, grounded to old car wheels and the supplementary wires. That portion of the road west of the power station is provided with automatic circuit breakers, so that any trouble arising in that direction will not interfere with the city portion of the system.

ROLLING STOCK.

The car equipment consisted, before the company's car shed was burned, of sixty motor, sixty trail and thirty twenty-eight foot cars. The motor and trail cars have sixteen foot bodies, and are twenty-four feet over all. Each motor car is equipped with two Thomson-Houston fifteen horse power S. R. G. motors. An equipment of twenty-eight foot cars has been ordered, each of which will be propelled by two twenty-five horse power motors of the above type. The twenty-eight foot cars first mentioned are remodeled double deckers that were used on the old cable road. The upper story has been taken off.

The company's extensive car shed, burnt during the past month, an illustration of which appears in another part of this issue, was 500 × 150 ft., and capable of accommodating 150 sixteen foot cars. S. L.

MR. CRUMP of Columbus, Ind., will build a three-quarter mile extension to his road this summer, and will convert three miles of mule line to electric. He will probably require four or five electric cars.

"Hurry Up" Tower Wagon.

Tower wagons have proved themselves such a necessary portion of the equipment of every electric street railway that a new type is particularly interesting. In the accompanying engravings Fig. 1 shows a "hurry up"

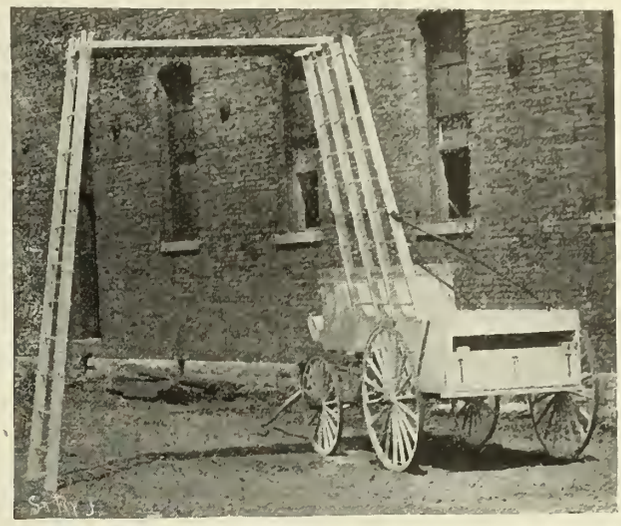


FIG. 2.—"HURRY UP" TOWER WAGON.

wagon, built by G. S. Blakeslee of Chicago, folded up as it usually stands at the barn ready for instant use. It will be readily seen that the wagon is so compact that there is nothing to prevent the team starting at a moment's notice, and at a full run. When the break in the wire is reached it is but the work of a few moments to elevate the tower and stretch the ladder, which can be easily done by two men.

Fig. 2 shows the top raised and everything ready for work. As will be seen, the bridge is formed over the track so that there need be no interruption of the traffic, since the cars can pass directly under the platform where the man is at work. In this position the wagon is especially valuable in case of fire, since the operators can take



FIG. 3.—"HURRY UP" TOWER WAGON.

the hose belonging to the fire department, climb the ladder and spread it across the platform thus removing it from the way of the cars which can continue to operate. Fig. 3, shows the arrangement when the wagon is on the track.

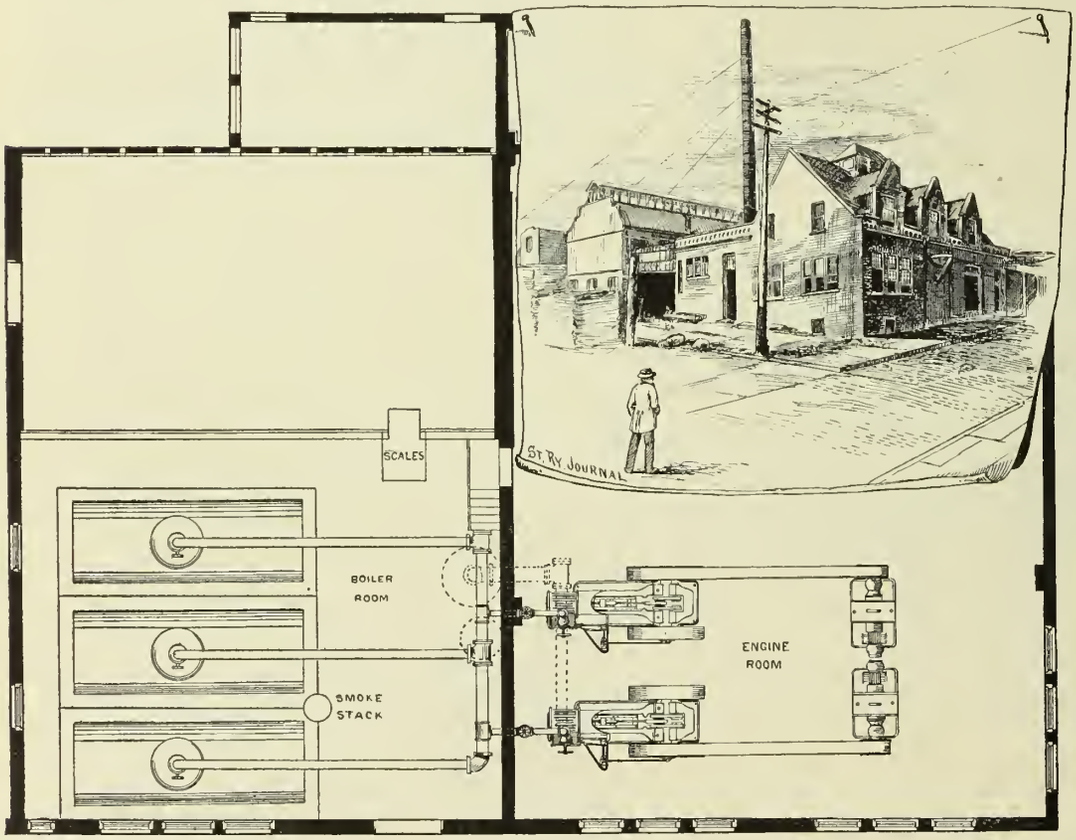
THE Capitol, North O Street & South Washington Railway Co. of Washington, D. C., have requested permission to change their name to the Belt Line Railway Co.

The Electric Railway at Wilmington, N. C.

If electricity has shown itself a desirable agent for the operation of street cars in our larger cities, it has also certainly demonstrated its advantages in the smaller cities and towns of this country, and in many localities has shown its ability to earn a living in towns of 10,000 inhabitants or less.

One of the first of the small towns in the country to install an electric railway system was Asheville, in North Carolina, and the success of this line was widely felt throughout the Southeastern states, and led to the direct electric equipment of a number of other lines in the same state. Of the five cities in North Carolina, which have as high as 5,000 population, four have possessed electric railways for a considerable time, and on May 1 the latest line was opened in Wilmington, the principal town of the State, having a population of 23,000 inhabitants.

For four years the Wilmington Street Railway Co. have had in operation in that city seven small horse cars over about four miles of track; and in December last this line was purchased by a syndicate, several of whom had been instrumental in the organization of the Asheville and other North Carolina roads.



PLAN AND EXTERIOR VIEW OF POWER STATION—WILMINGTON ELECTRIC RAILWAY COMPANY.

The track of the old horse car line had been laid with a thirty-two pound T rail laid upon cross ties, four feet apart. In rebuilding for electricity a mile of this track which lay on a paved street was taken up, and in its place there was substituted a forty-five pound Lewis & Fowler rail placed on ties two feet six inches between centres. Throughout the rest of the route the original rail was used, but the track was resurfaced and the number of cross ties was doubled. The contract for reconstructing the roadbed and building the overhead lines was let to J. G. White & Co., of New York. Situated as Wilmington is, in the heart of a yellow pine region, wooden poles were, of course, employed in the overhead construction.

The power station, shown on this page, was erected with the view of having a substantial, neat and conveniently arranged building at the least possible cost. The main building is of brick, and the whole of the lower floor, 68 × 45 ft. is reserved for the engines and generators. At present a temporary partition is run across one end, forming an engineer's store room and the superintendent's office. This leaves ample room for the accommodation of five 15 × 16 in., high speed engines and their generators. Should a sixth be required later, the wooden partition can be removed, and the superintendent's office located on the second floor.

Immediately adjoining the engine room are the boiler room and coal bin. The former is of sufficient size to accommodate three horizontal, return tubular boilers, built by the Union Works of Erie, Pa., and the latter will hold a cargo of from 450 to 500 tons of coal. Adjoining the engine and boiler rooms is the car shed which has room for twelve cars, and a freight track for the delivery of coal by rail.

The engine equipment consists of two 130 H. P., simple condensing engines built by the Ball Engine Co. of Erie, Pa., who were also the contractors for the supply of the boilers and the rest of the engine equipment. The feed water heater is of the Goubert pattern, and one Davidson, 300 H. P., independent air pump and condenser is used. The condenser and heater are so connected that they may be used together or separately, or the engines may be run non-condensing. Much attention was given in the designing of this station to its adaptability in future growth. In all additions of engines and boilers the distance between them is maintained at a minimum. The steam and exhaust pipes are of such size that should the entire engine room be fully occupied no changes would be required in the present pipe connections. The water for condensing purposes is obtained from Cape Fear River. The station electrical equipment consists of two Edison, 100 K. W., railway generators directly connected to the engines by Jewell belts.

The subject of ventilation, an important consideration in a Southern climate, was carefully considered and provided for. Located at the junction of two streets and facing the river, the corner fronting on the streets was reserved for the engine room, so that the windows would catch all the air possible. The engine room floor is five feet above the ground line, and the air openings are ample. An air shaft 9 × 16 ft. is carried through the second story and roof to a cupola, with the result that there is always a strong upper draft. This air shaft is also arranged so that it will ventilate the company's offices. The architect of the station was C. S. Luce of New York, and the contract price for the building complete, exclusive of engine, generator and the boiler foundations, was $10,000, with extras such as changes, office fittings and other minor improvements amounting to $200. The foundations for the engines and boilers consist of thirty feet spiles capped with 12 × 12 in. timber and planked with four inch board, on which is a layer three feet five inches thick of concrete. The cost of these foundations and of the dynamo foundations, was about $1,400, making the total cost of the power station, exclusive of machinery, in the neighborhood of $11,600.

The electric car equipment consists of six eight seat open cars and two sixteen foot closed cars, built by the Lewis & Fowler Manufacturing Co., of Brooklyn, and

equipped with two horse power, S. R. G., Thomson-Houston motors. Four of the eleven horse cars purchased with the road are being overhauled and repainted for use as trailers.

In addition to the equipment already described, the company under their exclusive franchises have constructed along the water front a dummy line, which when completed will connect all the railways entering Wilmington with the wharves, warehouses and principal mills of the city. This line will be operated by the Baldwin compound steam motor recently described in these pages. The officers of the Wilmington Street Railway Co. are C. A. Lieb, president; J. H. Barnard, vice-president and general manager; B. F. O'Connor, secretary; J. G. White, treasurer.

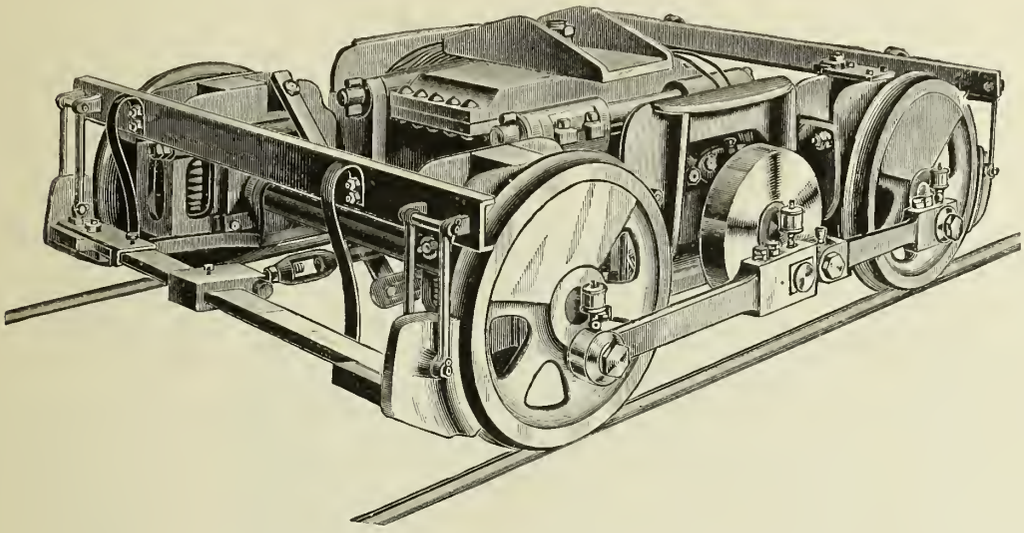


FIG. 1.—EICKEMEYER-FIELD BOGIE TRUCK FOR LONG CARS.

Eickemeyer-Field Bogie Truck for Long Cars.

The latest type of Eickemeyer-Field electric motor bogie truck for long cars having a wheel base of four feet eight inches, is shown in Fig. 1. The motor and its arrangement are the same as with a single truck car, and consist essentially of a gearless machine mounted in a frame of special design and arranged to drive both axles by means of parallel rods.

The motor is of the iron clad type; the steel castings, which entirely surround the field coil, protect them from accidental injury and also act as a part of the magnetic circuit. The field coils are not mounted on pole pieces, but surround the armature, making the length of the magnetic circuit as short as possible and utilizing all the lines of magnetic force. The field is commutated for speed regulation, and when the coils are in parallel has a resistance of less than half an ohm. The armature has a resistance of three-quarters of an ohm, and is built up of wrought iron discs and wound with coils of No. 9 B. & S. wire, so arranged that the separate armature coils do not cross each other, and any one can be removed. This arrangement secures perfect electrical and mechanical balance in all positions of the armature; each coil is of the same resistance, and every convolution in the same relative position with reference to its opposite convolution.

The motor itself is mounted in the square cast iron frame in such a manner as to allow of easy inspection or repair, a removal of but four bolts allowing the motor to be run from under the car body. The thirty horse power motor, such as is used on the truck shown, has a speed of 150 revolutions per minute, when a car is running at twelve miles per hour. The frame supporting the motor is a single, nearly square casting, and is entirely closed underneath, so that no mud or moisture from the street can reach the electrical apparatus. It is

Street Car Service at the Minneapolis Convention.

The visitors to Minneapolis during the recent Republican Convention, as well as the citizens of that city generally, were unanimous in their commendation of the excellent way in which the street railway company took care of the immense crowds during convention week. At the termination of the sessions in the large hall the number of persons who required transportation immediately was of course tremendous; but it was a noticeable fact that the service was ample for the occasions, and would-be passengers were kept waiting for accommodation for only a very short time. The average number carried during the days of the sessions by the cars was 100,000, and the maximum number in one day was 175,000. Another interesting fact is that though the number of passengers carried was very large, and the streets were crowded with thousands of foot passengers and hundreds of carriages, there was no accident of any kind.

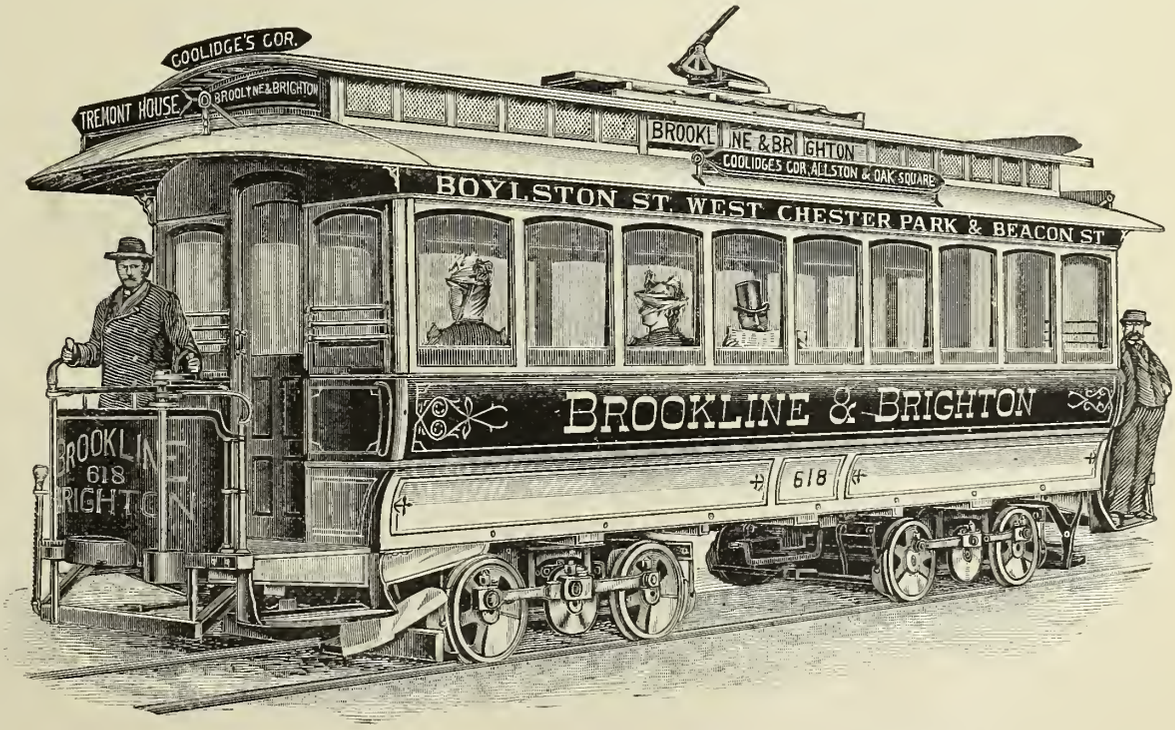


FIG. 2.—CAR ON WEST END STREET RAILWAY, BOSTON, EQUIPPED WITH EICKEMEYER-FIELD MOTORS.

spring supported and cushioned on the axles vertically while rigd horizontally.

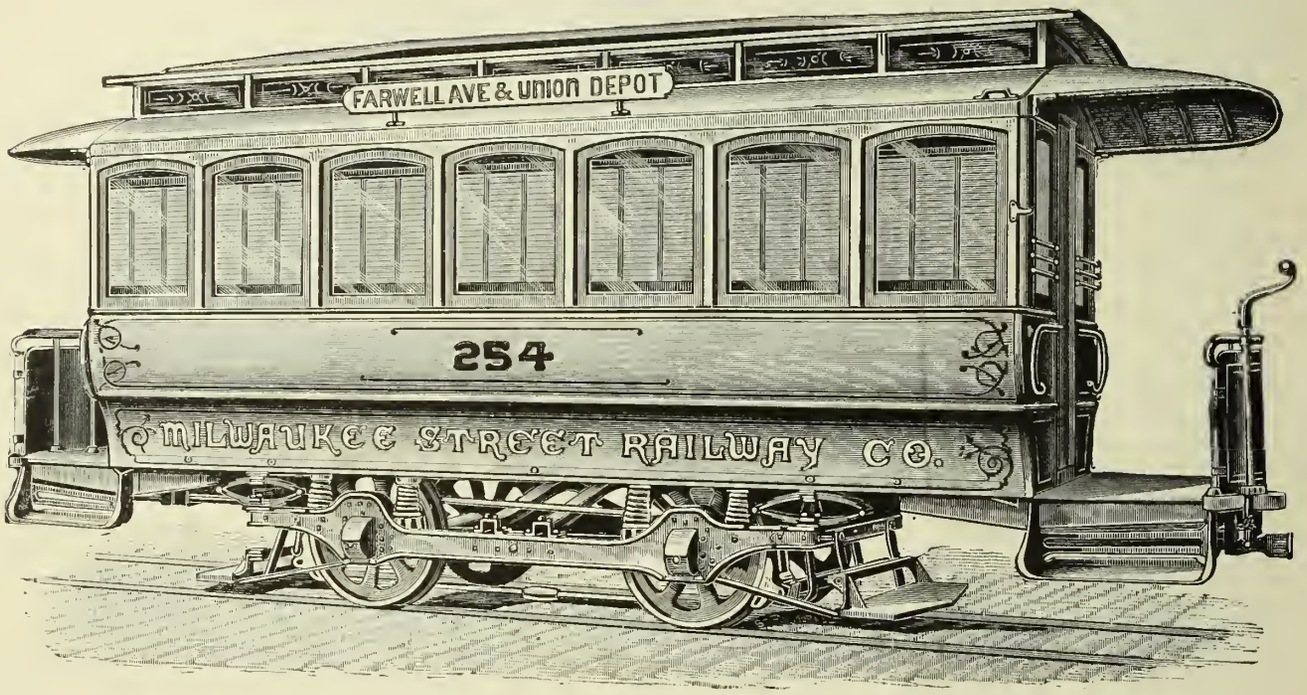
Connecting rods being used to transmit power from the armature shaft to the wheels, the rod to one wheel is jointed near the disc pin and provided with swivel boxes at its extremities so that no matter what track irregularities are encountered there is no consequent binding of parts or undue friction.

Owing to the location of the motor between the two axles where ample space is available, the car wheels on this truck are only twenty-four inches in diameter, and the lowest part of the motor frame is four inches above the ground, making the car easy of access for passengers.

New Electric Equipment at Cleveland.

The track construction on the line of the Woodland Avenue & West Side Street Railway Co., which have recently decided upon the adoption of electric power, will be of the most substantial description. The company have adopted for their roadbed a 98 lb. girder rail rolled by the Johnson Co., of Johnstown, Pa.

The dimensions of the rail will be 8½ ins. high, 2 ins. head, 3 ins. tram, 1⅛ ins. height of head and 5½ ins. base of rail. This rail will be spiked directly to oak ties, 5 × 8 ins., and placed 2 ft. between centres The ties at joints will be 5 × 12 ins. The fishplate will be very wide and have a bearing above and below. It will lap on three ties and have in all sixteen bolts which will be in two rows and staggered.



NEW CAR FOR MILWAUKEE STREET RAILWAY COMPANY.

Fig. 2 shows an Eickemeyer-Field thirty-three foot car in operation on the West End Street Railway, Boston, Mass.

Car for the Milwaukee Street Railway Co.

The accompanying engraving shows one of the electric cars recently built by the Milwaukee Street Railway Co. by the American Car Co. of St. Louis. As will be seen from an inspection of the engraving, the car presents a very neat appearance. There are seven windows on each side, the name of the company is on the lower concave, and the route on which the car will run is designated on a sign carried on the roof.

The length of the car body is eighteen feet seven inches, and the interior is fitted up very handsomely and tastefully. The car body is mounted on one of the latest type of trucks manufactured by the McGuire Manufacturing Co., of Chicago, and it will be equipped with two Edison motors.

IN a recent interview, Mr. Charles T. Yerkes, of Chicago, said that the Love electric conduit on his lines has been giving very good service in spite of the very wet weather which Chicago has experienced during the Spring months. Two cars are now running on the section of road equipped with the conduit, and they are carrying more passengers, and at a less cost, than was formerly done with four horse cars.

THE streets of Chicago were filled by thousands of visitors during the Democratic Convention in the latter part of the month, and the facilities of the street railway companies were taxed to the utmost. The latter gave a splendid service, and handled the crowds in a most excellent manner.

A section of the rail is shown in this column, see Fig. 1. About a mile of track will be laid with an 82 lb. rail on chairs until all the 98 lb. rail necessary for the road can be secured. The motors, as already mentioned, will be of the Westinghouse type, two twenty-five horse power motors being provided for each car. The car bodies will be supplied by the J. G. Brill Co. The original order was for fifty cars, but the company finding it impossible to equip all their lines this year reduced the number to forty. The bodies are 21 ft. long, 29 ft. over platforms, and are mounted on Brill's improved No. 13 trucks which have elliptical springs at the extreme corners of the truck, and a 7 ft. 6 in. wheel base. The cars are finished in solid

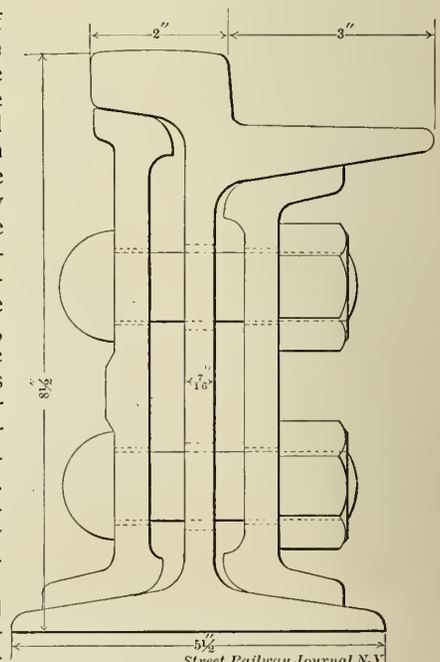


FIG. 1.—SECTION OF RAIL—WOODLAWN AVENUE LINE, CLEVELAND.

polished mahogany throughout, with decorated veneer ceilings, automatic spring roller curtains, spring seats upholstered with Wilton carpet, and solid bronze trimmings both inside and outside. They will be heated with six Burton electric heaters placed under the seats in each car.

The arrangement of the seats was to secure facility in the receipt and discharge of passengers, and, as will be seen from the accompanying diagram, Fig. 2, the plan decided upon differs materially from that of the ordinary car. The platforms have steps at one side only, being at the right hand rear corner platform and the left hand forward corner, the other two corners being enclosed by the dashboard which extends to the corner posts of the car. There

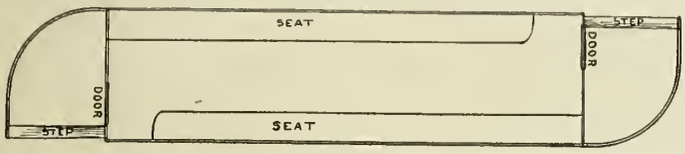


FIG. 2.—PLAN OF CAR—WOODLAWN AVENUE LINE, CLEVELAND.

is one extremely large door at each end of the car at the corner next to the step, the balance at each end of the car being occupied by one large window. One end of each seat is cut off about eighteen inches next to the door, thus providing large passageways direct to the step and reducing the seating capacity of the car only two persons.

The engines, which will be employed at the power station, will be of the upright, triple expansion type, of 500 H. P. capacity each, and will be supplied by the Globe Iron Works Co., of Cleveland. They will be coupled direct to Westinghouse generators. The boilers will also be supplied by the Globe Iron Works Co. and will be of the marine type.

The Sharpsburg (Pa.) Electric Railway.

One of the latest electric street railways in the city of Pittsburgh is the branch and extension of the Citizens' Traction railway. The Citizens' Traction is one of the oldest street railway corporations in Western Pennsylvania, and its president is John G. Holmes, also president of the American Street Railway Association.

Until 1888 the road was operated by horses. In the latter part of that year, however, the management decided to transform the main lines, running from the "down-town" district of the city to the East End and Lawrenceville, respectively, into cable lines. One of the branch roads of the company, running from Lawrenceville to Sharpsburg, a distance of four miles, was, until recently, operated by horses. It is this branch, which has since been changed into an electric road, and which was operated by that method for the first time on December 8, last year. Small as this electric road is in comparison with many others, since it only runs ten cars, there are many points about it which make it extremely interesting.

Fig. 1 shows exterior of the power house of the electrical branch. In the boiler room is a battery of three 125 H. P. tubular boilers operated by Murphy stokers. The engine room is entered from the boiler room, and is very handsome in appearance. The floor is of hard wood highly polished and covered with varnish and shellac. Long strips of India rubber matting are laid upon the places where there is the most walking.

There are three generators of eighty kilowatts capacity each, belted directly to the engines. The switchboard is of slate and stands a little distance from the wall, this arrangement affording easy access to the wires which are carried under the floor in a conduit.

Adjoining the power house is the car shed which forms part of the building in which cars of the cable lines are housed. The house is well lighted, spacious

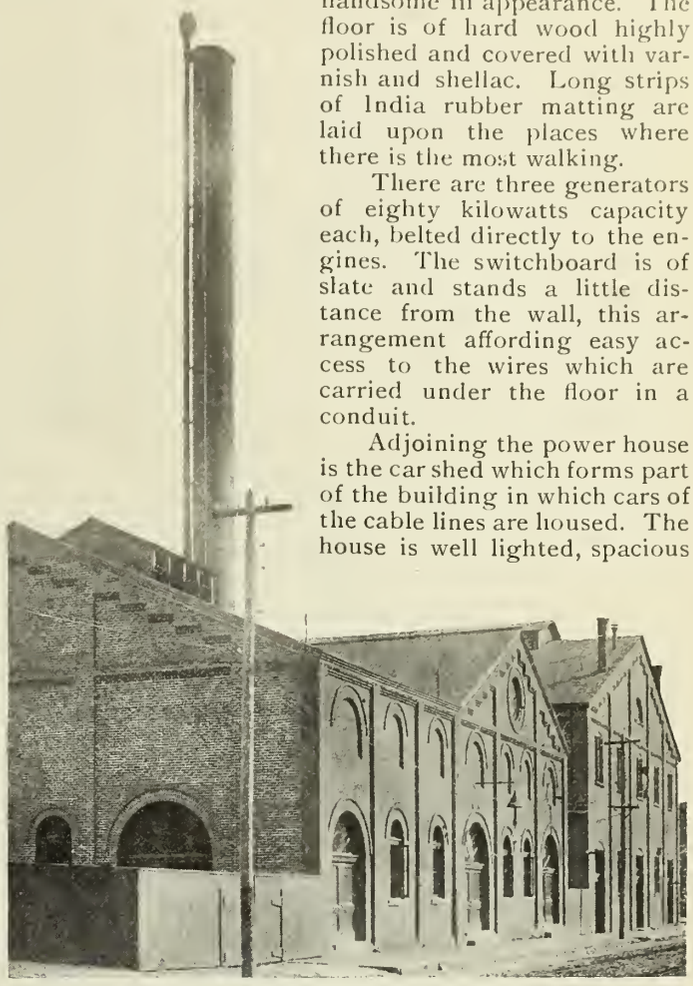


FIG. 1.—EXTERIOR OF STATION—SHARPSBURG ELECTRIC RAILWAY

and is arranged so as to afford an easy inspection of the cars before and after each round trip. It is one of the rules of the company that no car shall leave the shed until it has been submitted to an inspection so that there is no doubt that everything, from the wheels to the trolley pole, is in good working condition. This may seem somewhat exacting, and may possibly be considered by some as superfluous, but the managers of the road feel convinced, from experience, of the wisdom of the course.

In the basement of the car shed the company have a complete machine shop fitted with drill presses, lathes and planers. All the machines in this shop are operated by Westinghouse direct current electric motors (United States type). This machine shop has been established by the company for use of both the cable and electric divisions.

The line operated consists of nearly four miles double track. The roadbed is laid with Johnson girder rails, resting on three feet of solid concrete bottom. Fig. 2 presents a view of a bridge by which cars cross the Allegheny river,



FIG. 2.—BRIDGE ACROSS ALLEGHENY RIVER—SHARPSBURG ELECTRIC RAILWAY.

Improved Short Single Reduction Motor.

So much attention has been given by the technical papers to the double reduction and gearless motors manufactured by the Short Electric Railway Co. that the merits of the single reduction motor manufactured by the same company have been to a considerable extent overlooked; but, from the increasing demand for the single reduction motor it may reasonably be inferred that this machine is likely to outstrip its more popular rivals.

This motor did not spring clean cut from the inventor's brain, but, like most important inventions, it has been improved by successive steps and along lines suggested by the behavior of the different parts in actual service. This fact is strikingly apparent when its graceful lines are studied and the careful designing of each separate part is noted. Hence our illustrations, Figs. 1 and 2, are not of a new motor, but of one that has been in service a considerable time and which has earned by economical and efficient service a clear title to the claims made for it.

Having had the opportunity of watching its performance in service and of studying the successive steps in its manufacture at the company's shops at Cleveland, we are able to present from original sketches this improved motor to the street railway public.

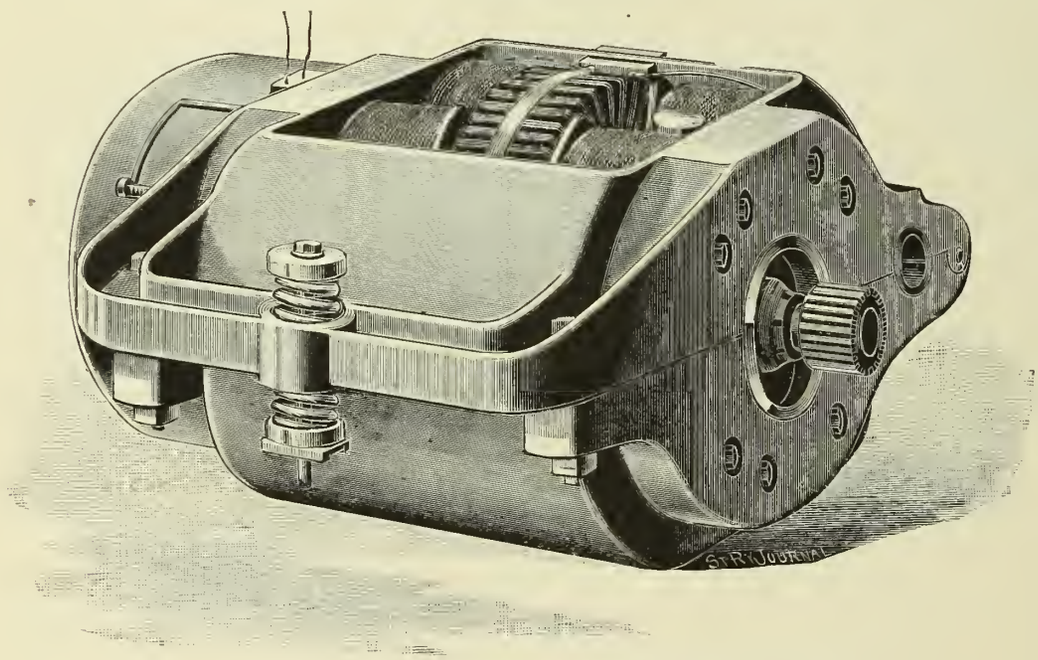


FIG. 1.—VIEW OF SHORT SINGLE REDUCTION MOTOR, IMPROVED TYPE.

THE FIELD MAGNETS.

have the same general shape as those employed in the other types of Short motors, but the cores and pole shoes are cast in one solid piece of soft steel which is afterwards annealed, and which has very high magnetic qualities, the tests showing it capable of being forced up to 130,000 C. G. S. lines per square inch, or 20,200 per square centime. The coils are wound directly upon the core, from which they are carefully insulated by a composite insulation nearly one-fourth of an inch thick consisting of layers of shellacked paper, rubber cloth, mica and duck. The wire is supported at the ends and securely held in place by means of brass heads which are firmly secured to the core.

THE ARMATURE CORE

is eighteen and a half inches in diameter and about four inches wide, and is built up, as are all the ring armatures of this company, by winding a ribbon of sheet iron directly upon the hub, the turns of iron being insulated from each other by a ribbon of tissue paper which serves to prevent the formation of eddy currents in the core. The hub is of bronze and has a long bearing upon the shaft, as shown in the engraving, to which it is securely fastened by means of a key and two set screws.

The bobbins are wound with flat wire about twice as wide as it is thick, which renders them strong and stiff mechanically, the shape of the wire not affecting its electrical qualities. The bobbins are carefully insulated from the core by composite insulation of the same description as that used on the magnets, about one-eighth of an inch in thickness. This, when the shellac is dry, becomes a hard, compact sheet, both mechanically and electrically strong, and not liable to be affected by moisture. The armature is composed of forty-eight bobbins wound with a continuous wire, but each is divided into three sections, and each section is connected by means of soldered copper strap and a flexible, composed of fine German silver wires, with a commutator bar, there being three times as many bars as bobbins. The bobbins being thus subdivided there is, comparatively, a small number of turns of wire between the consecutive commutator segments, which obviates in a great measure the spark, due to self induction. The bobbins, being raised above the core, provide for ample ventilation of the whole motor, as the projections of the bobbins serving as paddles to draw the air on one side down into the frame, and expel it on the other. For this reason the armature will stand a higher current density than if the matter of ventilation was neglected. The method of armature winding followed in the Short type of motors makes it possible, should any one of the forty-eight bobbins happen to burn out, to rewind it without disturbing the others or removing the armature from the shaft.

The object of employing German silver wire for the connections, or flexibles, as they are called, between the bobbins and commutator bars is because it is mechanically stronger and less liable to crystallize from the jarring of the truck than copper wire. It is not so good a conductor as copper, but this deficit is made up by using a larger flexible. The flexibles are insulated by rubber tape which is laid on very thickly by hand, thus insuring perfect insulation, and are led from the armature to the commutator bars over a wooden sleeve which covers all intervening metal parts. A layer of rubber cloth is first placed upon the sleeve, and the flexibles being in position they are interwoven with strips of tape, so as to hold them firmly in position and prevent any possible motion which might tend to rub through the insulation. A covering of twine is then wound over them, and finally a covering of heavy duck with shellac.

THE COMMUTATOR

is nine inches in diameter, and is composed of 144 bars. The bars are stamped out of hard drawn copper plates having the proper bevel. This material is considered by the manufacturers best both electrically and mechanically, because it is a better conductor, stands the wear of the brushes, does not eat away so rapidly from the sparking, and when in place there are no burs to cut through the mica insulator. The construction of the commutator is such that there is complete protection from injuries due to flashing, the continuous metal parts which hold it together being separated from the bars either by mica or a very long air space. On the outside a mica ring insulates the bars from the commutator head and projects a quarter of

an inch beyond the ends of the bars, leaving the head out of the way of any flash that might occur at the brushes. On the outside the commutator body is entirely covered by the shaft wires and the insulation protecting them.

The commutator body and head are of cast iron, and the head is secured by means of bolts which provide for its being held firmly in position. Mica is employed as an insulating material in the manufacture of the commutator, and this is prepared by carefully splitting the sheets into the ultimate leaves which are again laid with shellac so as to prevent the possibility of a metallic vein in the mica from completing a circuit between the bars. The flexibles being connected with the commutator bars the armature is placed in a lathe and the commutator trued up to the centres on which the shaft was turned. It is then mounted on ways and balanced, after which and inspection, it is ready for testing.

THE BRUSH HOLDERS

are of a novel type and so constructed as to hold the ordinary carbon brush with an even, light pressure square upon the commutator. To secure this two clock springs are employed,

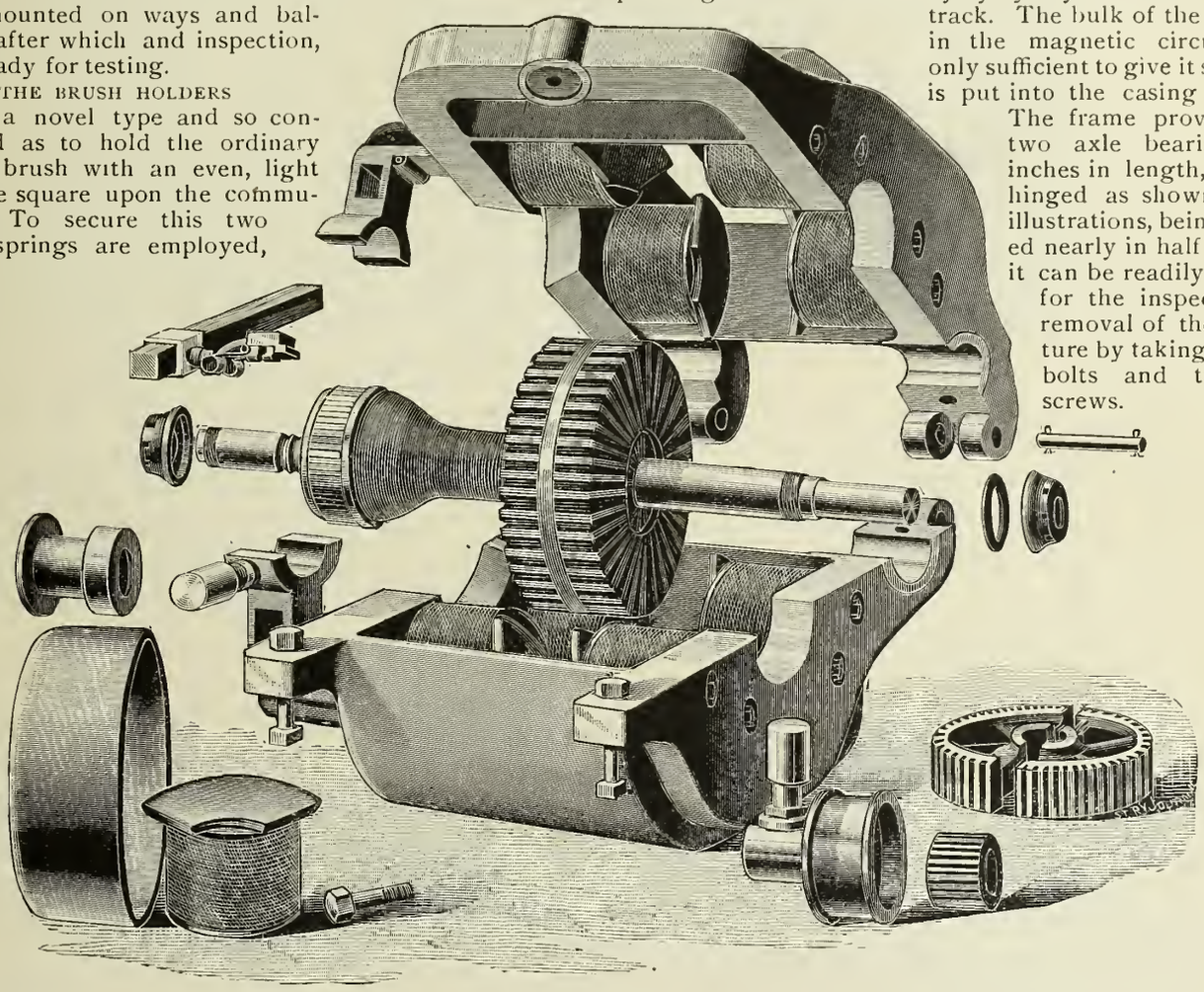


FIG 2.—PARTS OF THE SHORT SINGLE REDUCTION MOTOR—IMPROVED TYPE.

which are coiled in circular boxes, one on each side of the brush holder, their free ends connecting with a clip which bears upon the centre of the brushes, thus allowing them to follow quickly and freely any irregularity in the commutator, and the pressure being light the tendency to heating and squealing is generally decreased.

THE ELECTRICAL CONNECTIONS,

which are of heavy, insulated Clark cable enclosed in garden hose, are brought in at two places. Those for the armature are led through a fibre block just above the commutator, and thence through the wooden bars which support the brush holders to the brushes, being entirely protected from mechanical or electrical injury. The field connections are brought to two terminal binding posts at the end of the motor next to the hinges from whence the current is distributed in due proportion among the magnets.

THE JOURNAL BEARINGS

are inserted in light iron castings which rest, one in a chamber bored out of the frame at the pinion end of the shaft, and the other in the overhanging arm of the frame at the commutator end. Brass bushings are provided, which are forced into the castings by hydraulic pressure. The journal castings are provided with a chamber which constitutes an oil guard, a ridge being turned on the shaft within this chamber so that the centrifugal force throws off the oil and prevents the waste from working into the casing and reaching the commutator.

The armature is kept in a central position by two hardened steel collars which take the thrust either way, and which are held in position by means of drop forged thrust nuts securely locked by a split pin and all in convenient position for centering when the motor is placed upon the car.

THE FRAME OR CASING

is of cast iron, and is practically waterproof and also proof against mechanical injury by any obstruction on the track. The bulk of the metal is in the magnetic circuit, and only sufficient to give it strength is put into the casing proper. The frame provides for two axle bearings six inches in length, and is hinged as shown in the illustrations, being divided nearly in half so that it can be readily opened for the inspection or removal of the armature by taking out two bolts and two cap screws.

THE GREASE CUPS

are of the ordinary compression type, but are extra large and require to be filled only at long intervals.

THE GEARING

teeth are of the epicycloidal type, having great strength, the pinion being cut from the best hammered steel, and the split or axle gears being cut from steel castings carefully selected.

SPECIAL CLAIMS

for this motor are: Thorough mechanical protection of all parts by the casing; a thorough ventilation without the necessity of openings in the casing; a sparkless running of the commutator; ease of rewinding the armature; accessibility of all parts when the case is swung open on its hinge; quiet running and high average efficiency.

THE Trenton Passenger Railway Co. recently started the first part of their road in operation with electricity. The work is in charge of the Field Engineering Co. The first equipment will consist of twenty cars, which will be rapidly increased to a total of about fifty or sixty cars. Col. Lewis Perrine, Jr., is president of the road.

Car House Burned at St. Louis.

On Monday, June 13, about 9:20 P. M., fire broke out in the extensive car shed of the St. Louis & Suburban Railway at De Hodiamont, just within the city limits of St. Louis. By the time the first of the fire engines had arrived the flames had gained uncontrollable headway, and the efforts of the firemen were confined to saving the power house, which adjoins the car shed on the north, and which can be seen on the right in the engraving. The destroyed building was 500 ft. long and 150 ft. wide. In the western portion 40 × 50 ft. was occupied as a paint shop, and here some valuable iron and wood working machinery was lost as well as the tools and effects belonging to the workmen. A short time after the fire broke out the stock of oil in the paint shop exploded, and carried the flames eastward. Adjoining the shop was the emergency fire pump, which, however, was of no use.

In the car shed proper were thirty-two motor cars valued at $180,000, and trailers and eight wheel cars valued at $30,000, or a total loss on cars alone of $160,000. The loss on the shops in the rear of the building and on the building itself was $60,000, making the total loss $220,000. The origin of the fire, is unknown, but is attributed to spontaneous combustion among greasy rags in the paint shop.

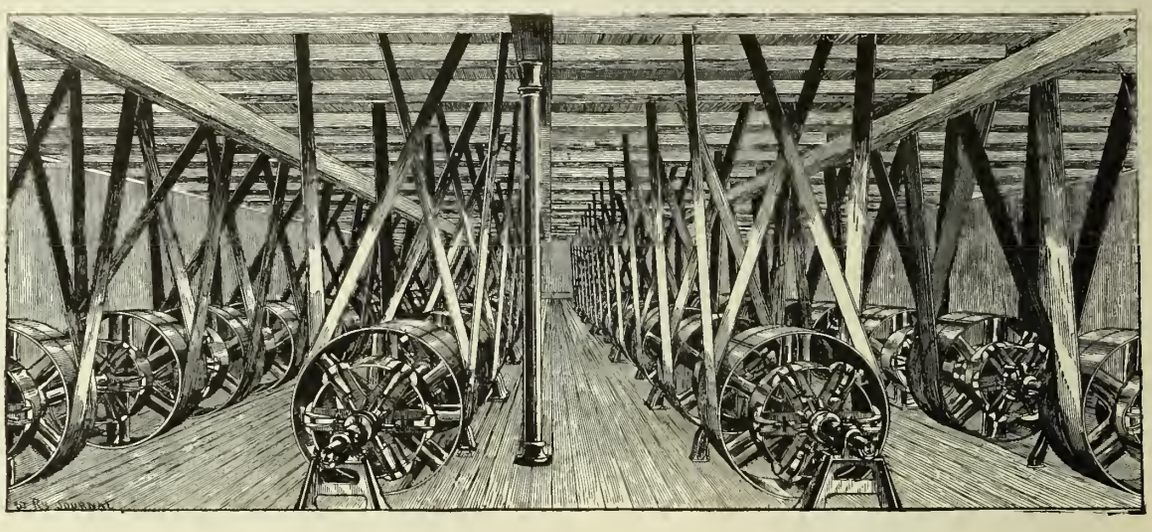
The power house not being damaged, the company are in shape to do business, there having been fifty cars on the road at the time of the fire and ten having been rescued.

The company will rebuild immediately a shed exactly similar to the one destroyed, and a new paint shop separated from the shed and situated between it and the power house. An equipment of thirty twenty-eight foot cars has already been ordered from a St. Louis builder, each of which is to be propelled by two twenty-five horse power Thomson-Houston S. R. G. motors.

S. L.

Shafting for Power Transmission.

The electric station of the Municipal Light & Power Co. of St. Louis, said to be the largest electric station in the world, is especially interesting to the street railway manager on account of the extensive system of power transmission by shafting used. The station supplies current to nearly 3,000 arc and 10,000 incandescent lamps, and this latter number will be increased to 50,000 as soon as possible.



SHAFTING—MUNICIPAL LIGHT & POWER CO.'S STATION, ST. LOUIS, MO.

The second floor of the building, of which a view is given herewith, is equipped with 400 ft. of six inch, hammered iron shafting, ground and polished, divided into eight sections of fifty feet each, and set up in four parallel lines on floor stands which are bolted to double I beams below. The bearings of the shafting are self-aligning and adjusting, and vary in length from eighteen to thirty-two inches. Each shaft is driven by a forty-eight inch, double leather belt, running over a steel rim pulley fifty-six inches in diameter, fifty-two inch face.



RUINS OF CAR HOUSE—ST. LOUIS & SUBURBAN STREET RAILWAY CO.

On each shaft is placed seven double crown friction clutch pulleys, fifty-two inches in diameter, with twenty-two-inch face, from which lead fourteen ten inch belts to the floor above to drive the dynamos. The clutch mechanism is operated from the dynamo floor by a simple lever device. Each engine belt has a patent steel rim tightener pulley, thirty-six inches in diameter, with a fifty-two inch face, which is operated from the shafting floor to tighten or loosen the belt. All the castings are exceptionally smooth and well made, and the boxes are lined

with babbit metal, reamed and bored, with deep oil grooves. The oil is fed to each bearing by a system of pipes, and carried thence by drain pipes to the oil filter in the basement, from which it is pumped to the fourth story to be used again. All the transmitting machinery on this floor was made and set up in place by the Falls Rivet & Machine Co. of Cuyahoga Falls, O., and it is an interesting fact that, while only one man is required to care for it during operating hours, no time has been lost from any mechanical defect of the shafting or pulleys since the plant was started.

A Combination Car.

A new type of combination car has recently been added to the rolling stock of the Newton Street Railway Co., of Newton, Mass., from the works of the Combination Car Co., of Waltham, Mass. Over all the car measures thirty-three feet, the length of the car body is twenty-five feet,



INTERIOR OF COMBINATION CAR—NEWTON STREET RAILWAY.

its extreme outside width eight feet ten inches and inside width six feet ten inches.

There are nine large windows on each side, and it is in the arrangement of the windows that the Combination Car Co.'s patents apply. The bottom of the sash is about the height of the arm to a car seat. The window frame is made in two horizontal sections and drops by a double slide into the side of the car, making it practically an open car. Slat curtains are also provided, which shut out sun or rain, without at the same time excluding the air. These curtains roll into spaces over the window frame, which are covered by a narrow panel so hinged that the curtain is easily accessible if there should be any trouble with it. The windows are also provided with spring guards to prevent rattling. The change from open to closed cars can be made rapidly.

The seats are arranged on each side of the centre aisle, and a seating capacity for thirty-two persons is provided. The car itself is handsomely painted in white and maroon with gilt lines. The sides and ceiling of the interior are beautifully and carefully finished in oak with a delicate figuring in pressed wood.

THE Oshkosh (Wis.) street car line has been sold, it is said, to a Detroit firm which will put in electricity.

Whytehead Joint Chair and Fishplate.

The combined box joint chair and fishplate, shown with section of track in Fig. 1, was designed by H. E. Whytehead, general manager of the tramways, North Staffordshire, England. The inventor has aimed at making

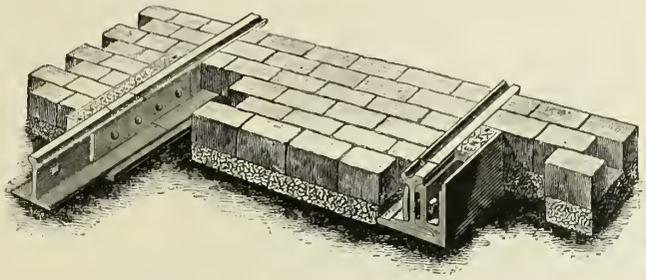


FIG. 1. WHYTEHEAD JOINT CHAIR AND FISHPLATE. FIG. 2.

the maintenance of tramway track more easy by reducing the number of bolts and nuts to a minimum, and by so arranging the parts that these nuts are accessible with but little more trouble than on an ordinary roadway line. Mr. Whytehead believes that no form of locknut can be relied upon to maintain the tightness of a rail joint under traffic, and that the only reliable plan of doing so is to tighten the nuts periodically. In Fig. 2 another arrangement is shown in which a chair is dispensed with, the rail being bolted direct into the sleeper, the recess for the nuts being formed in one of the fishplates.

Street Railways in Pennsylvania.

For the year 1890 140 street railway companies made reports to the State Board of Railroad Commissioners, according to the annual report just published by this body. This year the number has been increased to 207. The stock capitalization of these corporations is reported at $34,622,120.26, an increase of $7,956,541.67 during the year. The companies have a funded and floating debt of $16,699,488.88, a capital of upwards of $50,000,000 being invested in the street railways of the commonwealth. The returns show that the cost of these roads has been $19,945,127.13. The combined length of the lines is 683.32 miles, an increase during the year of 96.72 miles. The total number of cars is 2,722,148 having been added during the year. While the electric and cable systems are supplanting the horse cars, there are still 11,666 horses in use; an increase of 954 over the previous year.

The number of cars propelled by electricity is 335, while the horses are still dragging along 1,050 cars. In 1890 there were carried 219,505,616 passengers. In 1891 the number was increased to 237,781,172. The total receipts for the year were $12,631,433.60.



COMBINATION CAR—NEWTON (MASS.) STREET RAILWAY.

New Electric Motor Controlling Switch.

The question of the best method of controlling the speed of an electric motor on a street car by varying the amount of current going through it is an important problem. A method easily thought of is by the use of a resistance in the circuit, but this is, of course, decidedly wasteful; in fact, it involves the consumption of nearly as much energy when the motor is running at a slow speed as when running at a high speed, although the work given out by the motor in the two cases is very different. It has, consequently, been customary to modify this method of regulation by providing in addition a device for changing the effective winding of the field magnets so as to vary the counter electromotive force at different speeds. In some cases these two methods of regulation by means of resistance and alteration in field magnet strength have been combined in a system of commutating sections of the field magnet coils by which the coils themselves offer a greater or less resistance to the passage of the current. In other cases a combination of the two methods has been effected by having a separate resistance external to the motor, and then in addition, providing a switch to cut off a section of the field magnet coils or shunt a portion of the current around them for the highest speed.

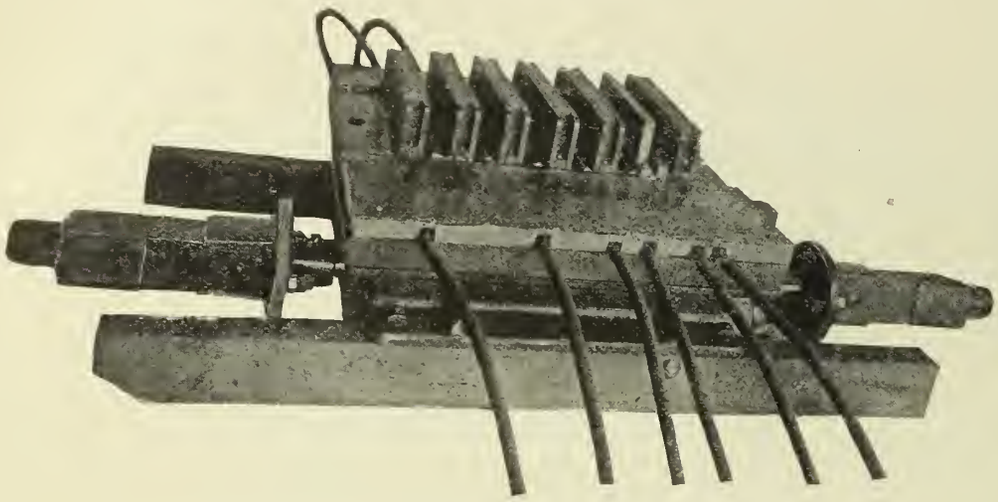


FIG. 1.—TOP VIEW—NEW MOTOR CONTROLLING SWITCH.

Believing that a still better method of motor control could be devised, engineers of the Thomson-Houston Electric Co. have been engaged in a long series of experiments, with the result that this company have recently placed on the market a new controlling switch which is shown in the accompanying engravings. In a number of instances where this controlling switch has been used for some time, it is claimed that a saving of 30 per cent. in consumption of current has been effected; and when it is realized that this means a saving at the central station of over 300 H. P. out of 1,000 H. P., the great importance of this new device cannot be doubted.

The principle upon which the new controller is based is the shifting of the connections of two motors from series to multiple, so that for slow speed the two motors will be in series, giving in consequence a high counter electro-motive force (that of each motor being in series with that of the other) at a low rate of speed, while for higher speed they are connected in multiple, in which condition highest speed and power are obtainable with equal economy.

Fig. 1, shows a top, and Fig. 2 a bottom view of the new controller. As will be readily understood from an inspection of the illustrations, the apparatus consists of a longitudinal shaft acting upon a series of switch levers to produce the various connections necessary to place the motors in series or parallel. This controller is to be placed at any point beneath the car and operated by a mechanical connection from either end of the vehicle. In this apparatus the mechanical and electrical details have been worked out with the greatest care, and it was permitted to go on the market only after satisfactory tests had been made proving the efficiency and reliability of the device. The Thomson-Houston company have for some time owned controlling patents of this type of controller; the most important being No. 385,055, dated June 26, 1888, and No. 393,322, dated November 20, 1888.

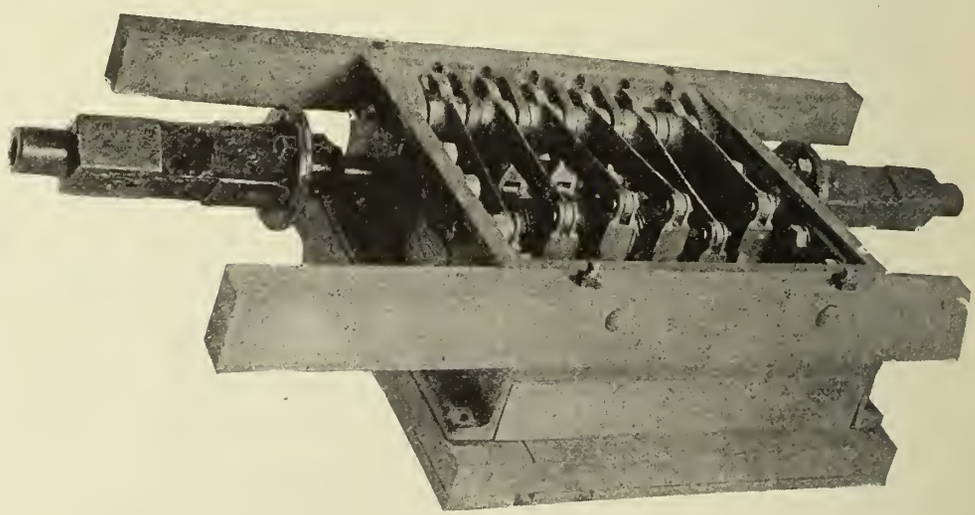


FIG. 2.—BOTTOM VIEW—NEW MOTOR CONTROLLING SWITCH.

The New York Rapid Transit Plan Approved.

The commissioners appointed by the General Term of the Supreme Court to decide whether the underground railroad proposed by the rapid transit commissioners should be constructed according to the plans proposed, and in lieu of the consents of the abutting property owners, filed their decision last month. The commissioners were David McClure, Robert Maclay, and Benjamin Perkins.

The commissioners decided in favor of the construction of the roads as proposed by the Rapid Transit Commission, except as to that part from Ninety-Sixth Street to Jerome Park which was left detached by the special act of the Legislature which withdrew from the operation of the Rapid Transit Act that portion of the road which it was proposed to construct under Madison Avenue from Forty-third to Ninety-sixth Street. The routes approved and which will now be built if the franchises can be sold are from the Battery to Fourteenth Street and continuing on the west side to the city line near Yonkers, with a loop under Main Street, City Hall Park, Park Row and Chambers Street, and a branch extending from Fourteenth Street partly under Park Avenue, to a point near the Grand Central Depot on Forty-second Street.

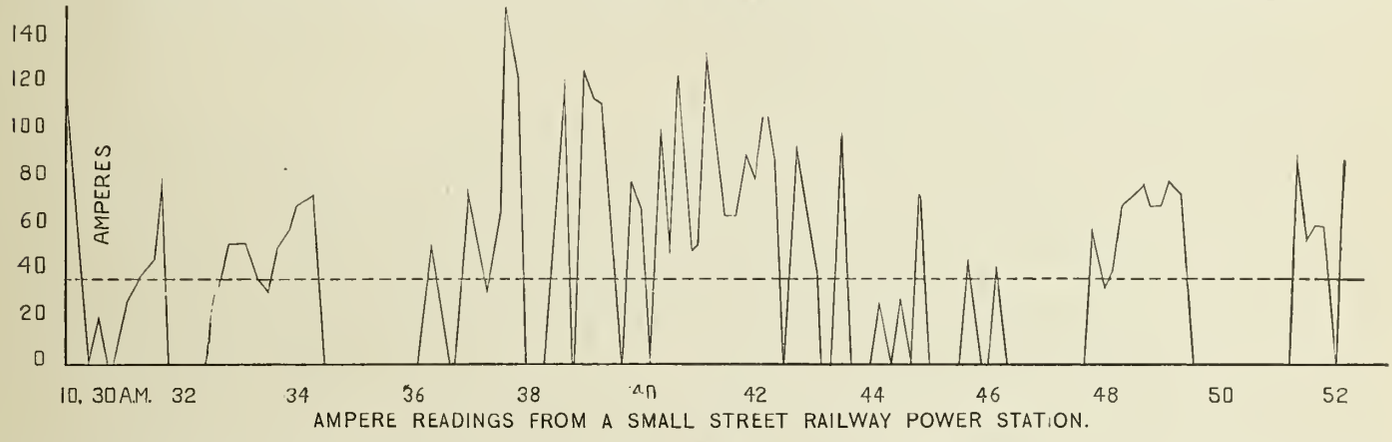
It is expected that the rapid transit commission will now soon ask for bids for the construction and operation of the road under the franchise.

THE Denver (Colo.) Tramway Co. are erecting a large electric power station on 32d Street. It will be 165 × 110 ft. and will contain an engine room 110 × 92 ft.

Points on Small Power Stations.

By Wm. Lee Church.

BEAR IN MIND THAT THE ENGINE IN AN ELECTRIC RAILWAY POWER STATION IS NORMALLY AN UNDERLOADED ENGINE, NOT AN OVERLOADED ENGINE. That the above statement is not made more prominent is wholly the fault of the printer, and not of the emphasis which the writer desires to give it. Strange to say, a belief precisely the opposite of this seems to be floating vaguely in the minds of most railway men. It would seem, somehow, that the abruptness of the load, and the momentary excess which is found every few minutes, have been confused in the mind, so as to take the place of the working facts which exist. It is true that an electric railway engine gets frequent and heavy overloads for an instant, but no more than ought to be comfortably taken care of by the flywheel and a proper steam distribution, provided the engine is intelligently adapted for the work. But this overload has little *direct* bearing on the economy of the engine; in part, because the overload lasts but a moment, and in still greater part, because a heavy load is, as a general statement, an economical load, within limits depending somewhat upon the type of engine. With reference, however, to the *fuel duty* of the engine, it is not the overload which is to be principally considered, but the variations of load; and of these variations the minimum load plays by far the greater part in the final economy.



AMPERE READINGS FROM A SMALL STREET RAILWAY POWER STATION.

To put the matter in another light, we would say that the maximum load determines the size of the engine, and the minimum load determines its duty. At this point the investigator is likely to jump to the false conclusion that the *average load for the day* represents the true performance of the engine upon which he can base his estimate of fuel consumption. This certainly seems reasonable, but nothing can be further from the truth. To make the point clear, we will have recourse to another ampere diagram taken from a small station operating a country line over numerous grades. In this diagram it will be observed that for fully 20 per cent. of the time there is no load whatever on the engine other than its own friction and that of the generator. At such times the cars are all, for the moment, on the down grade, the circuits open and the ampere meter at zero. This particular diagram is necessarily confined to a section of but a few minutes' run, but the same action was continuous throughout the day. Now the *average* horse power for this run would reduce to the power represented by the dotted lines, equivalent to thirty horse power, but this average of thirty horse power resulted from a continuous fluctuation from 0. H. P. to 125 H. P., and out of this arise some pertinent questions.

Assume that you are about to equip a small power station, and that you are aware of the probable fluctuation of load. Sufficient experience is now available to make this assumption a reasonably safe one. For present purposes we will go to the extreme, though not uncommon case, represented by the diagram and assume that your maximum load will be 125 H. P. It is manifest that you are compelled to select an engine of a rating certainly not less than 100 H. P. at the determined steam pressure, in order that it may pull over the high spots without sensible diminution of speed. Being limited by this rigid necessity, you next propose to estimate beforehand what your probable coal account will be, since the final statement of the operating account will contain this as a large item. Shall we reckon the fuel duty on the basis of the rating of the engine, say, 100 H P.? Manifestly not; because the engine gets no chance to work at its rated horse power except at brief and infrequent intervals. Shall we reckon the duty of the engine on the basis of the average of its power throughout the day, as per the dotted line? Assuredly not; and let us see why. If you jump to conclusions again, you would figure something as follows: "My engine is a 100 H. P. engine, but it will average only twenty-five horse power throughout the day. Now, if it were running at its rated horse power it would consume, say, twenty-five pounds of water per horse power per hour (it is assumed to be a compound non-condensing engine of the ordinary type not capable of meeting a fluctuating load); but since it is operating at an average load of about 25 per cent. of its rating, I will allow that it will use as high as thirty pounds of water per horse power per hour; or a total of 13,500 lbs. water, or say 1,340 lbs. coal, or, with banking fires, about 1,500 lbs. of coal for an eighteen hour run, equal, with $3 coal, to $2.25 per day; and this is what I will figure on in estimating my expense account." And in figuring this way, you would figure exactly wrong, and forever thereafter you would wonder why you were burning so much coal. Moreover you would gently curse the engine under your breath. Now, as a matter of fact, *your power averages itself, but your fuel duty does not*, and this is what you never thought of.

Suppose we examine this point. A fuel duty under a continuous rated load, if your engine is a non-compound, non-condensing engine of the slow speed variety, would be, perhaps, twenty-eight pounds of water, or as low as twenty-five pounds with the ordinary compound engine. But even if the engine ran *continuously* at the *average* load of twenty-five horse power, its performance would be not better than forty-five pounds, which will be fully demonstrated in another paper. Unfortunately, even this condition, bad as it is, almost never exists for more than a moment, but in fact the engine is alternately anywhere from 25 per cent. overload down to no load at all—that is, no effective load. Under the rated load or thereabouts, you would be getting from twenty-five to twenty-eight pounds; under a *continuous average* load, if you had it, you might even get forty pounds, but under the actual conditions of fluctuating load, out of which your average load is only *computed*, not *created*, you are getting anywhere from thirty to seventy-five pounds and varying every moment. If you will now average the fluctuating duties due to the fluctuating loads, instead of averaging the load first, and then assuming a duty based on that, you will find that instead of thirty pounds, you will consume at least fifty pounds of water per hour for every electrical horse power delivered. This means coal and dollars, and if you never knew it before, you will know it when you come to divide your coal bills by the car mileage. Perhaps I ought not to have taken so extreme a

case, though an actual and common one, but all small stations suffer under these conditions, and the larger stations only modify them.

This condition of things, already bad enough, is further aggravated by the power required to drive a more or less extended line of countershafting, which power is a constant, and becomes a proportionately greater factor as the effective load becomes lighter. This subject, however, will be treated more fully in another article. The conditions outlined above, as has been said, are found in greatest intensity in the smaller class of stations and on hilly roads, and to a certain extent become modified as the station becomes larger, the extremes of fluctuation being toned down by overlapping of a greater number of cars. The fluctuation is by no means reduced as much as is popularly supposed, and it is at present a question in the writer's mind whether 1,000 H. P. is not the smallest unit, on the single engine plan, which can with safety be considered in the hope of economical results. It is these small and moderate sized stations which the writer has most heavily on his mind ; the big stations get the best attention and treatment, although, I humbly submit, not necessarily the best judgment. The smaller stations are apt to be tinkered up by home talent to save money (?), or laid out in a general sort of haphazard style by some one more interested in the contract than in the engineering results. The fact of the matter is, that the small station has the heaviest odds against it in respect to earning capacity, anyway, as is the general law with all small enterprises ; from which it follows that it should, *per contra*, receive the most painstaking engineering in order to offset this disadvantage and raise its intrinsic operative efficiency to the highest point. In short, give me the small stations and I care not who builds the big ones.

We therefore return to our original proposition, and once more repeat that the engine in the power station of an electric railway is essentially an underloaded engine and not an overloaded engine, and must be so treated. Having established this premise, the next and reasonable thing would be to examine the essentials of an engine capable of giving a high duty under light loads, or, more properly speaking, a uniformly high duty under all and wide variations of load. It has been well settled that no ordinary type of engine, compound or otherwise, can accomplish this desired result, even approximately, and since it has fallen in the writer's way to be connected with the development of certain improvements in precisely this direction, it will be the proper object for the next article to make the nature of these improvements somewhat plain.

Series Electric Traction.*

By NELSON W. PERRY, E. M.

In long lines, the bugbear of the multiple arc system of distribution is the drop in potential at the further end. The potential may be amply sufficient near the generating station, but it becomes less and less as this proximity is departed from, until, at the further end, the lights which burned brightly near the station dim down to scarcely more than a dull red, and the cars are operated under heavy loads with difficulty or not at all. There are two remedies for this drop in potential at hand — either to increase the amount of copper in the feeders, which within commercial limits is but a partial remedy, or to increase the pressure, using the same amount of copper which, when the multiple arc method of distribution is employed, introduces as many difficulties as it obviates. There is still a third remedy, and that is to employ the constant current method, in which, under all circumstances, the current remains the same and the pressure varies as the work performed.

If energy can be much more advantageously distributed to long distances by the constant current method for arc lamps, why should this method not commend itself to the ever increasing distances to which our electric street railroads are reaching?

The answer is that the constant current method, as heretofore developed, has not been sufficiently elastic to meet the requirements, and although the generation of a constant current involved much less complex machinery, and the cost of distribution to distant points necessitated a much smaller initial outlay, still the difficulties introduced by this method largely outweighed all its advantages.

The system which I am about to explain may properly be described as consisting of a circuit interrupted by a series of breaks in multiples of two, or one consisting of a circuit interrupted by breaks in multiple series with each other. The conception then would be like Fig 1.

But in order that a current shall pass around this circuit, it is necessary that *one* of the breaks in each multiple shall be normally closed. It matters not which one is closed; so our plan would now look like Fig. 2.

If a translating device should successively occupy each of these breaks, it would receive current during the time that its terminals con-

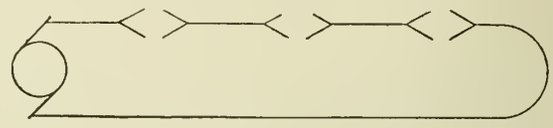


FIG. 1.

nected the ends of the two broken wires, in proportion to the relative conductivity of the two paths open to the current. But we are not satisfied to have a portion only of the current pass through our motor— it is necessary that *all* the current must so pass. We must, therefore, make the resistance of the other branch infinite during the time in which the motor is bridging, through its terminals, the break, or, in other words, the normally closed branch must be broken.

If, therefore, we place an electro-magnet in *series* with the normally broken branch, so that when vitalized it will open the switch in the normally closed branch, and allow it to close again by gravity or

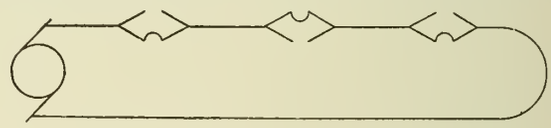


FIG. 2.

otherwise, when the magnet is devitalized, we have provided in a crude way for operating traveling translating devices in series. Our conception now would be represented somewhat by Fig. 3.

By this arrangement, the moving device only receives a momentary impulse as its terminals touch the ends of the break, and would have to rely upon its acquired momentum to carry it to the ends of the next break.

It is desirable, however, that the moving device be impelled by as nearly a continuous force as possible, instead of by a succession of momentary impulses. Instead, therefore, of having the ends of the nor-

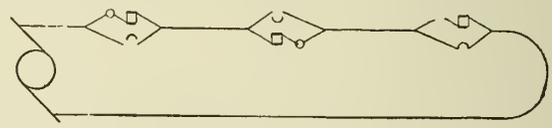


FIG. 3.

mally open break face each other as represented heretofore, we may extend these wires for some distance parallel with each other, and our plan assumes the form shown in Fig. 4.

And it is desirable that the interval of time during which the device is without current, viz., that occupied in passing from one break to the next, shall be as small as possible. This naturally suggests having the normally open breaks all on the same side of the normally closed breaks, and if these parallel wires be continued so as to overlap those constituting preceding and succeeding breaks, a car or other moving translating device may pass from one break to another without even

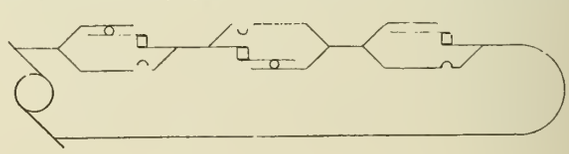


FIG. 4.

momentary interruption of current. In Fig. 5, the lower line which I call the "feeder," contains all of the normally closed breaks, represented by mercury cups normally connected electrically by a fork taking into them, which constitutes a double pole switch actuated by an electro-magnet in the manner to be described.

The upper pairs of wires, which, it will be seen, are merely the parallel extensions of the other possible path for the current, are in multiple with the path through the mercury cups. One of each of these pairs of wires, which will hereafter be denominated sections, is connected to the feeder wire on one side of the mercury cups, and the other has a similar connection on the other side. The two wires of each section normally without electrical connection with each other, constitute what has been termed the "series of breaks normally open." If, however, these two wires be connected electrically through the terminals of a motor, the latter will be in multiple with the mercury cups and momentarily receive only the current due to the relative conductivity of the path thus offered. By the arrangement shown in Fig. 5 the

*Abstract of paper read at the Chicago Meeting of the American Institute of Electrical Engineers, 8th, 1892.

electro-magnet which opens the mercury cup switch is in series with the motor circuit, and the latter no sooner receives current than the former is actuated, the switch is opened and the whole of the current which was momentarily divided between the two branches, is diverted to the motor.

If the corresponding wires of the succeeding sections be caused to overlap without making electrical connection with each other, and these laps be staggered as shown, a means is provided whereby the motor prepares the succeeding section for occupancy before wholly passing out of the one it is about to leave, and accomplishes this without interruption to the current. When the motor is in the position represented in Fig. 5, there is but one path for the current, viz., around the open switch in the feeder and through the electro-magnet by which it is kept open, back again to the feeder.

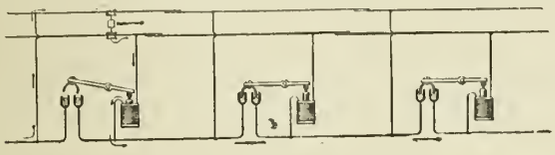


FIG. 5.

As the motor proceeds to the right, one of the terminals first embraces the lower lap, thus offering two paths for the current—one passing through the switching arrangement that controls the section the car is about to leave, and the other through that controlling the section it is about to enter. As it progresses still further this terminal passes beyond this lap at about the same time that the other terminal embraces the other lap. This leaves the first switch without current and the succeeding switch is automatically opened. There is no break in the circuit, however, even during the short interval occupied by the two switches in acting, for while the further terminal embraces the further lap, both of the switches concerned are short circuited.

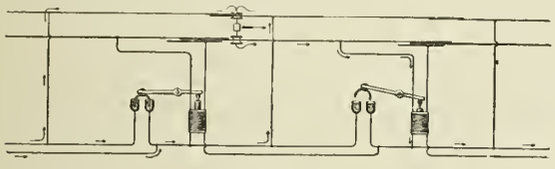


FIG. 6.

Before the further terminal has passed beyond the lapping portion of the two succeeding wires, the first switch will have closed and the succeeding switch will have been opened, thus diverting all of the current to the section upon which the motor has now entered.

On single track roads where turnouts are required, the turnout constitutes merely an additional section to one side of the main line, which is skipped by the car keeping the main track, and taken by the other car in passing, It, like every other section, has its own individual controlling switch, and when both the main track and siding are occupied by cars, their motors are arranged in series with each other.

But the plans thus far discussed possess serious faults. In them we have provided a means by which a car may leave one section on a given road and enter another one on the same or another road without breaking the main circuit, *provided the car is always going in the same direction.* In all of the cuts thus far, the car is supposed to be going from left to right, and the switches are arranged accordingly; but, if we examine the drawings again, it will be found that in the plan suggested in Fig. 5, if the car were going in the opposite direction, the circuit would be momentarily broken as it left one section and would fail to divert the current to the section it was entering. In Fig. 6 however these difficulties seem to be removed.

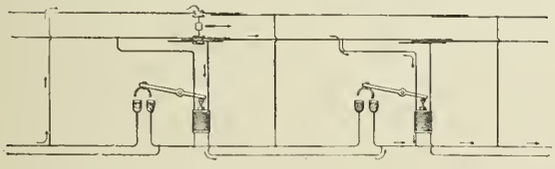


FIG 7.

It will be noticed in Figs. 6 and 7, as in the first plan described, the trolley wires of adjacent sections are lapped, and that these laps are staggered; that parallel to, but insulated from, the nearer laps, is placed a subsidiary wire which short circuits the switch to the right. The switch controlling magnet, as is shown, has two coils wound cumulatively, and may be operated either by the current passing through the subsidiary wire, by that passing through the nearer trolley wire, or by both when it takes both paths.

THE Boston *Daily Traveller* makes the following mention of our last issue: "The June number of the STREET RAILWAY JOURNAL (the *World* Building, New York) is filled with most valuable matter, much of it being finely illustrated. The importance of this magazine to all in any way interested in street railway management can hardly be overestimated, covering, as it does, the entire field ably and in a manner to interest all readers."

A New System of Electric Propulsion.*

BY H. WARD LEONARD.

If in a street railway system we could operate from the constant potential system a shunt wound motor running at a constant speed, and could interpose between this motor and the axle some device equivalent in its effect to an infinite number of different sets of mechanical gears, so that we could make use of any reduction desired, it would enable us while using a constant power to increase the torque as we decreased the speed, and *vice versa*, which is just what is desired in railway practice where the least torque is required when at full speed on the level and the greatest torque is required at the slow speed in starting and in operating on a grade. Numerous and very ingenious devices have been invented for accomplishing this variable mechanical reduction, but on account of the complication, noise and unreliability they have never proved successful.

The writer has recently devised an electrical method of securing all the results which could be obtained from such a set of gears described, with a freedom from the noise, wear, complication and rigidity which such a set of gears would necessarily involve.

Following is a general description of the arrangement proposed, as indicated by Fig. 1:

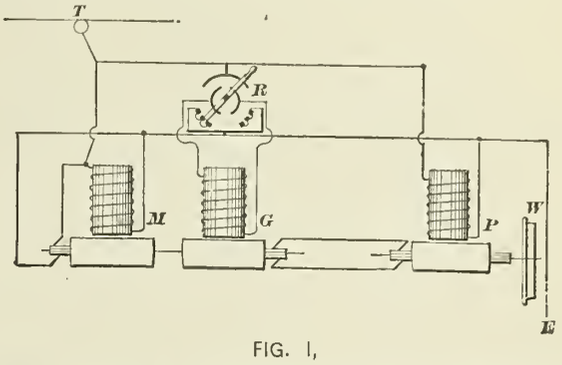


FIG. 1,

T, Trolley. M, motor portion of power converter. G, generator portion of power converter. P, the propelling motor for the car. R, the regulating and reversing rheostat in field of G. E, the connection to ground. W, the car wheel.

Each axle is driven by a gearless motor, either directly or by means of a connecting rod. The fields of these motors are excited directly from the constant E. M. F. of the line and independently of the armature circuit. Beneath the car and between the axles there is suspended a motor-generator, each armature winding being in a separate field. The motor portion of the motor-generator—which will, for convenience, be called the power converter—is shunt wound and connected just as a shunt motor is for use upon ordinary constant potential circuits. The field of the generator portion of the power converter has its field connected across the line and has inserted in it a regulating and reversing field rheostat. This field circuit is independent of the armature circuit. The generating armature of the power converter is in metallic connection with the armatures of the propelling motors. It will be noticed that this circuit, including the armature, is a distinct and separate metallic circuit having no connection with the line in anyway.

Suppose, now, that our shunt motor is running at full speed and that our controlling rheostat in the generator field circuit is at its central position, so that the generator field circuit is broken. Although the generator armature is being driven at full speed, it is revolving in a field having no magnetism except the residual magnetism, and hence produces practically no volts. Let us now move our controlling switch so as to place the generator field across the line, but with a resistance in series with the field of ten times the resistance of the field coils. We now get a slight excitation of the field and a development of volts at the brushes of, perhaps, forty volts. This voltage will produce a current through the armatures of the driving motors dependent upon the ohmic resistance of this current only, and hence, even at this low voltage, a large current will be produced, which being in a field full of strength will cause a torque sufficient to start the armature. The speed of the armature will, of course, be governed by the counter E. M. F. which its revolution produces in its strong field; and hence, just as in the case of a shunt wound motor, its speed will be practically constant so long as the E. M. F. supplied is constant.

If we now gradually increase the magnetic field of the generator by cutting out resistance by moving the controlling switch, we will gradually raise the E. M. F. of the armature circuit, and with it the speed of the driving motors. Since these armatures are revolving in a constant field, the torque they produce will be exactly proportional to the current in them, and the current will automatically flow exactly as is required to produce the necessary torque to maintain a speed such that the counter E. M. F. will approximately equal the E. M. F. supplied by the power converter. Thus it will be seen that the speed of the car will be dependent upon, and proportional to, the E. M. F. supplied by the power converter, and the torque or tractive effort will be dependent upon, and proportional to, the current supplied by the power converter.

Let us suppose that sixty amperes flowing through the armatures in fully excited fields will produce a torque sufficient to move the load when upon a grade. It is evident from what we have seen that forty volts from the power converter will produce this current. Hence, by

*Abstract of a paper read at the Chicago meeting of the American Institute of Electrical Engineers, Chicago, June 8, 1892.

an expenditure of 2,400 watts in the secondary circuit, or a total power, including field excitation, etc., of about eight horse power, we can start a fully loaded car upon a grade.

Under the existing systems, we would need the same sixty amperes in the same fully excited field, but would necessarily use the full voltage of 500 volts, and, therefore consume energy represented by 30.000 watts, as against possibly 6,000 in this system. The current from the line in starting the car under ordinary conditions by this system would be about twelve amperes at 500 volts, instead of from sixty to 100 amperes at 500 volts.

It will be evident from what has preceded that with this power converter system we can propel a car upon any practicable grade with a consumption of power no greater than is required to operate the car at full speed upon a level, by merely reducing the speed to the required extent.

Following is a tabulated statement (Table 1) showing the results we may expect to obtain by this system in operating with fully loaded car under three different conditions: First, at twelve miles per hour on level; second, at three miles per hour on 5 per cent. grade; and third, at one mile per hour on level.

TABLE I.

DUTY OF CAR. SHOWING VARIOUS LOSSES EXPRESSED IN WATTS.

Various Losses Involved.	8 Tons at 12 Miles per Hour on Level. Full Speed, 1-6 Full Torque; Armature Current, 10 Amperes.			8 Tons at 3 Miles (or 5 Tons at 5 Miles) per Hour on 5 per cent. grade. ¼ Full Speed, Full Torque; Armature Current, 60 Amperes.			8 Tons at 1¼ Miles per Hour on Level. 1-10 Full Speed, 1-6 Full Torque; Armature Current, 10 Amperes.		
	Power Converter.		Driving Motors.	Power Converter.		Driving Motors.	Power Converter.		Driving Motors.
	Motor part.	Gen. part.		Motor part.	Gen. part.		Motor part.	Gen. part.	
Field	250	275	250	250	60	250	250	25	250
$C^2 R$ in armature	160	60	60	250	2000	2000	20	60	60
Friction	60	60	120	60	60	30	60	30	10
Foucault currents, hysteresis, etc.	200	400	200	200	50	50	200	10	10
Total	670	795	830	760	2170	2330	530	125	330
Total watts wasted		2295			5260			985	
Watts of work done		4000			6000			400	
Total watts absorbed		6295			11260			1385	
Amperes at 500 volts		12 6			22.5			2.8	

In arriving at the losses, as indicated, the motor part of the power converter has been assumed as having the following features:

E. M. F. 500 volts, current capacity for ten hours' continuous duty, fifteen amperes; resistance of shunt field winding, 1,000 ohms, armature resistance, 1.1 ohms.

The generator portion of the power converter and the driving motor are assumed as having the following features:

E. M. F. 500 volts; current capacity for ten hours' continuous duty, forty amperes; resistance of field 900 ohms; armature resistance, 0.55 ohms.

The rolling friction with gearless motors on good level track is assumed as twenty pounds per ton. Car is assumed to be eight tons in weight full loaded and five tons for moderate load.

TABLE II.

SHOWING PROBABLE COMPARATIVE FIRST COST PER CAR BY PRESENT AND PROPOSED SYSTEM.

	Present System.	Proposed System.
Steam plant, generators and conductors per car (steam plant 1,000, generators 700, conductors 500	2200	1100
Motors (two 15 H. P. equipments)	1800	1400
Power converter	0	900
Controlling switches, cables, rheostats, etc	200	30
Total first cost per car	4200	3430
Saving in favor of proposed system per car		$770

The features of the proposed system which seem, at first sight, to be very objectionable are: The increased cost of the car equipment and the fact that we are adding an additional machine, having two fields, two armatures and three bearings; but, as we have seen, there is only an apparent increase in the first cost, for the saving in the generators and distributing plant far exceeds the additional cost of the car equipment; and the use of the motor-generator for elevators, traveling cranes, etc., has demonstrated that, as regards the attention it requires and the depreciation it suffers, it has a marked advantage over the rheostat or commutated field used in the present methods of operation.

Coming Development of Electric Railways.*

By FRANK J. SPRAGUE.

It is a trite but mistaken saying that electricity is in its infancy. It dropped its swaddling clothes when Morse sent the first telegraphic message. It put aside dresses and pinafores when the dynamo machine and arc light were invented. The incandescent lamp, the telephone, the art of welding, the transformer, are incidents of buoyant youth. The modern electric motor and electric railway mark a vigorous manhood.

The truly marvelous development of electric applications of every kind, the accomplishment of many things which in ignorance of the very art, or lack of knowledge, of what are now well known facts, and more particularly the great commercial development of the transmission of power, whether for stationary purposes or for electric railways, has led to many a foolish prediction and idle boast.

This is no age of inspiration, nor time for hopes never to attain fruition. It is above all things a practical age, perhaps too practical, but nevertheless one in which commercial enterprises to be successful must promise either a new field of development or economies in older fields.

It would, perhaps, have been proper in making my inaugural address to so representative a body as that of the electrical engineers, that I should touch upon the special discoveries and experiments which have recently attracted attention, but there have been so many enthusiastic and brilliant workers, that neither the time at my disposal nor the knowledge I possess would permit me to do justice to their work; hence, it seems better to take up a subject with which I have been more particularly identified, which to-day commands so much attention, and concerning which there are such conflicting opinions. While finding encouragement in the achievements of our profession, I think the time opportune for a word of caution.

Electric street railways are no longer experimental nor is their success problematical. Their history for five years is that of an almost unequaled development. Almost within a decade has occurred the first working of a practical electrical railway. In a third of that period there have been put in operation or under contract more than 450 roads, equipped with nearly 6,000 cars and over 10,000 motors, and with over 3,000 miles of track. There is made a daily mileage of not less than 700,000 miles, and over a billion of passengers are carried annually. At least $75,000,000 have been invested in this industry alone; 30,000 horses in a single year have been relieved from the slavery of street car propulsion; stables are disappearing, and streets becoming cleaner; luxurious cars are running on smooth, well built and rigid roadbeds. Dividends have been increased, expenses reduced, investments enlarged, the unproductive has become productive, the impossible possible. Land values have been increased, habitable limits extended, homes created and time saved.

We no longer hear seriously of the dangers of the trolley wire, the failure of service. Not only have the smaller towns adopted what is the only available means of current supply, but the larger cities are following their example. St. Louis and Baltimore, Minneapolis and St. Paul, Buffalo and Rochester, Boston and Brooklyn have fallen into line, and latterly even Philadelphia seeks an improved street service, and in New York public interest is being aroused.

The general feeling of opposition to poles and wires ought not, however, to act as a barrier to such reasonable and proper introduction of an overhead system of supply as the conditions now existing in that city very properly warrant.

Among the numerous places in New York where an overhead system could be put in perfect operation are: Central Park west, the Boulevard from Fifty-ninth Street up, a part of the First and Second Avenue lines, the Third, Sixth and Ninth Avenue lines, and all the suburban extensions from the annexed district.

In these large cities, however, one condition should be insisted upon, and if this condition is met in the proper spirit then much of the objection which has been raised against an overhead system must necessarily disappear.

The construction must be of the very best. The only overhead line allowed should be a contact wire with sufficient strength; the main conductors and the feeders should be put underground in proper conduits. There would then be overhead only a wire necessary for the smallest duty and of the requisite strength. In many streets, of course, the cable will hold its own until an electric conduit or surface contact system shall be proven satisfactory.

Impressed by the great development of this industry and brought face to face with the changes it has wrought, the query is continually made. Will the electric motor replace the steam locomotive? It is similar to the older questions, will the telephone replace the telegraph? Will the electric light annihilate the gas systemn? And in all soberness a like answer can be made It will not, but it will, as the electric light and as the telephone have done, create a field of its own, and will replace a portion of the service now done by steam.

It seems to me that the growth of electric railways will proceed something in this order: First, the street systems in the various towns, then connecting lines between adjacent towns following the line of the highways, then longer connecting lines either on the track of existing steam lines, or growing bolder, on exclusive rights of way on the same order. Then will come suburban traffic on a larger scale, and freight transfer system, and finally the more ambitious projects of trunk line service under limiting conditions, such as I will specify.

It has been very properly said that a man will make the first long

*Abstract of address delivered at the meeting of the American Institute of Electrical Engineers, Chicago, June 6, 1892.

ride on electric railways by transferring from one town system to another through connecting links rather than on individual roads.

But, evidently, this natural process of evolution does not offer scope enough for the more enthusiastic, and we are now and again treated to an ideal electric road to be built on plans boldly defying both geography and the abodes of civilization. An air line route according to rules of surveying allowed only in Russia and on the Desert of Sahara; abolition of the grades and street crossing; rigid and continuous rails; loaded cars of light weight, each operated by its own motor and making but few or no stops; unlimited potentials and undiscovered resistance to insulation; new physiological and engineering laws; indestructible material; unheard of powers of braking and new methods of train operation and signaling; around all a clear atmosphere, above all a perpetually smiling heaven, and behind all an unlimited bank account and the unlimited confidence of the investor.

These are some of the characteristics of such a road, but perhaps it is only fair to ask, Given some of these conditions, what would be the capacity of steam traction?

Rapid Transit Plans in Sydney, New South Wales.

The Parliamentary Standing Committee on Public Works, of New South Wales, recently presented a volumnious report covering 298 closely printed pages in regard to a proposed cable railway in the city of Sydney, from King Street via William Street to Ocean Street. The report carefully considers the relative advantages of cable and electric power, and gives the views of a number of experts in street railway engineering.

As a result the committee recommend the construction of a double track cable line, and their report reads in part as follows:

The total length of the line would be 2 miles 24 chains, the gauge 4 ft. 8½ ins., and the steepest gradient 1 in 9, which can be improved to 1 in 12.

The estimated cost of the tramway, inclusive of rolling stock and land, is about £80,000, the estimated annual earnings £35,000, the estimated annual working expenses £17,000, and the interest on cost of construction and depreciation, £7,600. These figures show the total annual expense as £24,600, and deducting this from the amount representing the annual earnings, there is an estimated annual net revenue shown of £10,400, which is equal to nearly 13¾ per cent. per annum upon the cost of construction.

The railway commissioners report very favorably of the tramway, and anticipate an even larger return than is shown in the estimate of the engineers. They set down the annual expenses at £23,000, and the value of the passenger traffic at £35,000, which would leave an estimated annual profit of £12,000, a sum equivalent to a profit of 15 per cent. They say that "a considerable increase of traffic would probably follow the opening of the line, as it would be a marked improvement on any existing mode of conveyance, and would tap sources of traffic hitherto not reached.

At the opening of the inquiry a request was made by the minister for public works, through the under secretary of the department, that the proceedings of the committee should be stayed until a report had been received and forwarded to the committee from Sir John Fowler on the working of tramways by electricity. Impressed with the importance of recent developments in electrical tramways, and the advisableness of having the subject carefully inquired into, if only for the reason that the committee's investigation and decision might influence the questions of both the construction of our tramways and the type to which the existing tramways might be converted, the minister, after consultation with the commissioners for railways, had moved Sir John Fowler to report upon it, and it was thought desirable that the committee should await the receipt of this report rather than deal with the subject of cable tramways exclusively. The committee agreed to the postponement of the inquiry for a month, and having at the end of that period received Sir John Fowler's report the inquiry was resumed, and continued uninterruptedly until the passing of a resolution to await the result of experiments with an electrical tram between Randwick and Waverley. These experiments were made, and the inquiry based at this point chiefly upon information gained during experiments, was continued until intimation was made to the committee that the minister for public works intended to obtain through an officer of the department, specially appointed for the purpose, a report upon all matters of importance connected with both cable and electrical tramways, as they are in America at the present time. As it was probable that this report would contain some very necessary information with regard to the exact relative positions of cable and electrical tramways in America, and to the cost of maintaining electrical tramways, and the profits derived from them—information not obtainable here—the committee decided to defer coming to a decision in the matter of the tramway referred to them, until this report should be received, and in the meantime they were able to examine a witness occupying an important official position in connection with the Melbourne cable tramways. In this manner the inquiry became very comprehensive. The attention of the committee was throughout closely directed to the proposal referred to them by the legislative assembly, but in view of the request of the minister of public works, and of the report obtained from Sir John Fowler, it was thought desirable to investigate as far as possible the claim of electrical tramways to consideration, in order to ascertain whether in the construction of our tramways in the city the electrical system would be perferable to that of the cable.

EXISTING CABLE TRAMWAYS.

According to the evidence before the committee, cable tramways, so far as they have been constructed, have proved profitable; but they have been very expensive in construction, and to some extent in working and maintenance.

(1.) *At North Shore.*

The North Shore Cable Tramway is now paying about 4 per cent. the secretary of the railway commissioners states, if the cost of the land be left out of consideration. Some of this land the commissioners could, if thought advisable, sell to recoup the government for a large part, if not all, of the expenditure upon land in connection with this tramway, and consequently it is not out of place to set aside the cost of the land when considering the return which the tramway is making. This tramway was an exceptionally expensive line. It cost about £70,000—between £20,000 and £30,000 of it was for land—and it is one and a half miles in length. The cost of working the line is 2s. per car mile, and the earnings about 2s. 4d. The proposed tramway under the consideration of this committee would cost considerably less than the North Shore line in construction, the earnings would be very much greater and the cost of maintenance, in proportion to the earnings, would be less.

(2.) *In Melbourne.*

Desirous of obtaining all the information available with regard to the construction and working of the cable tramway in Melbourne, the committee wrote to the Melbourne Tramways Trust and the Melbourne Tramway & Omnibus Co. At first it was proposed that a sectional committee be appointed to visit Melbourne for the purpose of obtaining the information wanted, but as the sectional committee could exercise no power under the Public Works Act outside New South Wales, and, therefore, could not enforce the giving of evidence in Melbourne, it was considered that as much information could be obtained by correspondence as by a personal visit, and the proposal to send a sectional committee was, therefore, not adopted. Letters were sent to the chairman of the Melbourne Tramways Trust, and the chairman of the Melbourne Tramway & Omnibus Co., asking them for information upon every point which it appeared to the committee was important to a right understanding of the tramways in Melbourne, and though all the information asked for was not supplied, as the directors of the company considered it was not to the interests of their shareholders that some of the questions asked by the committee should be answered, sufficient was obtained to prove that the Melbourne tramways are very successful in their operation; that though the cost of construction has been large, the cost of maintenance is comparatively small, and that the profits are large and satisfactory. The cost of the roadway complete, including permanent way, tunnels, concrete, etc., is given at £20,000 per mile; the cost of cables £500 per mile and the cost of engines and machinery about £6,000 per mile. The cost of each centre of driving power has varied, according to the traffic and length of line, from £9,000 to £30,000. The cost of land for engine houses has also varied very much. The engine houses have cost from £6,500 to £15,500. The total maintenance per car mile the replies to the committee's questions do not give, nor is the percentage of profit realized on the tramways stated. The directors of the company do not consider it advisable to give this information, but some idea of the profit made may be obtained from the report of the directors to the shareholders, presented at the annual meeting of the company on August 29, 1890, a copy of which report the secretary to the company forwarded to the committee. The balance sheet and profit and account shown in the report are, to June 30, 1890, and the profit, including £10,093 7s. 6d., carried forward from the last year, and £2,137 0s. 6d. from sales of freehold properties, is set down at £156,935 13s. 4d. From this four quarterly dividends of 4 per cent. each had been paid, amounting to £64,000, leaving £92,935 13s. 4d., and this it was proposed to apply by a transfer to the reserve fund of the profit on properties sold, £2,137 0s. 6d., a payment of a dividend of 2s. per share, £80,000, and carrying forward a balance of £10,798 12s. 10d. In addition to this it was intended "to make a further issue of £160,000 shares without premium to the members of the company, in proportion to their present interests, say, two new shares to every ten shares now held, to be allotted on application and payment of 10s. per share, placing them on an equal footing with existing shares, carying dividends from July 1 last." Mr. H. T. Jordan, who has been treasurer of the Melbourne Tramways Trust since the formation of the trust in 1884, gives the average cost of constructing the cable tramways in Melbourne, including track, engine power, land, buildings, legal, administrative and engineering expenditure, but not including rolling stock, as £35,000 a mile. This cost of £35,000 may, he points out, seem heavy, but a large portion of the amount has consisted of the expense of alterations for drainage, etc., alterations to gas and water pipes, and the widening of two bridges across the Yarra. Judging by results, he says, the tramways in Melbourne have given eminent satisfaction, and they have been very remunerative. The Melbourne tramway system is carried out by two bodies, the Melbourne Tramways Trust, composed of the representatives of the municipalities in which the tramways are laid, and the Melbourne Tramway & Omnibus Co. The trust constructs the tramways, borrowing money necessary to cover the cost; the company takes the tramways from the trust on completion, and conducts the traffic and maintains the lines. From the earnings on the tramways the company pays the trust the interest, 4½ per cent. due on the loans obtained for the construction of the lines, which interest amounts to £67,500 per annum, and for the first ten years of the company's possession or lease of the lines, it pays the trust another 1½ per cent. as a contribution to a sinking fund, which amounts to £22,500 a year. During the second ten years the company pays to the sinking fund 2 per cent. extra, and in the third ten years 3 per cent. extra; all the time keeping everything connected with the tramways in good running order. This money, so paid by the company, is invested by the trust in municipal debentures, or in mortgages on city property, and it is computed that at the end of thirty years the money will pay off the total cost of the

system and enable the tramways to be handed over to the municipalities free of further expense except that of maintenance. The lease to the company is for thirty years, and it will expire in 1916.

(3) *In America.*

America has more largely adopted the cable system of tramways than any other country, and it appears to have been profitable there. Mr. Maxwell Bury has given some of the most important evidence relative to cable tramways in America, and in addition to this evidence it will be found of advantage to read the correspondence between himself and American railway and tramway authorities which Mr. Bury has laid before the committee. Mr. Bury's evidence is principally based upon what he considers to be reliable information from America, and he represents that cable tramways can be worked at much less expense than electric tramways. "The conclusion they have come to in New York," he says, "is that cable tramways can be worked for 2d., and in some instances 4d., a mile less than electric tramways"; and he declares that cable tramways are in great favor in America, and that they have held their ground better than any other system that has been introduced. On the authority of a letter to him from Messrs. Strong and Trowbridge, of New York, he states that over seventy miles of cable trams are to be laid in New York City, and this in the face of repeated trials, and the tremendous efforts of the electric people to introduce the electric system. Mr. A. D. Mosstudd, secretary to the American Cable Railway Co. of New York, writing to Mr. Bury, on September 13, 1890, also bears testimony to the progress of cable tramways in New York in spite of the efforts made to push forward electrical tramways, and Mr. C. B. Holmes, president of the Chicago City Railway Co. has informed Mr. Bury, under date October 1, 1890, that cable tramways are invariably found preferable to tramways of any other description under circumstances which require certainty, speed and economy. Where the travel is sufficiently heavy to warrant the expense of building a cable line, the cable, he says, will do the work so much more cheaply and reliably that there is scarcely any comparison between it and the electric system. Mr. Thow, during his visit to America, found cable tramways in extensive operation in Chicago and San Francisco, there being about thirty-five miles of cable road in the former city and ninety in the latter. He saw them also in New York, Pittsburgh and Denver. San Francisco is similar to Sydney in respect of heavy grades, though some of the grades upon the tramways there are far steeper than anything here. In many places 1 in 5¼ exists, and yet the average speed upon the San Francisco tramways generally is, allowing for stoppages, about seven and a half miles per hour. Cable tramways have been in operation in San Francisco for seventeen years, and up to the present there is no electrical tramway there. In Chicago, also, the cable system has been very successful. As far as Mr. Thow's observation went, wherever cable tramways have been constructed in America they appeared to have given satisfaction. Most of the original tramways in America were worked by horse traction, and the extensive change which has taken place from horse tramways to tramways on the electrical principle has been due chiefly to the smaller cost of constructing an electrical tramway compared with that which has to be incurred in the construction of a cable tramway. In no instance, as far as Mr. Thow could learn, had a cable tramway in operation in America been converted into an electrical tramway. The first cost of laying down a cable tramway is great; but that having been incurred, the cost of maintenance does not appear to be higher than that of other tramway systems, and the service performed by the cable tramway is, as a rule, uninterrupted and thoroughly satisfactory.

ELECTRICAL TRAMWAYS.

Evidence as to Electrical Tramways.

7. The evidence which has been before the committee with reference to electrical tramways will be found somewhat voluminous, but the subject was regarded of such importance as to justify the committee in obtaining the fullest information upon it available. Sir John Fowler's report, though conveying a good general idea of the different systems of electrical tramways in operation, was not sufficient to enable the committee to come to a decision in the matter, and the evidence of witnesses in the position of experts who had had a recent personal acquaintance with the construction and management of electrical tramways, was regarded as a very important part of the inquiry. This evidence, supplemented by the report of the officer of the railway department who specially visited America, though it does not give information upon all essential matters connected with the electrical tramways, will be found to very fully explain many points of interest which in any proper consideration of these tramways it is necessary should be rightly understood. So far as the committee have been able to do, they have obtained information on every point important to be considered in an inquiry as to the superiority or otherwise of electrical tramways over those worked with the cable, or as to the advantages or otherwise of constructing electrical tramways in the streets of Sydney. The principal heads under which the committee have sought information respecting these tramways may be stated as follows:

(*a*) The nature of electrical tramways.
(*b*) How they have progressed in construction.
(*c*) Cost of construction.
(*d*) Cost of working.
(*e*) Extent to which they have been profitable.
(*f*) Probable position of these tramways in the future.
(*g*) Their suitableness or unsuitableness to the route of the proposed tramway.

Nature of Electrical Tramways.

(*a*) An electrical tramway, described in general terms, is a tramway which finds its motive power in electricity generated at an established station, when necessary machinery has been erected and conveyed to the cars by wires which may be suspended over the cars or placed in a conduit or groove under them; or by what are called accumulators, which are first charged with electricity at the generating station and then placed in the cars. The principal kinds of electric tramways in operation are:

(1.) The conduit system (as at Blackpool, England).
(2.) The accumulator system (as at Barking, England).
(3.) The overhead wire system (as shown in the systems known as the Thomson-Houston and the Sprague).

There are some other descriptions of electrical tramways in existence, but in comparison with the three kinds mentioned they are of little importance.

In England, Sir John Fowler states in his report, there are, broadly speaking, two systems of electrical tramways in use, applicable to street traffic. One of these is that of underground conductors (without accumulators) to convey the electric current from the generating station to the motors on the cars; the other is that of accumulators, charged at a generating station by fixed plant. The first of these systems is in operation at Blackpool and Northfleet, and the second at Barking and Birmingham. The Blackpool and Northfleet tramways have been in operation for some years, and have been a commercial success, inasmuch as a fair return has been paid on the invested capital, but Sir John Fowler points out that they have not been adopted in other English towns, and therefore cannot be said to be regarded with favor generally; and "though well worked out electrically" he does not consider them applicable to a city like Sydney. The accumulator system is specially suitable, Sir John Fowler states, for introduction on an existing tramway, as it involves "no alteration in the permanent way or street surface, no large outlay of capital beyond the generating station and accumulators, and no interference with existing street traffic." This accumutator system, as carried out at Barking, is the only system, so far as English experience is concerned, which, in his opinion, furnishes a basis for adoption in Syduey. At Barking the system has been in operation for the last four or five years; at Birmingham for less than one year. Improvements in accumulators, Sir John Fowler says, are continually being made, and he anticipates with some confidence the introduction of storage batteries considerably superior to any existing type. He is of opinion, however, that in the matter of electric traction for street tramways, America is much in advance of England, and this advancement is due mainly, if not wholly, to the adoption of overhead wires from which the electrical power is conveyed to the cars. The overhead wire system of electrical tramways is in operation extensively in some of the principal cities and towns of the United States. The wires, generally about three-tenths of an inch in diameter, are suspended from insulated cross wires placed 125 ft. apart and stretched from the tops of two poles, or it may be iron posts twenty feet high, one on each side of the road, the cross span having a deflection of two feet. In some instances the wires are suspended from brackets instead of from cross wires. The electricity is conducted fom the wire to a motor beneath the car floor, by means of a lever or pole on the roof of the car, this lever holding a grooved pulley or trolley firmly against the wire. By this method the electricity passes from the wire to the lever, and thence through the motor, where the electrical power is directly applied to the propulsion of the car, to the earth, the wheels and running gear acting as conductors. As the rails furnish ample contact, the return is made through the earth after the manner of ordinary telegraph circuits. The trolley wires are held in position over curves in the track by means of guy wires, and the trolley lever or pole, being sufficiently flexible, conforms to the lateral movements necessary to keep the trolley in contact with the overhead wire while the car is rounding the curves. A change of route, or the running of the car from one track to another, is managed by having at all branches of the tramway switches of the ordinary kind in the track and switches serving similar purposes in the wires overhead, so that the trolley wheel runs in the same direction as the wheels of the car. Two attendants, or conductors, travel with each motor car—one to collect tickets and fares, and the other to drive, the driving being very easily managed by the use of brake handles. The different descriptions of electrical tramways can be very well understood from detailed information, with illustrations from photographs and engravings, published with this report as an appendix.

How Electrical Tramways Have Progressed in Construction.

(*b*) At the end of 1889, according to Sir John Fowler's report, there had been constructed in the United States by the two principal electrical tramway companies, 106 electrical railroads, with 636 miles of track, and 1,063 motor cars; and eighty-six other roads, representing a mileage of 217 miles, were under contract and construction. At the date of Mr. Thow's visit to America, between December, 1890, and February, 1891, there were at work and under construction or translation 320 roads, representing 2,800 miles of track and 3,860 motor cars. In 1885 there were three electric roads in operation, with seven and a half miles of track, and thirteen cars. A large proportion of these electrical tramways are converted horse tramways; very few, probably none of any importance, are converted cable tramways.

Cost of Construction.

(*c*) The cost of constructing an electrical tramway on the overhead wire system, which is the system commonly adopted in America, cannot be given very definitely. Mr. Thow, in his report, states that "for Sydney, where the poles would have to pass through existing pavements, the expenditure for overhead apparatus of the best class would probably reach £1,400 per mile," the cost of track and of pro-

viding engine power, cars, etc., depending upon the circumstances connected with the locality where the tramway is to be constructed, and the magnitude of the installation and traffic to be dealt with. Sir John Fowler estimates the cost, by making use of the rails at present laid down in Sydney, and having a service of one car every five minutes, at £5,500 per mile of double track ; but Mr. P. Bedford Elwell, in the belief that the traffic in Sydney would require two cars every four minutes in a large portion of the system, states the cost of construction, "doubling all except the overhead wires," at £9,800 per mile. The track itself is little or no different from that of other tramways. The cost of construction on the conduit system, which Mr. Elwell favors for heavy traffic in Sydney—though under further examination he somewhat modified this view—would be, he is of opinion, about £3,000 or £4,000 a mile, including everything ; and according to Sir John Fowler £4,000 or £5,000. In the total outlay the expenditure upon the conduit system would be, Mr. Elwell states, about 30 per cent. more per mile than the total cost of the overhead line, or about £8,000 per mile. As opposed to this, Professor Threlfall is of opinion that the cost of an electric system with underground conductors would be about the same as that of the cable system, as in each system there would be about the same care necessary to arrange the conduit and place the wire satisfactorily. Mr. Gustave Fischer of the tramway construction branch, department of public works, gives the cost of laying down the permanent way for an electric line, on the overhead system, along the route of the proposed cable tramway, including the erection of wires and posts, at about £30,000. The same weight of rails, he states, is as necessary for the electrical system as for the cable or the locomotive system, and then there is the additional expense for wires and posts, which he considers would be about £1,200 a mile. The total cost of an electrical tramway along the route proposed, with complete equipment, would be, he estimates, £60,000, as compared with £80,000, the estimated total cost of the cable tramway.

Cost of Working.

(*d*) Various statements have been made to the committee as to the cost of working electrical tramways, but no evidence has been given or information laid before them sufficient to show conclusively what this cost of working is, and so far as they have been able to ascertain, it is, in the present condition of electrical tramways, very difficult to get accurate information on this point. This difficulty is said to be due to the circumstance of the companies controlling the electrical tramways in America being subject to the municipal authorities of the localities in which the tramways are laid. A provision in the agreement between the municipalites and the companies requires the latter to reduce the fares upon the tramways, immediately a certain rate of profit has been reached, and to avoid this reduction the companies are said to conceal the actual profits made, and consequently the actual working expenses incurred. Mr. Gustave Fisher, who has given considerable attention to the subject, states that electric cars could be run in Sydney for 6d. a car mile, and he estimate that the annual cost of the electric system for motive power and car repairs would be about £6,000 less than for a cable tram, while the permanent way repairs and maintenance, and the cost of conducting traffic, would be about the same as for the cable system. According to this, £6,000 would be saved annually by adopting the electric system, besides the saving in the cost of construction and in interest. The cost of working an electrical tramway increases as the time interval between the running of the cars is extended. Mr. P. Bedford Elwell agrees with Mr. Fischer in his estimate of working cost ; Mr. Elwell giving it as "between 5d and 6d., as nearly as possible."

Extent to which Electrical Tramways Have Proved Profitable.

(*e*) The same indefiniteness which surrounds the matter of working cost attends the question of profitableness. Nothing has been before the committee to show them free from doubt that the electrical tramways in America have been worked at a satisfactory profit. It is right to say that the information given or produced by some of the witnesses examined, leads to the inference that the tramways have been profitable, but there is nothing before the committee which directly shows it. Professor Threlfall, who spent some time in the United States examining the electrical tramways, never heard, he says, of an electrical tramway there which paid a dividend; but he was informed that the stock of the companies had gone up in value, That, he admitted, might happen without a dividend; but, as already stated, the plea put forward for not publishing particulars of dividends or working expenses is the fear that it may lead to the companies being despoiled by the municipalities. Mr. Thow, in his recent visit to America, met with the same difficulty experienced by Professor Threlfall. He obtained copies of published statements by various companies concerning their operations, but they are not sufficiently explicit to afford the information required.

Probable Position of Electrical Tramways in the Future.

(*f*) Judging from the manner in which the number of electrical tramways in America has increased, and from evidence which shows that efforts are constantly being made to effect improvements in electrical traction, there appears to be every probability that electrical tramways will be an assured success in the future. The principal objections at present to the system which is most in use are the unsightliness and inconvenience of the overhead wires. While the overhead wire system is the easiest and cheapest to construct and to work, the wires and poles necessary in connection with it are in many instances a blemish in the general attractiveness of streets or roads, and an obstruction to many of the operations carried on in large towns or cities. In crowded narrow streets they may be a source of considerable danger. If a desirable method be discovered by which these wires and poles may disappear and be replaced by wires laid underground, or if the electrical tramway on the accumulator principle should be so improved that the weight of the accumulators would be materially reduced, the permanent success of electrical tramways is certain. Both these great improvements on the present systems are possible. Theoretically the accumulator system is preferable to all others; practically, in consequence of the enormously heavy accumulators that have to be carried in the cars, it is at present a failure. Professor Threlfall does not see much margin for improvement in the efficiency of the electrical machinery, but there is, in his opinion, room for improvement in the mechanical details of the machinery, and in the means of carrying the current to the point where it is to be used. He mentions a new system with which a considerable amount of success has lately been obtained in experiments made. In this the track is laid with a third or central rail, this third rail being put down in sections of such length that the greatest number of sections that can be connected by the electrical current with the car at one time are shorter than the length of the car. The electric current passes to the car through the third rail from a conduit under the track, but having no opening, and this passage of the electrical power is effected by means of a magnet carried by the car. As the car passes along the rails the magnet attracts a strip of iron attached to the conductor, making a contact with that portian of the rail, but with no other. Mr. Thow, in his report says, regarding improvements in electrical tramways generally, that "we may confidently indulge the hope that in a few years improvements in details will be made to an extent which will greatly reduce both first cost and maintenance. Already," he states "the Thomson-Houston company has produced a new motor which has only one reduction or armature speed, with one set of toothed gearing instead of two. The armature runs at half the speed of the present types, and its arrangement is simplified so as to permit more perfect protection of the machinery from dirt, and more perfect lubrication of the parts subject to the greatest wear and tear." And he anticipates that important improvements will follow in other channels.

Suitableness or Otherwise of an Electrical Tramway for King Street and William Street to Ocean Street.

(*g*) The question of the suitableness or otherwise of an electrical tramway for the streets, through which lies the route of the proposed cable tramway, referred to the committee by the Legislative Assembly for consideration, depends principally on the nature of King Street. That street is so crowded with traffic that many persons can be found, and some were among the witnesses examined by the committee, who doubt the advisableness of laying down there a tramway of any description; but when in addition to the objection on the ground of traffic, there is that of increasing the number of posts and overhead wires, the prospect of an electrical tramway in the street proving satisfactory is very doubtful. The posts to sustain the wires for the tramway would have to be placed either at the edges of the pavements or in the middle of the street. If they were placed at the pavement edges they would inconveniently increase the number of posts already there, and possibly the wires would interfere with the overhead telegraph and telephone wires. If the posts were placed in the middle of the street. or anywhere in the street between the pavements, they would probably seriously interfere with the passage to and fro of horses and vehicles. William Street is better adapted for an electrical tramway on the overhead wire system, because the traffic in that street is comparatively small; but in William Street (as in one part of King Street) there is a steep ascent, which it has not been satisfactorily shown a tramcar loaded with passengers, and moved by electrical power, would be able to ascend at an appreciable speed. The narrow streets, called William Street North and William Street South, beyond William Street, would also present obstacles to the satisfactory working of an electrical tramway, and it is only along the wide and not much frequented road which passes Rushcutters' Bay and extends to Ocean Street, Woollahra, where the space and absence of traffic and steep grades would make the success of a tramway on the overhead wire system probable.

MATTERS OF IMPORTANCE OUTSIDE THE IMMEDIATE INQUIRY.

Some Other Points of Importance in the Evidence.

8. Some points appear in the evidence which are of importance in relation to the subject of tramways generally, but are not such as are necessary for the committee in the present inquiry to deal with in any way other than by drawing attention to them. The question of leaving tram construction and working to private enterprise is one matter, the idea in the Municipal Council of Sydney that the council should receive some share of the profits from tramways laid down in the streets of the city as compensation for the cutting up of the streets is another; and a third is the question whether any tram construction should be carried out before the extension of the railway into the city, and a site for a new central railway terminus has been determined. These and other matters of some prominence, upon which the committee do not consider it their duty to express an opinion, will be found referred to in different portions of the evidence, and will repay perusal.

DECISION OF THE COMMITTEE.

As the result of a careful consideration of the whole of the evidence which has been before them, the committee have decided, by seven votes to five, to recommend to the Legislative Assembly the construction of the proposed cable tramway. This decision has been arrived at mainly for three reasons : Because the majority of the Committee regard King Street as unsuited for an electrical tramway on the overhead wire system ; because, notwithstanding the number of electrical tramways in America, and the testimony given in their favor, they consider these tramways to be still in the stage of experiment, or that at least they have not yet reached that point of development which would justify their introduction on this route; and because cable tramways are a proved success both in capacity to deal with a large traffic and in paying satisfactory profits. The grounds upon which they regard King Street as unsuited for the overhead wire system have already

been mentioned. The opinion that electrical tramways are not yet sufficiently developed to justify their use along this route is based upon the incompleteness of the information obtainable as to the cost of working them, the amount of profit made, and their power to successfully deal with a heavy traffic over steep grades. An examination of the evidence given by witnesses who have appeared before the committee, and of information afforded in appendices to the evidence, will show that while many statements as to cost of working are given, they are not of that character which would cause them to be accepted as absolutely reliable, and they are greatly inconsistent with the results shown in the operations of the electrical tramway between Randwick and Waverley. That tramway, constructed under the direct supervision of officers connected with the Thomson-Houston company of America, on plans specially obtained from that company, and operated upon by electrical engineers in their service, with electrical machinery and cars manufactured by the company, has not been a success. Though no expense was spared in connection with the experiment, and every opportunity was afforded the Thomson-Houston company to make the tramway successful, it has not reached expectations either in regard to capacity for dealing with traffic or in reasonable cost of working; and the noise and motion of the cars have been subjects of comment. On these points the evidence of the locomotive superintendent of tramways, and a return furnished by the secretary to the railway commissioners, and published in the appendix, will be found interesting. The grade on this experimental line is in one place as high as 1 in 17. Some explanation of the failure of the line may be found in the evidence of Mr. Gustave Fischer, to the effect that the machinery is underpowered. Mr. Thow, in his report concerning his observations in America, says that no doubt need be entertained as to the power of electricity to mount grades of 1 in 12, but from what he could learn it had not been thoroughly proved by any direct experience that electricity was able to move over such grades "a sufficient load at a sufficient speed to satisfy every commercial requirement in Sydney." The point of the whole question, he says, "is a multiple of speed and weight, because on these depend the popularity of any tramway system, and it seems to me we have to settle that point definitely for ourselves." He therefore suggests "that an experimental line be laid over 1 in 12 grades in Sydney, and that bogies fitted with motors of at least fifteen horse power may be obtained to suit one of our existing car bodies, so that the point in question may be exhaustively worked out." If the result of this experiment should be successful, then he would favor electrical instead of cable traction for Sydney. The committee do not consider it advisable either to go to this expense or to await the time that would be occupied in this second experiment before closing their inquiries respecting the proposed cable tramways referred to them. The third reason which has influenced the committee in their decision with reference to the tramway now under consideration is the great success which has attended the operations of cable tramways. In this regard the cable tramways of most importance are those of Melbourne. The system in that city is undoubtedly successful in meeting the requirements of a large traffic, and in paying large dividends. What those dividends are cannot be precisely stated, but there is sufficient evidence to show that they are considerably more than ordinarily is regarded as satisfactory. In America, also, notwithstanding the extension of the electrical tramway system, the cable tramways appear to hold an unassailed and satisfactory position; and in the vicinity of Sydney, at North Shore, a cable tramway has proved itself fairly satisfactory in spite of many difficulties. Cable tramways are undoubtedly more expensive in first cost than electrical tramways, but this first cost may, it now appears, be materially lessened by reducing the size of the tunnel in the roadway in which the wire cable runs; and in the expense of working the two systems there appears to be little, if any, difference. The reduction in the size of the tunnel for the running of the cable is indicated in evidence relating to an improved method of cable tramway construction recently patented by the engineer connected with the tramway system in Melbourne, by which improvement a saving in cost of construction will be effected, it is stated, of no less than £7,000 a mile. Mr. Thow considers electrical tramways to be safer than cable tramways, but the evidence generally does not support this opinion.

Further Evidence in Support of Cable Tramways.

10. Since the decision of the committee in this inquiry, and in relation to the proposed tramway through George, Pitt and Harris Streets, Sydney, further evidence has been given by Mr. H. T. Jordan, treasurer of the Melbourne Tramways Trust, on the subject of cable tramways, and this further evidence supports the opinion of the committee that the proposed tramway from King Street, *via* William Street, to Ocean Street, should be constructed upon the cable, as preferable to the electrical system. He states that the working expenses of the cable system will probably be less than those of the electrical system.

ACCORDING to *Le Journal des Transports*, the General Omnibus Co., of Paris, who operate both street cars and omnibuses are about to make a series of experiments in electric traction on several of their street railway lines, with a new type of accumulator. If these experiments give the results expected the system will be extended. The company also contemplate the installation of a number of compressed air motor cars on several of their lines. Construction upon these motors has been commenced and permission has been obtained from the municipalities for their use.

Bookkeeping and the Classification of Street Railway Accounts.

From Advance Sheets of "Street Railways" (Trams).

BY C. B. FAIRCHILD.

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Whatever benefits may accrue to a community from the existence of a street railway, the prime motive with the projectors and operators is *revenue*, and every means that tends to increase the net income should be carefully considered. No department of the service is more important or more responsible for securing this desired end than the accounting department. Any neglect in properly organizing or conducting this department will be as fatal to the financial success of a street railway company as would neglect in the operating department. Aside from matters relating strictly to the accounting for everything received, the accounting department incidentally gains considerable statistical information relating to the exact nature and extent of the numerous labors performed and the precise cost of movements, which furnishes the best obtainable data from which to rate the degree of skill and economy exercised in each department, and by each class of officials and employes. In order to properly conduct it, an efficient clerical force is necessary, and the work should be done in accordance with proper rules and regulations, and the items should be combined and condensed as much as possible. In order to assist in this direction the following analysis of accounts is presented (see next page), which is based on the requirements of the Railroad Commissioners of the State of New York, under which all the street railway companies of the state are required to make annual reports to the Board. The requirements of other states may vary, but the same basis of division under different heads, and the same system of keeping accounts can be used, whatever the local requirement or personal fancy may be.

The following notes may be added in explanation of the analysis. They indicate the individual accounts that should be carried to the various headings.

3. COST OF ROAD AND EQUIPMENT.

1. SUPERINTENDENCE AND GENERAL EXPENSES.—To include salaries and personal expenses of general officers and superintendents, with their respective assistants and clerks, furniture, stationery, fuel and other office supplies.

2. ENGINEERING.—To include wages of engineers, draughtsmen and assistants, with office and other expenses.

3. RIGHT OF WAY.—To include cost of obtaining franchise, salaries and expenses of agent in securing consents, with all payments for right of way.

4. REAL ESTATE AND BUILDINGS.—To include cost of all real estate and buildings used exclusively for railroad purposes, together with all necessary furniture and fixtures.

NOTE:—*All real estate not so used should be charged, as an investment, to an account kept for that purpose.*

5. ROAD BED AND TRACK.—To include the cost of preparing the foundation, cost of all material and labor of distributing and laying same, including paving and wiring.

6. OVERHEAD CONSTRUCTION.—To include cost of poles, wire and insulating devices with expense of placing same.

7. ROLLING STOCK.—To include the cost of cars and trucks built or purchased, cost of grips, motors, wiring, trolley, switches, furnishings, etc.

8. AUXILIARY APPLIANCES.—To include cost of snow plows and sweepers, with electrical equipment or grips for same, wagons and other vehicles.

9. POWER PLANT.—To include cost of engines, boilers, cable winding drums, pit machinery, tension devices, generators, switchboards, shafting, belting, cranes, foundations, pumps, piping and labor of securing all in position, with heating and lighting appliances.

10. CABLE AND CARRYING SHEAVES.—To include cost of wire ropes, with carrying and terminal sheaves and placing the same ready for operation.

11. REPAIR SHOPS.—To include cost of iron working and wood working machinery, tools and power, if it is independent of the power plant, and the expenses of setting the machinery and appliances

12. ADDITIONS AND BETTERMENTS.—To include such expenditures as actually increase the construction or equipment, and such expenses for renewals or repairs as exceed what is necessary to make good any depreciation of road and equipment.

ANALYSIS OF ACCOUNTS.

1. History.
2. Capital Stock and Funded Debt.
3. Cost of Road and Equipment.
   1. Superintendence and general expenses.
   2. Engineering.
   3. Right of way.
   4. Real estate and build'gs.
   5. Roadbed and track.
   6. Overhead construction.
   7. Rolling stock.
   8. Auxiliary appliances.
   9. Power plant.
   10. Cable and carrying sheaves.
   11. Repair shops.
   12. Additions and betterments.
4. Income.
   1. Earnings
      1. Passengers.
      2. Express and mail.
      3. Advertising.
   2. Other sources
      1. Sale of manure, old material, and disabled animals.
      2. Interest and rents.
      3. Surplus of previous year.
5. Operating Expenses.
   1. Miscellaneous
      1. Salaries of general officers and clerks.
      2. Office service and supplies.
      3. Insurance.
      4. Legal.
      5. Injury to persons and property.
      6. Contingent.
      7. Franchise account.
   2. Transportation
      1. Car service.
      2. Car barn.
      3. Lubricants and waste
         1. For cars.
         2. For power house.
      4. Supplies.
      5. Wrecking, sanding, sweeping and cleaning of conduits.
      6. Stable and power house.
      7. Provender and fuel.
   3. Maintenance of way and structures.
      1. Repairs and renewals of r'dbed and track.
      2. Repairs and renewals of overhead wire.
      3. Repairs and renewals of buildings, docks and wharves.
   4. Maintenance of rolling stock and power equipment.
      1. Repairs and renewals of cars and vehicles.
      2. Repairs and renewals of cable sheaves and grip dies.
      3. Repairs of harness and stable equipment.
      4. Horse shoeing.
      5. Renewals of horses and mules.
      6. Repairs of electric car equipment
         1. Motor armature.
         2. Gears and pinions.
         3. Trolleys.
         4. Miscellaneous.
      7. Repairs of power plant
         1. Steam.
         2. Cable.
         3. Electric.
      8. Tools and machinery.
      9. Miscellaneous.
6. Fixed Charges.
   1. Interest.
   2. Rent.
   3. Taxes.
   4. Franchise charges.
7. Balance Sheet.
   1. Assets
      1. Cost of road.
      2. Cost of equipment.
      3. Real estate and buildings.
      4. Stocks and bonds.
      5. Franchise.
      6. Other permanent investments.
      7. Cash on hand.
      8. Bills receivable.
      9. Open accounts.
      10. Supplies.
      11. Sinking fund.
      12. Sundries.
      13. Profit and loss (surplus).
   2. Liabilities
      1. Capital stock.
      2. Funded debt.
      3. Interest due and accrued.
      4. Dividends unpaid.
      5. Audited vouchers.
      6. Pay rolls.
      7. Open accounts.
      8. Bills payable.
      9. Sundries.
      10. Profit and loss (deficit).
      11. Deficit of previous years.

4. INCOME.

1. EARNINGS.

a. From Passengers.—To include cash receipts for fare and sale of tickets.

b. From Express and Mail.—To include returns for transporting freight—express or mail.

c. From Advertising.—To include receipts for advertising in cars, buildings or on tickets.

2. OTHER SOURCES.

a. Sale of Manure, Old Material and Disabled Animals.—To include receipts from the sale of worn out animals, old materials and manure.

NOTE. *Receipts from these sources may be credited, if preferred, under "Operating Expenses" to the account to which the new material purchased to replace the old is charged. If the old material is not sold or replaced it may be debited to the "Supply" account and when used again or sold this account should receive credit for the same.*

b. Interest and Rents.—To include receipts for interest on securities or loans and receipts for buildings, grounds, leased lines or tracks, and powerleased to other parties.

c. Surplus of Previous Years.—To include the net income, less the payments made therefrom on the business of the previous year.

5. OPERATING EXPENSES.

1. MISCELLANEOUS.

1. SALARIES OF GENERAL OFFICERS AND CLERKS.—To include salaries of general officers, heads of departments, division superintendents and wages of their respective assistants and clerks.

2. OFFICE SERVICE AND SUPPLIES.—To include the expense of heating and lighting the general offices, wages of porters, messengers, advertising, printing of blanks, tickets and circulars, stationery, blank books, tools, etc.

3. INSURANCE.—To include cost of insurance on any property used for railroad purposes, cost of guarantee against accidental bodily injuries or death of employes, passengers and the public, cost of conducting employes' mutual aid association, including expense of collections.

NOTE. *Insurance on property other than that used for railroad purposes should be charged against the property insured. The cost of guarantee may be charged to "Injuries to Persons and Property," if preferred.*

4. LEGAL.—To include salaries, fees and expenses of attorneys and all legal expenses of every kind.

NOTE. *A portion of legal expenses may be divided up between "Injuries to Persons and Property," "Real Estate" or "Franchise" as the services are rendered."*

5. INJURIES TO PERSONS AND PROPERTY.—To include payments made for damages to or destruction of property (not belonging to the company), for persons killed or injured, wages of the employes while disabled, medical attendance or any other expenses (except legal) incident thereto.

6. REMOVAL OF SNOW AND ICE.—To include cost of labor, salt and other expense incident thereto.

7. CONTINGENT.—To include any miscellaneous expenses or rents incurred exclusively in the operation of the road for which other provision is no made.

8. FRANCHISE ACCOUNT.—To include cost of repaving streets, over and above the repairs to pavements, which are chargeable to maintenance of way.

2. TRANSPORTATION.

1 CAR SERVICE.—To include the wages of all men employed on or about the cars while in service, chief conductor, inspectors, starters, with their respective aids.

2. CAR BARN.—To include wages of barn foremen and all persons employed for shifting, cleaning or inspecting cars, tools for same, cost of heating and lighting barns and sheds.

3. LUBRICANTS AND WASTE.—To include oil, grease, tallow and other lubricants, and waste employed on the journals of cars and motors, and on the engines, shafting, winding drums, generators and pumps in the power house and on the rope and carrying pulleys.

4. SUPPLIES.—To include such supplies as are not charged to repairs, such as conductors' punches and portable registers, flags, lanterns, switch sticks, etc.

5. WRECKING, SANDING, SWEEPING AND CLEANING CONDUIT.—To include the cost of replacing derailed cars and removing obstructions and wrecks, with the wages of men employed especially for this service, and cost of tools. Cost of sweeping track, cleaning conduit, sand ing track from car or by special means.

6. STABLE AND POWER HOUSE.—To include the wages of foreman, engineer, electrician and all employed in and about the stable or power house.

7. PROVENDER AND FUEL.—To include the cost of feed and the labor of grinding, cutting and preparing for use, and cost of bedding, medicine and veterinary services. Cost of fuel employed in the power house, with freight charges on the same, water rates and cost of pumping.

3. MAINTENANCE OF WAY AND STRUCTURES.

1. REPAIRS AND RENEWALS OF ROAD BED AND TRACK.—To include cost of all material and tools (rails, ties, paving blocks, sand, etc.), with the cost of labor, (wages of roadmaster, foreman and laborers) in maintaining, repairing and placing new material for track, joints, switches, bonds and supplementary wire, and tracks in buildings.

2. REPAIRS AND RENEWALS OF OVERHEAD CONSTRUCTION.—To include cost of repairs and renewals of poles, all wires and all suspension and insulating appliances.

3. REPAIRS AND RENEWALS OF BUILDINGS, DOCKS AND WHARVES.—To include cost of all material and expense of distributing same, and all labor performed in repairs of offices, stables, stations, buildings, scales, car and repair shops, power house and any other buildings, turntables, cranes, pits and wharves.

NOTE. *Repairs to buildings or other property not used for railroad purposes are to be charged against the property.*

4. MAINTENANCE OF ROLLING STOCK AND POWER EQUIPMENT.

1. REPAIRS AND RENEWALS OF CARS, SWEEPERS SNOW PLOWS AND OTHER VEHICLES.—To include cost of material and labor in repairing, renewing or rebuilding cars and appurtenances belonging thereto, such as trucks, grips, brakes, journal boxes, springs, scrapers, pilots, sand boxes, signs, wheels and axles. Cost of new cars purchased to make good any depreciation.

2. REPAIRS AND RENEWALS OF CABLES, GRIPS, DIES AND SHEAVES.—To include cost of ropes, splicing and placing the same in line; cost of lining and renewing carrying pulleys and terminal sheaves.

3. REPAIRS OF HARNESSES AND STABLE EQUIPMENT.—To include cost of material and labor in repairing or renewing, or of new harness or stable equipment purchased to make good any depreciation.

4. HORSE SHOEING.—To include cost of material and labor and cost of adjustable shoes.

5. RENEWALS OF HORSES AND MULES.—To include cost of horses and mules purchased to replace those worn out.

6. REPAIRS OF ELECTRIC CAR EQUIPMENT.

a. Motor Armatures and Fields.—To include the cost of new material and the labor of removing, repairing, replacing and making all connections for these parts, and the cost of new armatures and fields purchased to make good any depreciation.

b. Gears and Pinions.—To include the cost of repairs and renewals, with the labor of removing and replacing, and the cost of new gears and pinions to take the place of those discarded.

c. Trolleys.—To include the cost of repairs, renewals, labor and new trolley poles and wheels to replace those damaged or destroyed.

d. Miscellaneous.—To include repairs of motors and fields other than those above noted, and repairs and renewals of all auxiliary electric appliances, such as switches, lightning arresters, rheostats, pans, brush holders, brushes and fuses.

NOTE.—*If preferred, the cost of brushes and fuses may be charged to supplies under the transportation expenses, as, strictly speaking, they are not repairs.*

7. REPAIRS OF POWER PLANT.

a. Steam Plant.—To include cost of repairs of engines, boilers, pumps, steam pipe, belts and shafting.

b. Cable Plant.—To include cost of renewals and repairs to winding drums, gears and tension apparatus.

c. Electric.—To include cost of renewals and repairs to generators and their parts, with the labor of removing and replacing; also renewals of switchboard equipment and all connections.

8. TOOLS AND MACHINERY.—To include cost of repairs and renewals of repair and car shop equipment.

9.—MISCELLANEOUS.—To include all expenses of maintenance of equipment not provided for as above.

6. FIXED CHARGES.

1. INTEREST.—To include all payments made on account of funded or floating debts.

2 RENTS.—To include rentals of leased lines and buildings, stables, power houses, sheds and buildings for railroad purposes.

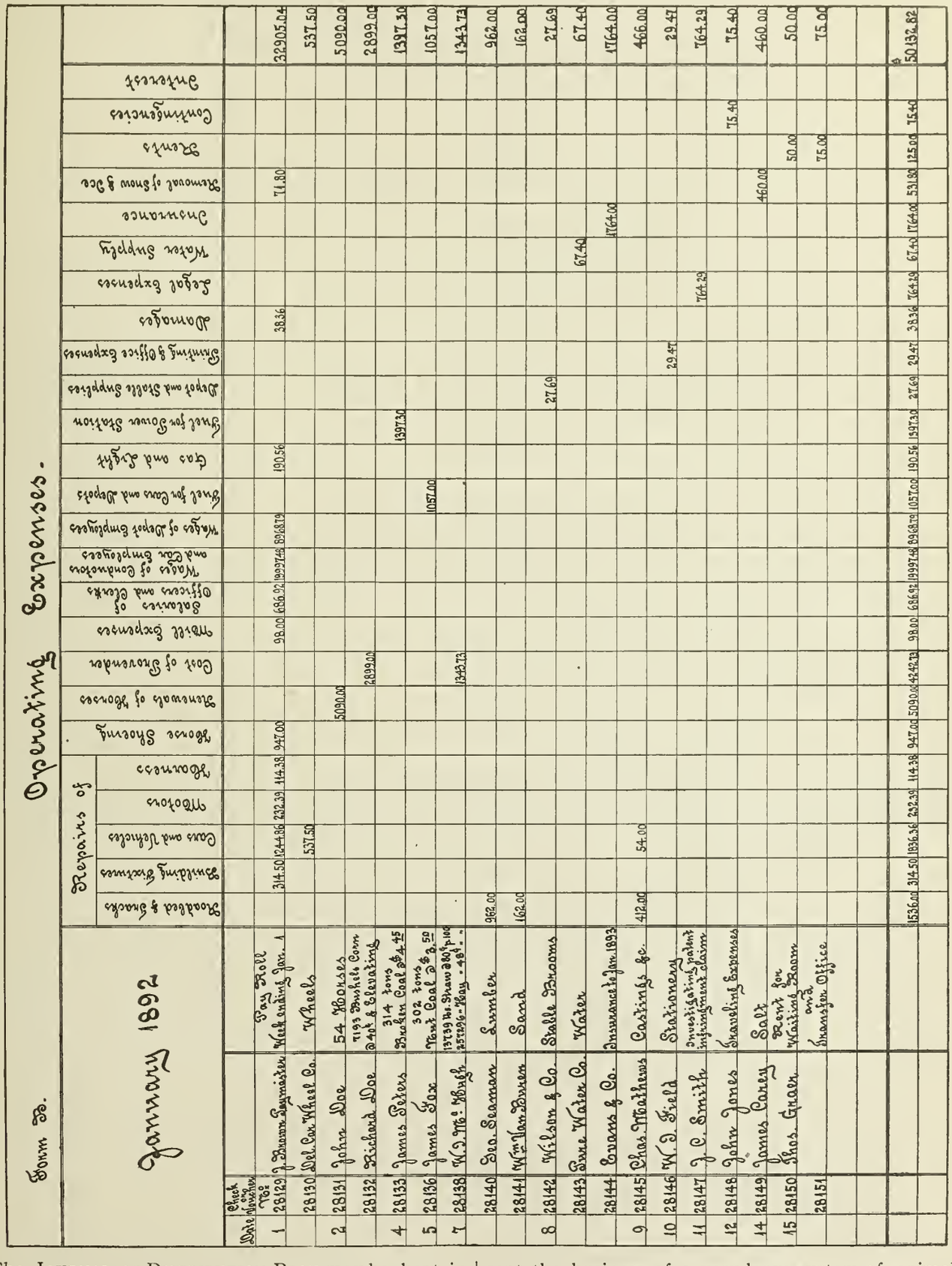
3. TAXES.—To include such as are assessed on property used in the operation of the road, on earnings, capital stock, and other than the foregoing.

4. FRANCHISE CHARGES.—To include any payments made to the city on gross earnings, in a consideration of franchise.

BOOKS.

Having properly analyzed the accounts, the book-keeping becomes a comparatively simple matter. Two

principal books only are required; the number of auxiliary books, or report blanks, will depend upon the extent and number of departments into which the business is divided. The principal books are known as Journal or Distribution Book and Ledger.



The JOURNAL or DISTRIBUTION BOOK may be kept in different ways. One form of ruling is shown in Form B, headed "Operating Expenses." This method requires that the pages of the Journal be about 28 × 17 ins., which is bound with a number of divisions to correspond with the number of ledger headings required. Each division is ruled to suit the number of sub-headings required, and a tag is inserted to mark the beginning of the divisions. By this method the sum total is carried to the debit of an account under "Operating Expenses" in the ledger, so that the various charges under the several headings do not take up the room on the ledger, but are condensed under the one heading, the details appearing only in this distribution book. The following embrace all the ledger headings that are employed in a set of books that represent the business of a very large system of animal traction:

Capital Stock,	Equipment,
Bonds,	Real Estate & Buildings,
Treasurer,	Operating Expenses,
Profit & Loss,	Interest,
Passenger Earnings,	Taxes,
Miscellaneous Earnings,	Accounts Payable,
Supplies,	Accounts Receivable.
Construction.	

The same thing is done with the "Equipment Account." A division of the distribution book has a heading, and under it the various columns show cost of cars, horses, motors, etc., and at the end of each month the sum total is carried to the account called "Equipment" in the ledger.

The same for "Construction;" the columns showing amounts expended for rails, roadbed, etc. By this means the details of all expenses, whether on account of capital, Track," etc. At the end of each month an inventory is taken of the supplies on hand and deducted from those various accounts, thereby showing the exact amount of expenditure for those repairs, cost of feed, etc., leaving the supply account debited with the amount of supplies actually on hand. By this means the company will always know what supplies are on hand and paid for, and the various accounts will only be debited with the amounts actually used.

(A) RECEIPTS. ..... *1892.*

Name of Conductor.	L. F.	Tickets.	Fares.	Total.	Brown Street Line.	White Street Line.	Green Street Line.	Fifth Street Line.	Office	Miscellaneous.	Total.	
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....

DISBURSEMENTS. ..... *1892.*

	L. F.	Check No.	A. V. No.	Sundries.	Audited Vouchers.	Miscellaneous.	Total.	Balance in Bank.	Cash on hand.
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

(C) TRANSPORTATION.

Date.	L. F.	A.V. No.		Sundries.	Audited Vouchers.	Supply Account.	Cash.		Transportation.
.....	.....	.....	.....	.....	.....	.....	.....	Car Service.	
.....	.....	.....	.....	.....	.....	.....	.....		
.....	.....	.....	.....	.....	.....	.....	.....		

FORM E.

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	For Year.
Miles between Termini	11.692	11.692	11.692	11.692	11 692	12.407	12.407	12.407	12.407	12.407	12.407	12.407	12.109
Miles of Single Track	23.384	23.384	23.384	23.384	23 384	24.814	24.814	24.814	24.814	24.814	24.814	24.814	24.218
Miles Run by Cables	31.926	28.881	31.989	31.089	33.670	33.466	35.029	34.958	34.202	35.325	33.793	35.214	399.542
Average Number of Trains Run	44 6	45.9	45.6	46.3	45.2	45.8	45.4	45	43.8	43.8	41.3	41.2	44.6
Total Number of Round Trips	22,531	20,706	22 644	22,291	23,006	21.612	22,993	22,533	21,021	21,451	19,300	19,910	259,998
Car Mileage	363,962	334,376	365,884	360,068	373,048	369,967	393.101	385,835	360,240	367,504	331,823	342,905	4,348,713
Passengers Carried for Revenue	836,003	718,801	794,653	927,339	959,810	979,723	1,039,362	1,024,325	1,028,523	1,126,949	830,566	871,967	11,128,021
EARNINGS.													
Car Fares	$41,300.15	$35,940.05	$39,732.65	$46,366.95	$47,990.50	$48,986.15	$51,968.10	$51,216.25	$51,426.15	$56,347.45	$41,528 30	$43,598.35	$ 556,401.05
Advertising	181.10	182.15	182.70	181 25	181.95	184.80	184.25	185.00	183.27	182.85	182.40	181.65	2,193.37
Rents	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30.00	15.00	45.00
Miscellaneous	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total Earnings	$41,481.25	$36,122.20	$39,915.35	$46,548.20	$48,172.45	$49,170.95	$52,152.35	$51,401.25	$51,609 42	$56,530.30	$41,740.70	$43.795.00	$ 558,639.42
OPERATING EXPENSES.													
Car Service and Expense	$13,846.82	$12,831.95	$13.715.22	$13,209.43	$13,000.71	$12,836.00	$13,097.42	$11,903.08	$10,533 29	$11,063.05	$10,174.88	$10,735.45	$ 146,947.31
Injuries to Persons and Property	2,532.07	1,722.86	1,570.33	4,209.29	2,804.10	1,982.78	2,013.23	1,102.39	1.493.29	1,031.82	987.57	3,058.94	24.503.67
Car Licenses	274.97	285.41	285.41	308.33	304.17	304.17	306.25	308 32	293.80	308.42	277 92	241.65	3,538.82
Repairs of Cars	797.75	727.68	851.49	664.70	580.89	730.20	677.49	732.55	570.41	729.97	1,013.70	835.78	8,912.70
Repairs of Grips	435.72	421.10	541.04	567.44	552.39	511.14	387.79	479.19	445.29	418.23	460.99	512.19	5,732.71
Motive Power	10,890.97	11,566.46	10,640.03	9,080.57	10,032.50	11,023.82	11,224.05	10,552.25	10,991.21	12,143.05	12,155.20	12,174.85	132,475.86
Maintenance of Track and Buildings	718.34	716.76	534.35	573.45	571.73	596.21	1,134.89	1,294.42	835.12	736.40	683.24	803.62	9,198.53
General and Miscellaneous	3,226.35	2,337.16	2,703.91	2,179.89	1,996.13	2,535.21	1,132.54	2,360.04	2,199.97	2,236.72	2,355.94	2,484 67	27,709.13
Advertising and Attractions	.....	36.40	406.90	76.88	129.59	289.87	349.54	325.11	810.05	735.08	.....	.....	3,160.42
Taxes	869.55	1.048.10	884.58	879.10	873.45	887.16	1,178.84	707.45	513 00	67 54	579.97	166.11	8,645.85
Total Operating Expenses	$33,592.54	$31,693.88	$32,133.26	$31,740.08	$30,846.46	$31,696.65	$31,502.04	$29,664.80	$28,685.43	$29,532.18	$28,689.42	$31,048.26	$ 370,825.00
Per Cent. of Earnings	80.98	87.74	80.50	68.19	64.03	64 46	60.40	57.71	55.58	52.24	68.73	70.89	66.38
Cost per Car per Mile	9.2c	9.5c	8.8c	8.8c	8.3c	8.6c	8c	7.7c	8c	8c	8.6c	9c	8.5c
Net Earnings, 1891	$ 7,888.71	$ 4 428.32	$ 7,782 09	$14,808.12	$17,325.99	$17,474.30	$20.650.31	$21,736.45	$22,923.99	$26,998.12	$13.051 28	$12,746.74	$ 187,814.42
Net Earnings 1890	$ 3,924.27	$ 6,428.11	$ 8,566.09	$15,764.01	$24,034.54	$23,274.26	$21.845.93	$20,997.25	$23,981.41	$22,212.06	$16,702.27	$14,641.19	$ 202,371.39
Increase	$ 3,964.44	.....	.....	.....	.....	.....	.....	$ 739.20	.....	$ 4,786.06	.....	.....	.....
Decrease	.....	$ 1,999 79	$ 784 00	$ 955.89	$ 6.708.55	$ 5.799.96	$ 1.195.62	.....	$ 1.057 42	.....	$ 3 650.99	$ 1,894.45	$ 14.556.97

operation, interest, taxes etc., are entered in the distribution book, and each month the sums total are carried to these various accounts in the ledger, the items of which can be found in detail by reference to the distribution book.

In keeping supplies, the purchases may be made and charged to the various operating accounts for which supplies are purchased; for instance, provender and the cost of preparing the same for use under "Cost of Provender;" hardware, wheels, car equipment, etc., to "Repairs of Cars;" rails and other supplies for track to "Repairs of

The receipts may be kept in the same book by having a department for "Passenger Receipts," with the pages ruled so as to show the receipts from different divisions of the system, and another department for "Miscellaneous Receipts." In this case no cash book is required, as the check stubs and petty cash book show all cash payments.

A CASH BOOK, of which Form A will serve as a model, may be used if preferred. This is headed on its opposite pages "Receipts" and "Disbursements." The "Receipts" side in the cash book shows the name of the conductor, the amount of cash for tickets, the amount

of "cash fares," the "Total" of the two foregoing; the total for line each being carried into the column under its proper head; tickets sold in office are entered under "tickets" and carried to "office" column; any other receipts are entered under "Miscellaneous." The total line receipts each day are carried to the total column as are all other receipts. The "Disbursements" side shows the name and the check number, and when an audited voucher is paid the number entered under "A. V. No." and the amount entered under "Audited Vouchers," and the total audited vouchers for the day carried to the "Total" column. For other disbursements the check number is entered under "Check No." and the amount under "Sundries;" for instance, if it is pay roll, which is divided into ten different parts, each part is entered separately and the total carried to the "Total" column. Any other payment would be entered under "Miscellaneous," and the amount under that head carried to "Total" column each day. The two columns "Balance in Bank" and "Cash on Hand" are merely memoranda to show at a glance the two items.

(D) THE PEOPLE'S RAILWAY.

Statement of Operating Expenses for 189

GENERAL EXPENSES.			
Salaries of General Officers			
Salaries of Clerks in General Office			
Miscellaneous Expenses, General Office			
Stationery and Printing			
Insurance			
Legal Expenses			
Injuries and Damages			
Contingent Expenses			
Stable Expenses			
TRANSPORTATION EXPENSES.			
Car Service			
Car House Expenses			
Oil and Waste for Cars			
Operation, Power House			
Coal, Power House			
Oil and Waste, Power House			
Light and Fuel, Cars			
MAINTENANCE OF WAY AND BUILDINGS.			
Repairs of Roadway and Track			
Renewals of Rails			
Renewals of Ties			
Repairs and Renewals of Paving			
Repairs of Overhead and Sup. Wire			
Repairs of Buildings			
MAINTENANCE OF EQUIPMENT.			
Repairs of Cars			
Repairs of Electrical Equipment :			
(*a*) Armatures and Fields			
(*b*) Gears and Pinions			
(*c*) Trolleys			
(*d*) Sundry Repairs			
Repairs of Steam Plant			
Repairs of Electrical Plant :			
(*a*) Dynamos			
(*b*) Switchboard			
Tools and Machinery			
Miscellaneous Expenses			
FIXED CHARGES.			
Interest			
Rent			
Taxes			
Receipts for Month			
Expenses for Month			
Surplus			
CONSTRUCTION AND EQUIPMENT.			
Building Construction			
Track and Roadway Construction			
Overhead Construction			
Car Equipment			
Snow Plows and Sweepers			
Power Station Equipment			
Tools and Machinery			
Improvements and Betterments			
Cash on hand			
Supplies			
Floating indebtedness			

At the end of the month posting may be done direct from the cash book to the ledger of the totals of the several lines, and the total of the "Office" column and the items under "Miscellaneous" to the several accounts to which they belong. The "Disbursements" side items are posted separately to the ledger, except the "Audited Vouchers" which can be posted in bulk.

A modification of the journal, shown in Form B, can be made to conform more nearly with the analysis given on page 415. In this case the divisions of the journal may be given the first sub-heading (General Expenses) under operating expenses, and the columns ruled to correspond with the final sub-divisions. This will necessitate a few more accounts in the ledger, or the items may be combined and posted under "Operating Expenses."

In order to reduce the size of the journal page, and for other reasons, Form C may be employed. With this method the journal is divided and classified to correspond with each ledger account; for instance, "General Expenses," "Transportation," "Maintenance of Way," "Structures," etc., and to each division is assigned a certain number of pages.

The name of the division "Transportation" is printed on the top of each page of that division, and on the margin of the first page of each division (see Form C), and the preceding leaves are cut out after the manner of an index, and at the beginning of each division a leather tag is placed, which extends beyond the leaves and on which the name of the division is printed, and serves as a ready refererence to any division. The sub-head "Car Service" is printed, in the last column, and a sufficient number of pages are devoted to each of the sub-divisions.

Each item chargeable to any account is entered in full, the audited voucher number, name of the firm, from whom the purchase was made, the article, so that all items charged to any account are readily referred to without consulting any other book, the audited voucher number being entered so that the original bill may be referred to with very little trouble.

The three columns headed "Sundries," "Audited Voucher" and "Supply Account," represent the principal credit accounts, and at the end of each month the totals of each account are posted to the debit side of the ledger and the grand totals of the three columns for the month are posted to the credit side of the ledger account represented. Items that do not come under either printed head can be all carried into the sundries column and posted direct to the ledger.

The ledger is ruled in the usual form, and does not differ from those used in ordinary bookkeeping.

As an aid to forming the divisions and subdivisions of the journal, the accompanying Form D is presented, which is a monthly statement made from a journal kept in the manner last described, and, it will be seen, is composed of five departments with their sub-divisions. The analyses of accounts given in this form do not correspond in all respects with that given on page 415, but are very satisfactory.

The auxiliary books or blanks may be ruled to suit the different accounts for which they are to be used; for instance, the record of armature repairs is made from the armature repair tag, which is sent to the office from the repair shop, and which is illustrated with other blank forms in this connection. The following are the points to be noted: 1. Armature No. —, 2. Extent of Damage, 3. Date Damaged —, 4. Cause of Damage, 5. From Car No. —, 6. Motorman, 7. Repaired by—, 8. Time Consumed, 9. Placed in Car No. —, 10. Date Same was Replaced.

Books for the daily and weekly horse report and power house reports with engineer's log book and others are also necessary.

Form E is offered as a desirable model from which a manager may make a summary of an annual report to his board of directors. The form is reproduced without altering the figures from the annual report of the manager of a large sreet railway system.

The Operation of Electric Railroads Without Compensation to the Abutting Owner.

By J. K. BLAKE.

A highway has been defined as "a passage, road or street, which everyone has a right to use. It is created (1) by legislative authority, or (2) by dedication. It is simply an easement or servitude, carrying with it as its incidents * * * * the right of use for sewerage, distribution of light and water, and for the furtherance of public morality, health, trade and convenience. The owner of the land retains the fee, and all the rights of property, not incompatible with the public enjoyment.* The most common use of the highway is that of public travel.

When the highway is created by enactment, compensation is required under the United States Constitution. This compensation is considered as the just return to the private owner for the loss of such enjoyments in the land as the public will deprive him, by its future use of the same. This return, therefore, is regarded as a complete and adequate one, paid all at once, for such enjoyments as the property owner loses now and will be deprived of in the near future. One of these enjoyments is the sole use of the land for passing and repassing. When the public has acquired, (by payment of the compensation), the present and future use of the enjoyment, it has a right to use the highway by any methods of traveling, whether they are the same as those in vogue at the time of the purchase of the enjoyment, or not, provided they do not encroach on any of the enjoyments, for which the owner has not been paid and has not, therefore, given up. In other words the highway may be used by the public in any way, in the line of public travel, whether such methods were contemplated by the public or not, when the land was taken, provided there is no deprivation of the enjoyments still remaining in the possession of the private individual.

When the land has been acquired by dedication, the owner gives up such rights as are necessary for the public use of a highway, retaining all others in himself. These can only be taken from him after proper compensation.

Besides the usual methods of travel, there are three which may be considered as not unusual to a public highway and concerning which the question might arise, whether they were directly in the line of public travel, and as such be entitled to the use of this enjoyment which the public have obtained. These are, (1) steam railroads, (2) horse railroads, (3) electric railroads.

A comparison of the incidents of the use of all three is necessary to determine their respective rights. It has been decided that the use of the first cannot properly be classed under the head of ordinary public travel on the highway,† the chief reason being that it excludes the public from a use of that part of the road which the rails occupy, both on account of the fear of accident and the construction of the track. On the other hand horse railroads do not so exclude the public, and have been held in the line of ordinary public travel.

"The placing of the tracks level with the surface of the street, the condition of the street between the rails * * * present practically no interference with the use of the entire street for all kinds of vehicles"‡

This description of track applies equally well to that used by electric cars, and in this respect they are as clearly in the line of ordinary public travel as horse cars. The only change has been in the motive power, and this has been held (where a horse railroad was changed to an electric road) not to change the character of the railroad nor increase the servitude.§

Does the erection of poles and wires along the line, however, impose an additional burden, for which the former owner has not been already compensated? It has been recently held, in the case of telegraph poles erected on the road side, that these are a burden for which an abutting owner may receive compensation, the reason being given that they were not in the line of public travel.* Surely poles and wires which directly supply the motive force and are the direct means of facilitating public travel, are not open to this objection, and their erection without compensation certainly cannot be opposed on this ground.

The poles ought in no way to hinder the access of an owner to his premises, for they should always be placed to accommodate abutting owners, but in case this was impossible it seems as if some compensation should be made to the property owner in proportion to the inconvenience suffered. For while he has lost the right to exclude others from the highway, he has not given up that of passing and repassing to his own private property.†

The slight danger and noise attendant upon the use of an electric road have been decided to constitute no additional servitude.‡ It seems, however, that the owner's easement of light and air may, to some extent, be taken away by such poles and wires, and though it has been held in a number of cases, that any improvement in railways which impairs this easement by reason of the structure of the same, affects property, and compensation must be made therefor; still it would seem that the obstruction of a single pole, either eight or ten inches in diameter at the most, from which the wires are supended in the middle of the street, would hardly constitute such an obstruction to the owner's light and air as would justify anyone in setting in motion the ponderous machinery of the law to obtain damages so slight. *De minimis non curat lex.*

When the poles are erected in the middle of the street, as they sometimes are, no land of the abutter is actually taken,§ and surely he is in no way deprived of either light or air thereby.

It may be contended, that since the cars might be propelled by a current supplied, not from an overhead wire but by storage batteries, or from a wire laid in a conduit underneath the street, the erection of poles is unnecessary and therefore unjustifiable. The relative values of these three systems however, is a mooted question, and as Vice-Chancellor Van Fleet decided, with the concurrence of the rest of the court in *Halsey* v. *Rapid Transit Co.*, it appears from evidence that in the present state of the art these (poles and wires) constitute the best if not the only means, by which electricity can be successfully used for street car propulsion.‖ Even should it be shown that some other than the overhead system was the best, it might still be debatable, whether a corporation is bound to use the latest and most approved means of locomotion, provided (as in the case of electric roads), the present means is otherwise entirely within the line of ordinary public travel on the public highway.

The whole subject may be summed up in this way: Electric railroads with the necessary poles and wires are in the line of usual public travel. The poles can be erected so as to make the burden on the land practically nothing, and, therefore, no compensation is necessary.

They might, however, be so situated as to materially interfere with access or light and air, and it would seem as if in such cases some compensation ought to be paid to the party injured.

*Bouviers Law Dict.
†Story *vs.* N. Y. El. R R., 90 N. Y. 122. R. R. *vs.* Hambleton, 40 Ohio.
‡Randall 2s. Jacksonville St. R. R. 25 Mass. 50.
‡Green *vs.* Inhabitants of Trenton, N. J., Supreme Court, January, 1892.
§Mt. Adams Inclined R. R. *vs.* Winslow, 3 Ohio, Circuit Court, Rep. 425.

*Pacific Postal Tel. Cable Co. *vs.* Irvine 49 Fed. Rep. 113.
†But Dillon's Munic. Corp. p. 716, note 1, says, where the fee of the street remains in the municipal corporation "mere inconvenience of access occasioned by an authorized use of the street gives to the owner no ground for a private action," and cites Kellinger *vs.* St. R. R., 50 N. Y. 206.
‡Lonergan *vs.* Lafayette St. R. R., Circuit Court, Ind.
§Halsey *v.* Rapid Tras. St. Ry. Co., 47 N. J. Eq. 380.
‖Confirmed in Lockhart *v.* Craig St. Ry. Co. 21 Atl. Rep. 26 (Penn. Sup. Ct

Strike in Cleveland.

The employes of the East Cleveland and Broadway & Newburgh street railroads went on strike during the latter part of last month.

They claim that the agreement which ended their strike of a few weeks ago does not operate satisfactorily. They accordingly presented a demand asking for more pay and longer hours, and that no one not a member of the K. of L. be employed. The demand was refused and at the time of going to press the strike was still on.

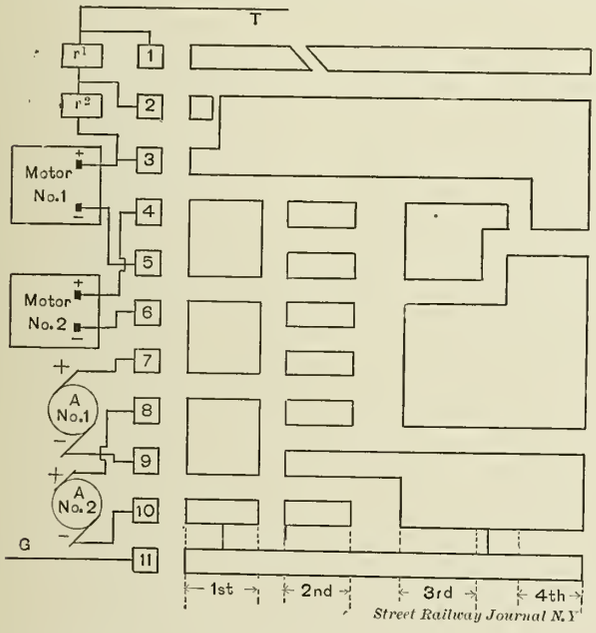
A New Method of Controlling Street Cars.

BY M. D. LAW.

Having seen a partial description of a series multiple street car switch, I present the following as an explanation of the series multiple street car switch which was designed by Mr. David Mason, engineer of the Edison General Electric Co.'s Schenectady works. The writer had the pleasure of assisting Mr. Mason in the experiments with this switch.

A resistance of from six to ten ohms is used, divided in two equal sections, one to carry ten, and the other twenty amperes. These resistances are placed in series with each other and in series with the trolley wire. Then the switch is so arranged that the first point will place the two resistance coils, fields and armatures in series. A slight move of the switch handle will short circuit one resistance coil.

The second point first drops one motor entirely, and finally drops the second resistance coil, allowing the car to be operated by one motor, which is sufficient power to handle a car on anything less than a 7 per cent. grade. The connections are so arranged as to use one motor in one direction, and the other in the opposite, allowing the



motors a large amount of rest and time to cool, thus reducing the number of burn-outs.

At the time of passing from the second to the third point, both motors are entirely thrown out of circuit by a dead point, which must be long enough to completely kill the motor which has been in use. At this point, the armatures of both motors are thrown in parallel and the fields in series, and at the fourth point both armatures and fields are thrown in multiple, giving the full force of the motors. It must be borne in mind that the separate coils of the field magnets are coupled in multiple at the motor.

It is found with a switch of this description, that the car starts very smoothly and will do the most of town running with the motors in series, while the voltage in in the motors is but one-half that on the trolley line. This method of operating has many advantages. The car being under perfect control at starting, in fact, the switch handle can be moved very slowly on the first, second and fourth points without sparking. It is better to make the movement at the third point rapidly, not only to save sparking, but so as not to have the motors lose speed, for at that point they are both momentarily thrown out of circuit.

Another great advantage is that the car can be operated on 30 per cent. less current. Only one point is used on reverse, and that with motors in series, the resistance being commutated the same as on the forward side. This is found to be all that is necessary, as it gives sufficient power to slide the wheels, and does not strain the motors and gearing in making an emergency stop.

The accompanying diagram will give a clear idea of the switch. The figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, represent the contact points on an ordinary three or seven point Edison switch, with the connecting wires from these points to the resistance coils, armatures and fields of two motors, the points r1 and r2 being the resistances. The remaining contact strips to the right of these figures represent a cylindrical switch laid out flat, the dotted lines at the bottom showing the different points.

It is very noticeable that the majority of street railway lines are being constructed in the same slovenly manner that electric light wires have been erected, and I suppose that we must submit to a large number of accidents before street railway companies will learn that only first class construction will pay. One of the principal faults is that of putting up the span wires without any insulation in them between the trolley wire and the pole. The one insulation between the trolley line and the span wire is not sufficient; there should be an insulator placed on each side of the trolley wire, so that when a telephone or telegraph wire drops over the span wire it can cause no trouble, for in such case the trolley pole is liable to leave the wire while the car is in motion, and in drawing down at the span wire it makes contact between it and the trolley wire, and an accident or fire is the result. Should guard wire be used, and this precaution taken, it would very much reduce the number of accidents. Let us have first class construction and thus stop the cry against the trolley.

Some street railway companies seem to think that after the trolley wire is once up over the street it requires no further care, but such is not the case. Great care should be taken to keep the line in its proper position over the track, for if it is not in line with the position that the trolley naturally takes, the trolley wheel will rub it on one side and soon wear the wire to such an extent that it will not stand the strain and drops into the street. It is cheaper to keep the trolley line and wheels in good condition than to put up a new line every year or two.

Stock Watering as a Business.

The get-rich-quick method of doing business is peculiarly American. It frequently "takes the breath away" from the average foreigner to see how Americans crowd results into a short period of time. This appetite or tendency is one of the incentives of stock watering, which process may fitly be described, when legitimately done, as capitalizing profits rather than assets. There are numerous ways of looking at this class of business, but the more important are two; one is from the standpoint of the operator who shares in the distribution, and the other from the standpoint of the one who does not. The consequent antagonism between the two is now one of the greatest obstructions business reorganizations have to contend with, and there are few signs that this conflict will cease until the subject is thoroughly ventilated in the press and understood in all parts of its bearings. The instinctive fear of those who are sharing in the watering process, which is founded upon the particular just described, is one of the reasons why more is not known about a subject which forms the active base among the numerous corporative reorganizations that are now taking place in all parts of the country. But there is nothing to hide so long as it is honestly conducted, and when it is otherwise, that is, when all the stockholders do not participate in the division of a watered stock, the stockholders themselves are as much interested in its exposure as they are in the exposure of any crime.

There is no questioning the statement that stock watering is closely interwoven with the great majority of the country's business affairs; and what is more, the outlook is that the process is here to stay; for never before in our history has so much of it been done as during the past few years. Next in importance, the act is deemed by investors perfectly legitimate, and the proof that such is

their general opinion, is that they daily invest large sums of money in undertakings which they know to be organized under that method. A few years ago it was a common occurrence for a concern which wished to organize as a stock company to capitalize itself at the exact cost of the plant, or its market value, added to the sum of money necessary to run the business. To day this is rarely, if ever, done except the concern is starting new in a business; and even then, if the undertaking is large it is more frequently capitalized on prospective profits rather than on actual resources. But that is an outside form of stock watering, and not a part of that to be seen in the larger undertakings of the day, which may more fitly be described as reorganizations or enlargements of existing institutions.

Of course stock watering frequently yields large sums of ready money to the organizers, for the process is the issuance and selling of capital stock on the future. Investors as a class are willing to so look upon the matter, and accept it as any merchant would an ordinary business risk. The investor well knows that the money he invests is a risk taken in the prospective earnings of a company, and if he is satisfied that those earnings are as good or better than any he can get elsewhere, the question of whether the stock is watered or not is a secondary consideration. This means that an investor is not deterred from making an investment because a stock is watered, because his whole attention is drawn toward earnings rather than the cost of resources. He well knows that a concern might have cost in cash any given sum of money, but if that concern was improperly managed, or otherwise possessed poor earning power, the fact of original cost being large does not in itself assure his dividends. The proof of this state of things is in the numerous instances of well known corporations which have added no water to their stock; to-day these instances do not bring one dollar per share more in the stock market in consequence of their self-imposed restraint, than do corporations which earn just as much money on their watered capitalization. We could cite many instances in support of this conclusion, but they would occupy space to little purpose, for they are well known by the average investor.

Now, be it noticed, right here we directly strike into the root or motive for stock watering, which is a recognition on the part of corporation promoters that the investor invests his money upon earnings, and not upon auction values of plants. This is the key note to the whole business, and it must be confessed that it was not much understood in this country until a comparatively recent date. So long as the investor thinks the assets of the corporation are large enough to properly conduct the business, he ignores them altogether.

We refer more particularly to investors' standpoint, because no one else is supposed to be interested in this form of doing business, the issue of the effects of a concern's doings on the outside public being another question. The investor in a business is its owner; he practically becomes a limited partner in it, and so long as the concern is situated to afford him a fair return on his money, he commonly ignores all else. Of course this investor is deeply interested in any stock watering which may take place after he has entered the concern, and if anything of the kind is attempted without his knowledge, and without allowing him a division in it, strictly speaking that is legally and morally a crime. That this has been done in certain cases is well known. Certain officers have secretly increased the issue of a stock and put it on the market for sale without giving any part of the proceeds to the other stockholders. This is a state prison offence in every or nearly every state in the Union, and naturally to be condemned by investors as well as all honest people. But when the stock is watered and an equal division is made of the increase among all stockholders, whether outsiders are informed of the matter or not, it strictly speaking is perfectly allowable; although in several states, any kind of stock watering, whether an equal division is made among the stockholders or not, is illegal. Laws have been passed against this business more from a misunderstanding of it than for any other reason, and the effects of such adverse legislation is to drive those who contemplate anything of the kind into other states where the law does not interfere.

It is well known on the stock exchange that a good 4 per cent. stock will sell for more money, proportionately, than an 8 per cent. stock; that is, if a concern is paying 8 per cent. dividends on $1,000,000 capital, and its stock is quoted at 120, should the concern vote to water its stock by doubling its capital to $2,000,000, while, of course, receiving no additional money to represent it, the stock, now becoming 4 per cent., is usually sold on the exchange for more than 60, which figure the stock watering would justify. Commonly 70, 80 or even 90 is paid for 4 per cents. under just such circumstances; which particular being well known among observers, is in itself a frequent cause for stock watering. The reason for this unreasonable state of affairs is that investors, as a class, are over or unreasonably suspicious of high dividends. For some reason, which they may best explain to their own satisfaction, they feel more secure in obtaining their dividends if such dividends are reasonably small. Of course this is nonsense, but investors have their little superstitions like some other people, and the corporation organizer feeds on the weakness accordingly.

Gas Motors in Chicago.

During the past two years a series of tests has been made in Chicago with the Connelly gas motor, with a view of determining its capability as a substitute for animal traction on the horse lines, and as an auxiliary to the cable line. Mr. Yerkes, in a recent interview with a representative of the STREET RAILWAY JOURNAL expressed himself well satisfied with the operation of the motor and stated that his companies have concluded to use them extensively on their lines. About twenty of these motors, according to Mr. Yerkes, are now being built and will be introduced at once upon the lines of the North and West Chicago street railway companies. They will be built by the Connelly Motor Co., of Illinois, in which Mr. Yerkes said his companies have purchased a controlling interest, a large plant will soon be in operation manufacturing these motors, the machinery for which is now being installed.

The motor car which has been in operation in Chicago during the past winter was of ten horse power. For a short time it ran on the Clark Street cable lines between the cable cars drawing one trailer. It also operated on the Dearborn Street line, where, in addition to a heavy traffic, there is a 5½ per cent. grade as well as two curves. On the last trip that it made it drew two trailers filled with passengers, starting from the Lincoln Avenue barns and making the round trip on the Clark and Wells Streets cable line, running between the cable trains. After more than three months' service it has recently been temporarily withdrawn to serve as a model for the new motor cars which are being built.

The motors, which are to be built to act as auxiliary to the cable cars and to run on the cable lines, will be of twenty horse power each and will draw two trailers. For all feeder lines, the motor cars will be of ten horse power and will draw one trailer. The success of this motor is attracting much attention in railway circles in Chicago.

This announcement will greatly interest many of our readers who have been watching the progress of the Connelly motor, and awaiting the result of its practical running on Mr. Yerkes' lines. That there is a great demand and a large field for an economical independent motor is well known, but the difficulties in the way of securing such a motor have been thought by many to be insurmountable. The endorsement and adoption of this motor by the Chicago companies is made after a series of practical tests, covering a period of more than two years.

THE Jersey City & Bergen Railroad Co., of Jersey City, N. J., have closed a contract with the Ball & Wood Co. of New York for three of their improved cross compound engines of 300 H. P. each.

Work on the Third Avenue (N. Y.) Cable Line.

The contractors are advancing the work of making over this important line for cable traction as rapidly as circumstances will allow. A person unacquainted with the details can form little idea of the difficulties that are met with as the work progresses, in the way of substructures in the street and treacherous formation that are encountered in the power house excavations, taxing to the utmost the ingenuity of the superintendent, engineer and contractors. In a previous article we have noted that it had been found necessary to put new and deeper foundations under a number of the posts which support the elevated lines in the vicinity of the power house and terminal pits. The next most serious difficulty, and one attended with enormous expense, is the moving of numerous gas and water mains. On the Bowery near Fifth Street a nest of five large gas and water pipes was encountered near the surface, which cross the line at the curve and continue parallel to the tracks for several hundred feet. It was found necessary, not only to lower these pipes below the foundations for the yokes, but, in the case of the water mains, the company are required to provide a brick subway along which access can be had to the mains for a considerable distance, as the water commissioner will not allow pipes to be placed where access cannot be readily had to them. This subway is being built up with brick walls, and is roofed with I beams carrying brick arches between. As the excavation progresses the pipes are supported by chains swung from cross timbers. In the case of the gas pipes the street railway company will provide one twenty-four inch main in place of the twelve and fourteen inch mains now being removed.

At several other points on the Bowery, cross mains are encountered which are being lowered one after another as they are met. In excavating for the pit machinery in front of the power house on Sixty-fifth Street, a thirty inch water main will have to be lowered below the pit foundations for a distance of about 300 ft. At the Bayard Street station the pit excavation encountered five sixteen inch, two twelve inch and one eight inch gas main, a twenty inch water main, an electric subway, several six inch pneumatic tubes and a large sewer.

It has been decided to entirely tear down the rear portion of the stable building on Sixty-fifth Street to make room for the power station. In previous notes we stated that the outside walls and a portion of the stalls would be retained until the power house proper had been equipped; but so much difficulty has been encountered in shoring up the walls that it has been decided to tear out the entire rear portion of the building and erect the power house complete over the old foundations, and the work of demolishing the stable building is now nearly completed, and excavation is well under way.

A large number of the new cars which are being built by the Laciede Car Co., of St. Louis, have been delivered, and the officers of the company express themselves as exceedingly satisfied with their appearance.

It is found in operating the horse cars over the grooved rail which is provided in the cable construction that it requires very much more power to haul the cars, and the horses are being worn out more rapidly than before. The increased draft is no doubt largely due to the sand which finds its way upon the rail from the new pavement, and is not entirely chargeable to the grooved rail. Some of the tilting or rope replacing sheaves are being installed at various points upon the line, and are of a special design, having been invented by Mr. J. H. Robertson, the superintendent of the lines. They are arranged to operate automatically from a lever in the track which is depressed by the wheel flange. These pulleys are to be placed at all points where it will be necessary to pick up the rope.

The company are in the market for a suitable switching motor for transferring the cars at the 125th Street car barn, and at present are considering the merits of the Connelly motor, and also of a storage battery motor. The purpose of the company to provide pits under each of the storage tracks prevents the use of animal power for doing the switching, so that a motor of some kind is a necessity. One of the most serious difficulties, as the work progresses, is that of providing for the traffic of the different horse car lines on the Bowery. The numerous turnouts and switches required are provided at very serious expense. It is expected that the line will be in operation before Christmas.

Baltimore (Md.) Notes.

The Lake Roland Elevated Railway, so called because part of the line is on a viaduct has been acquired by Messrs. Jarvis & Conklin, of Kansas City, and the work on the electric equipment is being advanced as rapidly as possible. Contracts have been let and the railway will be in operation before long. The elevated structure will be supplied by the Pennsylvania Steel Co., and, it is said, in all over 3,000,000 lbs. of steel, exclusive of rails, will be used in its construction. The Pullman Car Co. will supply the cars and J. G. White & Co. have charge of the electric equipment.

Work on the new power station of the Traction company on Gilmore and Mosier Streets is being pushed forward. The station occupies a building formerly used as a church, and the machinery, which is being installed by the Robert Poole & Son Co., possesses a number of novel features. Rope transmission will be employed, and both drums of a pair will be driven direct from a split pinion. The two parts of the pinion will be mounted loose on the shaft and driven by a compensating gear which will equalize the power transmitted to the two drums. The arrangement of the machinery is also very compact. The engines were supplied by the Corliss Steam Engine Co., of Providence. The Traction company hope to have the station in operation by August 1.

During June negotiations were concluded by which the property, franchises, etc., of the Baltimore Union Passenger Railway Co., the Baltimore & Hampden Railway Co., and the Highlandtown and Point Breeze Railway Co. were assigned to the City & Suburban Railway Co. The transfers were made under an agreement entered into by a majority of the stockholders on June 7. Mr. Nelson Perin is president of the new company, and their capital stock is $3,000,000.

The site for the power house for the Blue line of the City Passenger Railway Co, has been secured on North Charles Street, between Lanvale Street and Lafayette Avenue. The plans for the machinery are being finished and the building will be commenced as soon as the plant is laid out. Work on the other divisions is being carried rapidly forward.

The Curtis Bay Electric Railway has commenced operations, and is carrying large numbers of passengers.

Record of Service of Two Hauling Cables, New York & Brooklyn Bridge Railway.

Below will be found a record of the service of two of the hauling cables used on the New York & Brooklyn Bridge, which were manufactured by the John A. Roebling's Sons Co. No. 2 has, up to the present time, shown the greatest endurance of any of the cables used on the bridge, except No. 5. The latter is still in use and promises to serve for a long time to come.

Designation.	Service.		Miles Hauled.	Ton-Miles Hauled.	Average Load Hauled. Tons.	Remarks.
	Days.	Years.				
No. 2.	607	1.66	120,232	25,492,862	212	Removed.
No. 5.	415	1.14	88,590	26,502,183	299	In Use.

PARTIES desiring to secure space for exhibiting supplies, or who desire to secure hotel accommodations at Cleveland for the next meeting of the American Street Railway Association, which is to be held on October 19, next, should apply at once to Mr. H. J. Davis, secretary of the Local Committee, care of the Brooklyn Street Railway Co., 1,301 Pearl Street, Cleveland, O.

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THE STREET RAILWAY JOURNAL

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
Street Railway Publishing Co.,
World Building, New York.

As Traffic Promoters, handsome and highly finished cars are doubtless important factors in many localities. As to their universal value, opinions differ, as will be seen by reference to a number of replies to a direct question upon the subject, which are to be found in another column. In our opinion, the only way to settle the question as it applies to any locality, is to try the experiment. Wherever it has been tried it has proved of decided advantage, and we have never heard of a line going back to plain cars after trying the others. As to the employment of shabby and dirty cars no one can present advantages that will justify in any locality such a practice.

A New Breed of street railway employes would seem to be a desiratum with some of the street car lines in the state of Ohio. From one city we learn of a conspiracy on the part of a number of conductors to rob the company by changing the combination of the alarm punch, the practice having been going on for years, and by which the company has been defrauded out of large sums. Some of the lines of another city, we learn as we go to press, are idle because of a strike on the part of the employes, the alleged grievance being that the company refused to yield to the demand that only union men be employed. Organized labor can never command the respect of the public, and its demands should not be conceded by employers, until it has shown its ability to purify the *personnel* of its assemblies. When it can guarantee the honest and faithful performance of duties on the part of the individual every employer will be glad to yield to its demands.

Another Trolley Accident is a bold type heading that one sees occasionally in such of the daily papers as refuse to become reconciled to the electric system of traction. It matters not what the nature of the accident, whether it be a derailment, the butting into a too tardy truck, or the breaking of a wire, it is always classified under the one head. Notwithstanding the fact that the total number of accidents for a given period is less than under a former system of traction, either horse or steam power, and the traffic is far more acceptable to the patrons, and less objectionable to the residents along the line, these papers never lose an opportunity to display this favorite heading and to magnify every accident on the trolley line. If an individual were to cling to his prejudices and preconceived notions of things and refuse to be convinced in the face of overwhelming testimony, as do the impersonal publications, he would lose all standing with his fellows. Accidents will happen with any system of traction; even were a car to be hauled by a yoke of oxen, it is only a question of time when injury would be done to some person or to property, but they are not as common in the long run with electric traction as with horse or steam power.

The Directory of Street Railways, heretofore published in the STREET RAILWAY JOURNAL, is omitted this issue for the first time. It is our intention that it shall hereafter be published quarterly, and it will appear next with our September issue. This will, we think, be an advantage to all interested, because it will enable the publishers to make a better and more accurate Directory in every respect. Our friends who have been in the habit of sending us corrections monthly will hereafter be troubled but once a quarter. We trust this change will not in any way inconvenience those who have constantly been using the Directory as a reference, as, with a little care, they will soon learn to know just in which issue to expect the Directory. We take this occasion to thank our friends for the help they have given us, and, as in the past, we shall in the future use every effort to make the Directory better and more accurate in every way. We trust that all concerned will see to it that their roads are properly reported once every three months to the office of the STREET RAILWAY JOURNAL.

Accidents are an Unfortunate but an inseparable accompaniment to the operation of any railway, street or trunk line, where great forces have to be controlled by fallible operatives. The use of safety appliances and the employment of care will reduce the danger to passengers, employes and the general public, but it may confidently be said that even the best regulated transportation system is not absolutely free from casualties. Most street railway companies keep for their own information a list of the accidents occurring on their roads, and the authorities of some states compel the steam railway companies to keep a public record of such occurrences. The question whether this plan should be extended to the street railways was recently broached in the legislative halls of one of our neighboring states and was met with proper opposition by the representatives of the street railway interests. That such a plan, if carried out, would result in much injustice which would more than counterbalance any supposed advantages there can be no reasonable doubt. A record of the kind proposed would be simply an invitation to lawyers of a certain class to bring damage suits against the railway company for every person injured, and would prevent many accident cases from

being settled out of courts. Every large city, and many smaller ones for that matter, contains many lawyers of the class that haunt the city court house offering their services to the prisoners, and it is this class who would most profit from such a public record, and from whom both the victims of an accident and the street railway company should be protected.

The Skill and Ingenuity of engineers engaged in constructing cable lines are often taxed more severely, and their ability is measured more by the manner in which they deal with the emergency cases which arise as the work progresses, than in making the general plans for the system. Among the emergency cases are included the means to be provided so that the traffic on their own, the parallel or cross lines, shall not be interrupted, the moving of gas pipes, water pipes and sewers, and the excavation for terminal pits where the street traffic is dense. Unfortunately, the conditions being different in almost every city, engineers have new problems to meet, and since they cannot avail themselves of the experience of other engineers who have dealt with similar problems, the work is frequently attended with a degree of expense far beyond the estimates, and out of proportion to the general work on the line. We know of no branch of engineering that needs the accumulated experience of others so much as this work of dealing with emergency cases as above outlined. Knowledge gained in experience of this kind, if withheld, does not benefit the individual, for the reason that he may never again be called upon to use it, but if it were contributed to a common fund every one would be benefited, and new lines would be relieved of excessive outlays which accompany this work, which in nearly every case is now largely experimental. We hope this suggestion will induce such engineers as have successfully dealt with some of these difficult problems, to tell their experience by making it public through the columns of the STREET RAILWAY JOURNAL.

One of the Most Important Questions of the day is how to harmonize the relations between a community and its chartered servants, those corporations that are to a certain extent doing a public business. It is recognized on every hand that these relations are not so straitened as they formerly were, and that some of the men at the head of our great corporations are being looked up to and respected as public benefactors. This improved state of affairs is, in our opinion, due largely to the growing practice of publishing annual reports which set forth the affairs of the companies and show to the public that the net income from operations is not as fabulous as imagination is accustomed to picture it so long as a business is surrounded by an air of mystery. As the practice of making public the affairs of corporations becomes more general, so much more will the relations between the community and corporations harmonize. The day has passed when large fortunes can be made quickly from a public business, and capitalists must recognize the fact that only a limited income can be expected from investments in this direction, but it may be expected that this income will be large in proportion as the community is taken into the confidence of the corporation. On the other hand, the community should not only be just but generous in its dealings with such companies as undertake transportation in any shape, by giving them a place to put their lines, and in case of strikes providing the full protection of the police and military forces if necessary. It should never be possible for a strike to interrupt the operation of a rapid transit line. If necessary let the accounts of the companies be subject to the inspection of the public officers, and when a certain liberal per centage of income is realized, follow with a lowering of fares; but the companies should be exempt from taxation except on real estate. Experience shows, as we have often noted, that taxes of whatever nature come out of the public in the end from economies that are met by indifferent service, while on the other hand the service will improve in proportion as the companies are unrestricted.

Census Bulletin No. 55, which purports to give the relative cost of building and operating the different systems of street railways, was issued in April, 1891, and contained a statement that it would be followed soon by the publication of statistics of street railways. The public have been waiting very patiently for this second publication, but so far as we are informed it has not yet made its appearance. In the meantime, nearly every writer who has treated on rapid transit subjects in the popular magazines has drawn liberally on No. 55 for his statistics. We have had our suspicions from the first that there was something wrong with this bulletin, for the reason that its conclusions were very much out of harmony with the data that we were able to collect. That we were not alone in our suspicions, the letter of our correspondent printed in another column fully confirms. We have made considerable effort to locate the roads numbered in the bulletin, and think that we have been able to identify most of them, and from what we know of the lines, and from records, we have come to the conclusion that the bulletin in question is an aggregation of errors. When lines are said to have a grade of from 70 to 80 per cent., one naturally suspects that equally glaring errors may have crept in under other heads. We do not charge the Census department with having falsified the returns, by any means, but that there has been a looseness on the part of street railway companies in making returns, so that grave errors doubtless existed in the forms from which the bulletin was compiled. A case in point is that of one of the lines reported, which we think we have identified, for which the returns made to the department were filled out by one of the junior clerks in the company's office, and the officers of the company did not know that a return had been made, or, if they did know, did not take the trouble to verify the figures. We think the Census department in justice to itself should give the names of the lines referred to, and this would aid those interested to judge of the accuracy of the reports. Statistics of this kind are very valuable and often influence the investment or withholding of a vast amount of capital, so that it is important that they be reasonably accurate, but averages made from such statistics as are compiled in the bulletin are very misleading.

The Municipal Control of Street Railways is a favorite topic among many writers on economical subjects. It was not many months ago that a gentleman who makes an especial study of municipal administration, contributed to a leading magazine an article in which he described Glasgow as a model city. In the course of the essay he treated of its street railways, and commented with the fullest approbation on the fact that the system was owned

by the municipality. The roads are operated by a company whose lease expires in two years. The article, which attracted no little attention at the time, is recalled by the visit to this country of a member of the town council of Glasgow, who seeks information regarding the operation of street railways. His particular mission was to inspect the cable system of Chicago. While he admired the splendid work done by the system, he was not prepared to recommend its adoption by his city. The statements that he makes, however, indicate how much better off are the people of Chicago in the matter of transportation than are the residents of the Scotch city, in spite of the fact that Chicago is confronted by a serious problem of intramural transportation, the solution of which has been the study of various commissions. We do not believe in the principle of the municipal ownership or operation of railways, and the fact that Glasgow makes more money out of the local system than does Chicago from the car licenses, does not signify to us. The general question of municipal control needs no re-argument here. The point that interests us just now, is that relating to the prime considerations in street car service, judging from the passenger's point of view. How unenterprising the Glasgow management is, may be judged from the fact that the people have to depend solely upon horse cars and omnibuses. No step has been taken toward the introduction of either electricity or the cable. In Chicago where private enterprise alone is dominant, cable, electric motor and steam are employed, while new systems of traction which promise improved service are constantly being tried. The rolling equipment is far superior to that operated on the Glasgow tracks. In the matter of fares, too, Chicago has the decided advantage. For the expenditure of five cents the Chicagoan can secure transportation on several lines for a distance of about eight miles, where for the same distance in the Scotch city the fare would amount to sixteen cents, according to the schedule of two cents a mile. Were such a fare exacted in Chicago imagine the violent remonstrance of the average passenger! Chicago has nothing to learn from Glasgow; but the latter city may well question whether the principle of municipal ownership in all respects works to the advantage of the people generally who are interested in street railways solely as a means of cheap, convenient and rapid transportation. We have said that the general principle of city control needs no consideration here, but we cannot refrain from asking what would be the result if street car systems in Chicago were under the control of the City Council, seven of whose members are on trial for bribery at the time this paragraph is written.

"Nothing is Impossible," say the engineers; "only give us a banker's order and we will construct any public or private work that may be demanded for human convenience or happiness, but we cannot always guarantee that the income from operation will pay for the investment." The question of income being considered, the services of the engineer who advises when not to build is frequently of more value than those of one who boastingly undertakes to do a work in which doubt is an important factor. A case in point is that of the proposed, much advertised, straight, hundred miles an hour electric road between St. Louis and Chicago. We have given this matter little attention heretofore, because we considered the idea too visionary, and the details of operation as presented by its promoters too indefinite to merit serious consideration, but since the matter has been brought into prominence through a lecture recently delivered by the originator of this bold scheme before the New York Electric Club, and, hence, has been considered by some to have the endorsement of the club, it seems fitting that we should caution our readers or such of them as contemplate taking stock in the enterprise, to receive the proposition *cum grano salis*. So much stigma attaches to the memory of those who in the early days of railroading ridiculed the idea of steam propulsion that critics nowadays are very cautious about expressing an opinion regarding new methods of transit lest they in turn become the butt for ridicule. In reference to the project under discussion, we are willing to take our chances, however, for the details of the plan are so absurd and violate so many electrical and mechanical principles, while the cost of the enterprise is placed at such a low figure, and is confessedly confined to only one favored locality with a coal mine and water power ready made, for which "no one couldn't send in no bill for," that the proposition deserves ridicule if not contempt. As to the cost, which is stated to be $6,000,000 for the 248 miles, a few figures will demonstrate its absurdity. The roadbed, it is admitted, must be equal to that of a steam line, which, with ballast, proper drainage and suitable rail would cost at least $50,000 per mile, or $12,400,000, to which must be added the cost of rolling stock and electrical equipment. But a 200 H. P. motor with a weight of only 6,000 lbs. and a speed of 500 revolutions, is, in the language of another, a very great feat indeed ; but this is outdone by the current transformer scheme and multiphase system which starts with 500 volts at the generator, steps up to 25,000 volts, when it is brought down to 3,000 volts and led along the trolley wire. It would seem that it would not require a 200 mile line to demonstrate all this; there are plenty of long electric lines now in operation that would no doubt avail themselves of this saving in current transmission, and on which one or more cars could be run to demonstrate the practicability of the scheme before entering upon the equipment of the proposed line. We would not advise the Chicago & Alton or the other steam lines that now operate between the two cities to advertise their rolling stock or other stock for sale at present, nor the government as yet to cancel its mail contracts with these lines. It is safe to say that until after the Columbian Exposition is closed there will be sufficient traffic to keep all lines reasonably employed.

The Relative Merits of a cable or electric system of traction for a proposed line in Sydney, New South Wales, have been strikingly set forth in a voluminous report recently published by the Parliamentary Standing Committee on Public Works of that far away country. This report is the record of, probably, the most thorough investigation that has ever been made relative to rapid transit schemes, and could never have been made or published, owing to the expense, had it not been done under government auspices. The report gives *verbatim* the questions and answers put to and given by experts who were summoned to give testimony in the matter. Because of its value and for other reasons we surrender considerable space to the publication of the conclusions of the committee which decided, by a vote of seven to five, to recommend the cable system for the line under consideration. The decision of the committee, relating as it does to a particular line, is doubtless a wise one, for owing

to numerous grades it is doubtful if the line could be operated successfully by any electric method; but had the question been in reference to a system for the entire city or for the other cities of that country, then we think an injustice would have been done to electric traction, had the same opinion prevailed. We base our judgment in this matter on the fact that important additional evidence could have been secured in favor of electricity, while some of that given and which seemed to have great weight with the committee was unfortunate in that it was based on defects which could have been remedied. We refer to the electric line between Randwick and Waverly in the same country, which was constructed of material sent out to the Melbourne Exposition a few years since and was not put in service under the direct supervision of the Thomson-Houston company, and, as the report states, it has not reached expectations either in regard to capacity for dealing with traffic or in reasonable cost of working. Another feature which had great influence with the committee was the lack of reliable evidence as to the cost of operating electric lines, and the report on this subject reflects very seriously on American railway managers. We quote from the report in this matter: "It is, in the present condition of electric tramways, very difficult to get accurate information on this point. The difficulty is said to be due to the circumstance of the companies controlling the electrical tramways in America being subject to the municipal authorities of the localities in which the tramways are laid. A provision in the agreement between the municipalities and the companies requires the latter to reduce the fares upon the tramways, immediately a certain rate of profit has been reached, and to avoid this reduction the companies are said to conceal the actual profits made, and consequently, the actual working expenses incurred." This, not being true to any great extent either in regard to agreement or the practice of concealment, will at once be seen to be unfair testimony. We admit there is difficulty in getting reliable statistics relative to operating expenses, but it is owing, as we have frequently shown, to the constant additions that are necessarily made to nearly every line that has been put in operation, and usually, the method of bookkeeping employed by the companies does not separate strictly operating expenses from the cost of betterments. From the reports of such companies in states which require annual reports to be made to the boards of railroad commissioners, reliable statistics can be had. The report under discussion shows the necessity of some concerted action on the part of electric supply companies and the management of electric lines, looking to the compiling and publishing of reliable statistics relating to operating expenses. This emphasizes the necessity, as we have frequently noted, of a uniform system of keeping accounts and of committing this work to competent clerks who will care for details and render trustworthy reports. It is unfortunate that an industry that is developing so fast in our own country and is proving a boon to hundreds of towns and thousands of people should be denied to the dwellers on the other side of the globe, because its merits, looked at from so great a distance, seem to be distorted. We hope that the report which we publish will stir up the electric companies to look more carefully after their interests abroad.

THE Fitchburg (Mass.) & Leominster Electric Railway has been put in operation.

Electric Power on the New York Elevated Railway System.

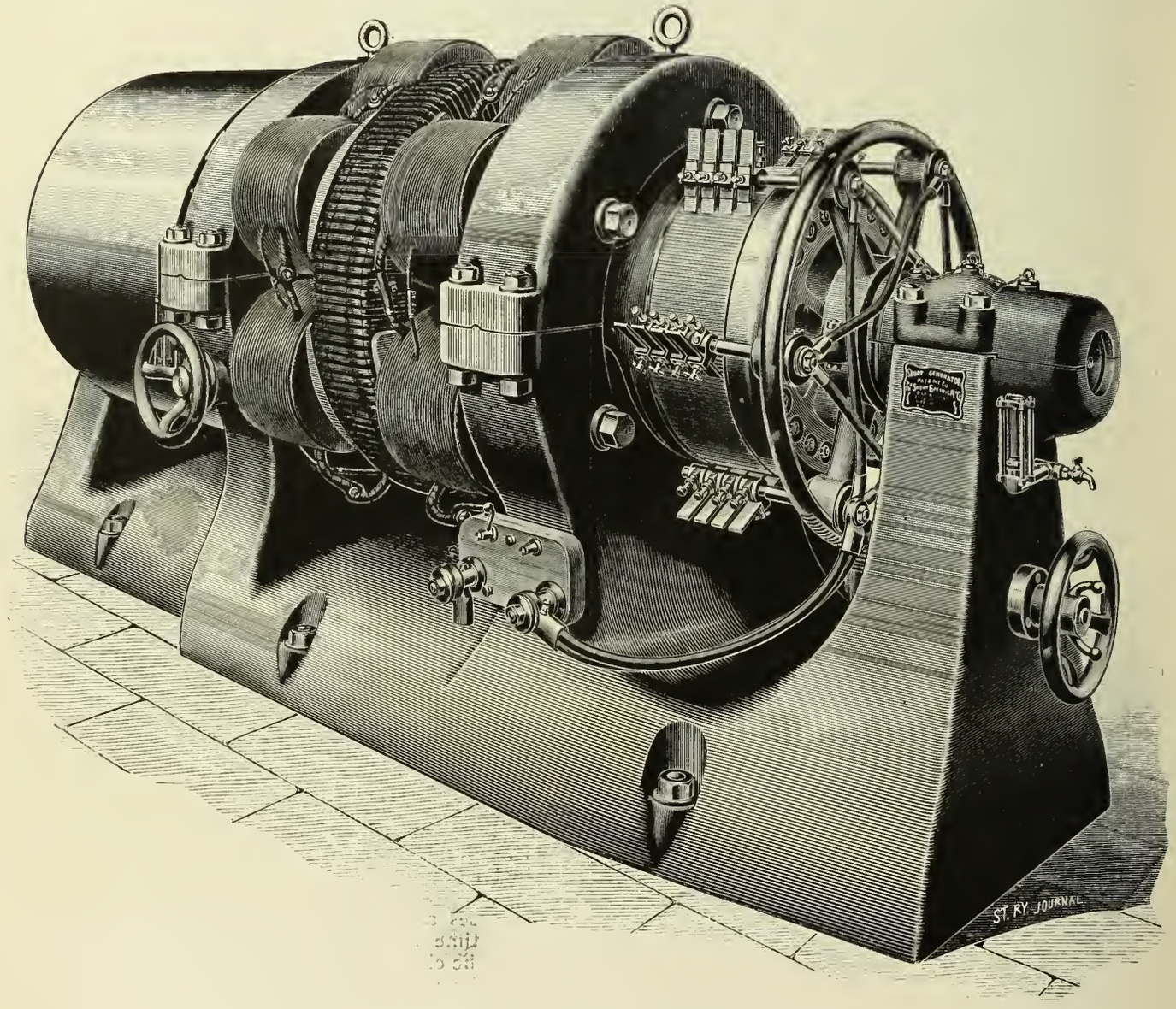
The elevated railway system in New York has long seemed to electrical engineers an ideal place for demonstrating the advantages of electric motors for a metropolitan transit system, and as our readers will remember, some of the earliest experiments with electric traction of Field, Sprague, Daft and others were with cars on this railway. Although these experiments were not followed by the adoption of electric motors on the road, they convinced the managers that in many respects electric power was preferable to steam power, and in view of the important improvements which have been made with electric motors during the past few years, it has seemed for some time that a change of motive power, which was undesirable a few years ago, might at the present time be made to advantage. The managers of the New York elevated railway system, therefore, through Col. F. K. Hain, recently requested and obtained from the New York office of the Short Electric Railway Co., of Cleveland, a proposition for the equipment of a portion of their system with electric power. The proposal made by the Short company includes all of the Third Avenue division of the system, the division upon which the greatest traffic occurs, it being considered by the electric company more desirable to install their system on a crowded division of this kind rather than upon the suburban branch, as first proposed. The plan is to build a number of electric locomotives about the same length as the present steam locomotives and capable of drawing the same load, *i. e.*, five loaded cars or more. The locomotives will have six driving wheels, each pair of which will be supplied with power by a fifty horse power gearless motor, similar in general arrangement to the street car gearless motor, but differing in some details made necessary by the different conditions. The supply of electricity will be taken from a novel third rail carried near the surface of the ties and protected carefully against possibility of short circuit. The rails will probably be used for the return, and feeders will be arranged so that the destruction of a portion of the track owing to the walls of the building falling on the elevated railway, or other cause, will not result in interruption of the supply of current on other sections of line. The power stations, of which there will probably be three or more, will be located near the East River, where the real estate will not be so expensive and where the facilities for the receipt of fuel, etc., are the best. After the equipment of the sections of road where there is a great amount of traffic, it is the intention that the trains drawn by the electric locomotives will run between the steam motor trains until the entire system shall be equipped. The principal advantages claimed for the use of the electric system besides that of economy and the obviation of smoke, gases and cinders, as well as escaping steam, are that less time is required to get up speed, and the decision of the elevated railway managers upon the proposition will be awaited with interest. Professor Short and Mr. E. J. Wessels, the Short company's general Eastern agent, have had several conferences with Vice-President Hain recently, and very likely there will shortly be a definite outcome in substantial shape, from their conferences.

THE West End Street Railway Co., of Boston, finding that their fifteen horse power electric motors were too small for their long cars, and having, in consequence of the substitution of long for short cars a surplus of electrically equipped short cars, have offered a number of these for sale. The cars for sale include sixteen foot open and closed cars equipped with single and double reduction motors. The company are also disposing of some of their double reduction motors mounted on four wheel swivel trucks.

THE mayor of Denver, Colo., is considering a proposition from the Denver Tramway Co. of that city to sprinkle the streets over which the cars run, by electric power sprinklers.

New 300 H. P. Generator.

Our illustration gives an excellent idea of the new 300 H. P. generator lately put on the market by the Short Electric Railway Co., Cleveland, O. This generator is capable of delivering a current of 500 amperes at a pressure of 500 volts. The field magnet frame is of a new design, thirteen feet in length and weighing ten tons. The field magnets twelve in number are bolted to this frame and are similar in construction to those of the four pole machine described in our September 1891 issue. The armature, which is mounted on a shaft thirteen feet in length, is of the well known ring type built by this company and is fifty inches in diameter. The construction of this armature was also fully described in our September 1891 issue. The shaft runs in self oiling and self centering bearings. The centre bearing is provided with six thrust collars. The box in which this bearing runs is provided with a new device by means of which it can be easily adjusted. On the lower half of the box there is cast a feather which moves in a similar groove in the frame, and it is operated by a screw which extends through the frame. This screw is provided with a hand wheel and jam nut by means of which it can be easily held and adjusted. The commutator is of large diameter, 24 inches and contains 200 bars. The brushes are six in number and are carried and adjusted in a novel manner. A split wheel is provided in the lower side of which are gear teeth which mesh into a pinion mounted on the shaft which extends from the frame. On the outer end of this shaft is a hand wheel and jam nut by means of which the brushes can be easily and quickly adjusted and held. This generator is designed to run at 300 revolutions belted and 250 revolutions when connected direct to an engine.



NEW SHORT 300 H. P. GENERATOR.

The Foundations for the Houston Street Station, Broadway (N. Y.) Cable Railway.

The decision by the managers of the Broadway & Seventh Avenue Cable Railway to rent the upper stories of the main cable power station, now being erected at the corner of Houston Street and Broadway, for offices and business purposes, necessitated a special construction of the foundations in order to avoid any vibration of the building by the operation of the machinery. It was, therefore, decided to make the foundations of the building entirely independent of those for the machinery, so that any throbbing and vibration of the latter would not affect the former. The plan decided upon, and now being carried out is as follows: The floors of the building proper are to be supported on forty-five interior piers and twenty-eight piers on a line with the exterior walls, which will be self supporting.

The exterior piers will consist of steel columns fixed on a grillage of iron bars, the latter resting upon stone walls. The interior piers are to be constructed as follows: Large cylinders of wrought iron or steel are to be sunk into the earth and filled with sand below and concrete above, and on the top is to be a grillage of iron beams.

The latter will be level with the tops of the cylinders, which are only six feet in length. Resting on the grillage will be massive iron bases, weighing in the neighborhood of 3,000 lbs. each. Steel columns will surmount these bases. The cylinders, except a few for supporting the court of the building, will vary in interior diameter from eight feet six inches to twelve feet. There is a two-fold object in their use; they will prevent the sand foundation from spreading laterally, and they will also divide the sand on which the building is to be supported from the sand foundation of the machinery floor, the latter being the principal reason.

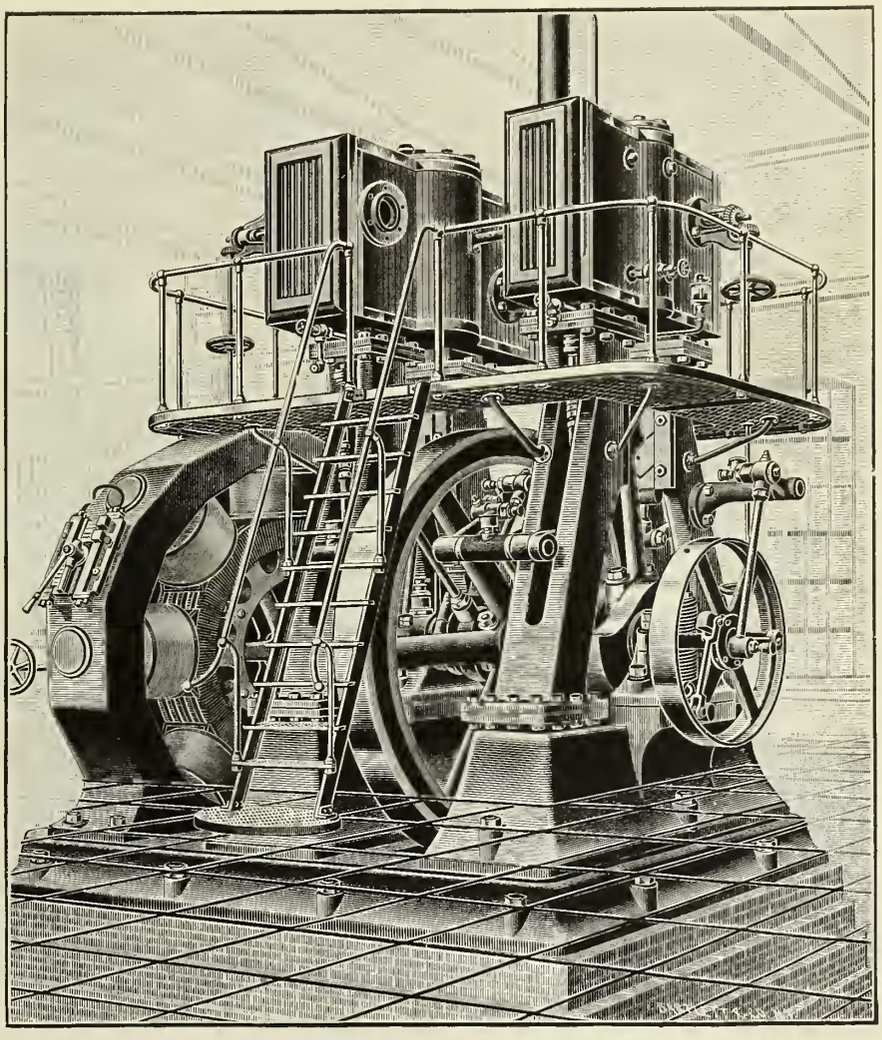
In order to have room for the driving wheels on the machinery floor, as has been already stated, it has been necessary to excavate to a depth of forty-two feet below the street level. Bridges of iron beams, resting on brick walls, are to be constructed around the columns supporting the building. The purpose is to prevent any part of the machinery floor, which will rest partly on the bridges and partly on the sand foundation, from touching the main columns. Thus all of the weight of the machinery floor will compress the sand not used to support the building. The latter will compress only the sand under the main columns.

Direct Connected Engine and Generator.

On this page is shown a multipolar electric generator, connected directly to the shaft of an engine built by the Lake Erie Engineering Works of Buffalo, a description of which was published in these pages some time since. The engine was designed with especial reference to direct connected multipolar generators, and the illustration gives a general idea of the appearance of the engine when adapted for electric railway service and driving one single generator on the low pressure side.

These engines are built, arranged for direct connection, in sizes from 50 to 5,000 H. P. units, and of either compound or triple expansion type. A number of the smaller sizes are already in use, driving by direct connection lighting dynamos in office buildings, a place where economy of space is an important consideration.

The Field Engineering Co., the Eastern representatives of the Lake Erie Engineering Works, expect to have several of the larger sizes running in electric railway service, connected direct to multipolar generators, at an early date.



DIRECT CONNECTED ENGINE AND GENERATOR.

A POINT of interest to stockholders in business corporations was decided June 17 by the N Y. Court of Appeals, in the case of Thomas Commerford Martin *vs.* The W. J. Johnston Co. Ltd. Mr. Martin, who was and is a stockholder in the W. J. Johnston Co., believing that its affairs were being improperly managed, obtained from the Supreme Court a writ of mandamus requiring the company to exhibit its books to him and to allow him to make extracts or memoranda therefrom. The company resisted the application, claiming that Mr. Martin was not a stockholder; that he had no right in any event to make extracts from the books, but only to inspect them; and that his motives for the examination were improper, as he was interested in a rival corporation.

The case was very strenuously litigated by the company, but the court mentioned has finally affirmed the decision of the general term, that Mr. Martin was entitled to the granting of the application as fully as was allowed.

New York Street Railways in 1891.

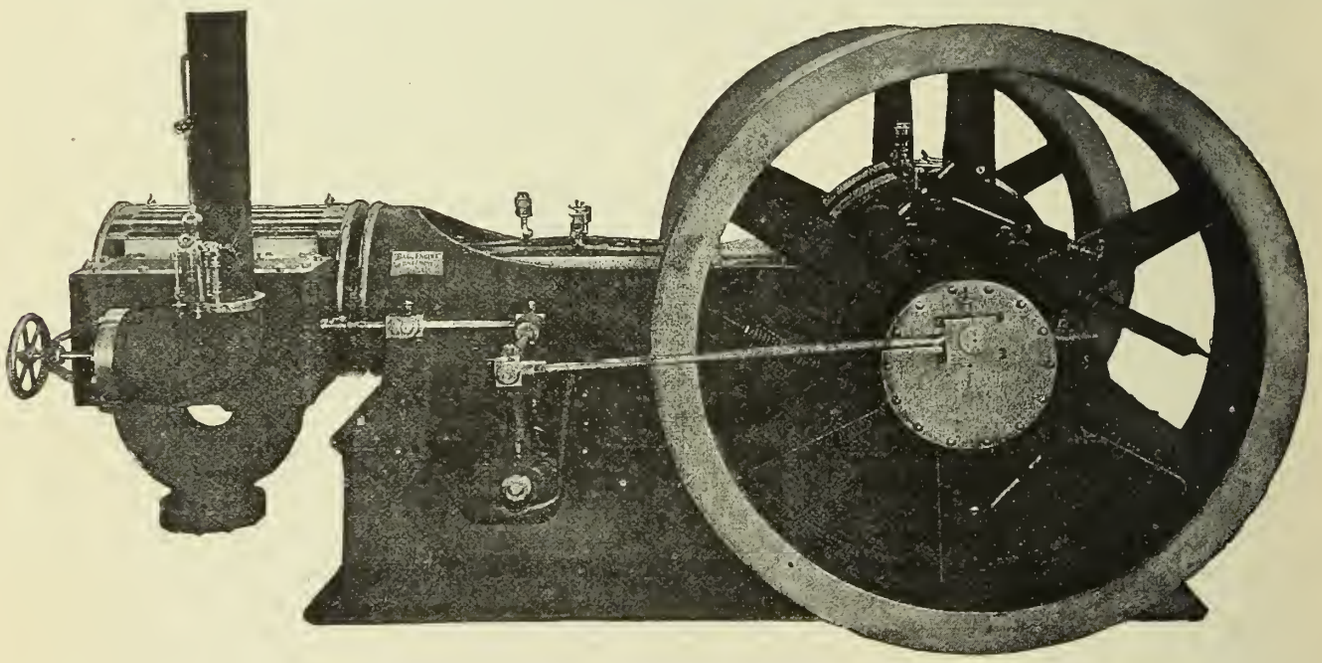
The second volume of the ninth annual report of the Board of Railroad Commissioners, of the State of New York, for the fiscal year ending June 30, 1891, which was transmitted to the Legislature on January 12, 1892, contains some very interesting statistics in regard to the street railways of the state as well as of the steam railways. We find in the state 105 companies reported as operating surface street railways. These show total gross earnings from operation of $20,153,973.66, and total operating expenses $14,914,204.72, giving net earings from operation of $5,239,768.94. The net earnings from operation during the year ending June 30, 1890, was $4,851,044.76. Nineteen roads reported a deficiency from operation during the year, and only twenty-five less than one-quarter paid dividends. The average rate of dividend paid was 8 per cent. In 1890, ninety-five roads were reported as in operation, of which eleven reported a deficiency. Twenty-nine paid dividends. The roads paid a total of $938,676.22 as taxes.

A FEW weeks ago a delegation from British Columbia waited on the Government, at Ottawa, and asked that the rails used in electric railways which weighed over thirty pounds be admitted free of duty under the same classification as rails used for locomotives. The Government forwarded the reply recently, stating that electric railways are classified as tramways, and the rails used for electric railways are duitable irrespective of weight. The decision is of interest to all Canadian cities which have electric railways, inasmuch as when an electric railway company wishes power to make a crossing over another railway, it is in the same position as an ordinary railway, and must make application to the Railway Committee of the Privy Council.

Heavy Duty Engine for Electric Railway Service.

The extremely varying load which a steam engine in an electric railway power station is so often called upon to carry, calls for the fulfillment of special conditions, prominent among which are great strength and prompt acting of the governing mechanism. It was through lack of one or both of these essential points that some of the engines in the early installed stations have showed themselves unfit for the task assigned them.

In the accompanying illustration is shown an engine recently brought out by the Ball Engine Co., of Erie, Pa., especially for electric railway service. It will be seen that this engine is, for its cylinder capacity, of great strength and weight, the makers claiming that the engines they build are, for the horse power, the heaviest engines made. The connecting rod and crank shaft are of forged steel. The crank shaft is eight inches diameter in the crank pin and in the journals. The crank pin boxes are lined with strictly genuine babbit; the crosshead boxes of pure copper and tin. The crosshead pin is of tool steel. The system of oiling the running parts is very simple and thorough. The valve, which has been used by this company with such success in the past in their electric light engines, is continued in the heavy duty engine. This engine has shown in practice perfect regulation under conditions where the variation in load on the generator from zero to the full capacity has occurred during less than five seconds of time. The makers of this engine, working on the theory that the electric railway interests demand a strictly first class engine, are using the very best possible material and workmanship throughout, and claim to give perfect satisfaction.



HEAVY DUTY ENGINE FOR ELECTRIC RAILWAY SERVICE.

Opening of the South Side Elevated Road, Chicago.

The South Side Elevated Railroad in Chicago was opened for regular traffic on June 6; and since that time the company have been giving an excellent service. The business, which was large from the very start, is bound to increase materially as the public appreciates the satisfactory operation of the road. The formal opening of the line took place some days previously, when the company invited, first, a party of gentlemen and subsequently a party of ladies to enjoy a trial trip over the line.

The management has studied carefully the operation of the New York elevated roads which serve in almost all respects as models for the Chicago system. The stations are radically different; so far as completed they are built under the track. They are of brick and terra cotta. The passenger entering the station takes a stairway which divides at the first landing, that on the east side leading to the platform for trains going downtown, and that in the opposite direction to platforms for trains south bound, and were illustrated in February, 1892, issue of the STREET RAILWAY JOURNAL.

The ticket sellers are young women, and one is employed at each station, together with a male ticket collector, who receives tickets in a "chopping" box of the same pattern as those used in New York City.

As an indication of the fact that the New York roads have served as models, it may be stated that the very gong which announces the departure of trains is the same in tone as that used on the Manhattan.

The coaches, which are similar to those in use in New York, have one improvement. The doors are constructed on the double sliding pattern, and when one is pushed back both open. The platforms are wide, and the cars can be emptied in a short time.

The facilities for handling passengers at the downtown terminus are not as good as could be desired. There is an excess of steep stairway and a lack of opportunity for purchasing tickets. There is a lack of provision for separating passengers entering and leaving the platform, and confusion and delay are the result. These are minor criticisms; as a whole the system is admirable.

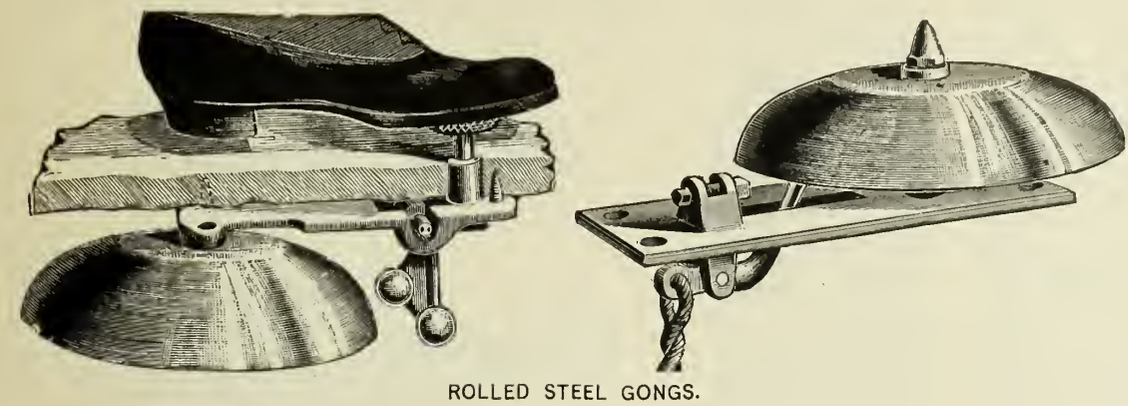
The compound engines made by the Baldwin company are performing satisfactory service. But little complaint is heard on the score of noise or smoke.

The road at present is operated only from Congress Street on the north to Thirty-ninth Street on the south, but eventually it will be extended to the World's Fair grounds at Jackson Park. Work on the extension is now in progress.

It may not be out of place in this connection to review briefly the history of the company. The Chicago & South Side Rapid Transit Co. was organized January 5, 1888. An ordinance for a franchise was introduced in the Council two months later, and after two months' delay was adopted. Efforts were then made to secure funds, and the attempt was at first entirely unsuccessful. A part of the bonds was then sold to a New York syndicate. In January, 1889, the Chicago City Railway Co. issued $500,000 of 4½ per cent. bonds with which it was believed that $500,000 of the bonds of the L company and a part of the stock was purchased. Work was prosecuted for many months, but the company finally exhausted their resources, and a halt on construction was called. At a meeting at the Union League Club, in December last, of local capitalists, sufficient money was pledged to warrant the completion of the road as far as Thirty-ninth Street, and its complete equipment, and work was resumed at once.

Rolled Steel Gongs.

Two new types of gongs for street car use in which the bell is of rolled steel, have recently been brought out by the Pittsburgh Steel Hollow Ware Co., of Pittsburgh, and are illustrated herewith.



ROLLED STEEL GONGS.

The diameter of the gong is eleven inches. As will be seen, both the type for foot use and that adapted to be rung by a cord overhead are simple in arrangement, and having few parts and no springs are not liable to get out of order. The rolled steel is guaranteed not to crack or lose tone in use. The gongs have been adopted by a number of prominent street railways, and are working satisfactorily.

The Fulmen Lightning Arrester.

A new lightning arrester, constructed on the principle of making the arrester consist of a magazine of inexpensive discharge plates, so arranged that upon the destruction of one set another will automatically come into position to receive the lightning discharge, has recently been brought out by C. S. Van Nuis of New York. The apparatus, ready for operation, is shown in Fig. 1. There is a porcelain base with four channels, two to receive the wire terminals, one connected to line and the other to ground. This constitutes the stationary part of the apparatus, and it may be attached to the station wall, car body or cross arm as the protection sought may demand.

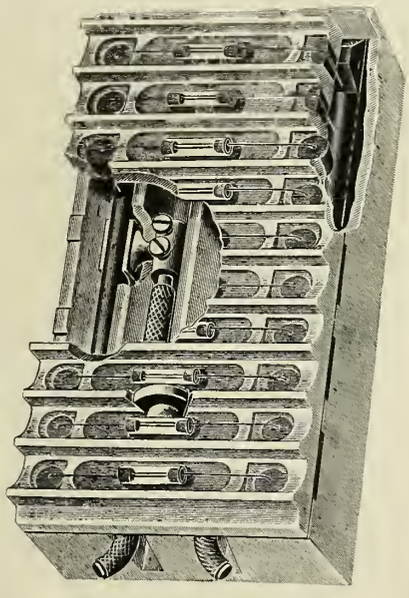


FIG. 1.—FULMEN LIGHTNING ARRESTER.

A corrugated cover of porcelain containing a series of fuse arresters is attached to the base by a simple lug and spring bolt, so that the two are held rigidly together,

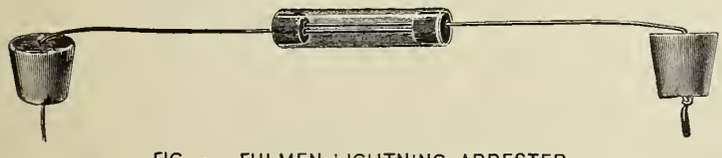


FIG. 2.—FULMEN LIGHTNING ARRESTER.

but can be quickly detached for reloading with new arresters when necessary.

The arrester proper is shown in Fig. 2, and consists of two small brass wires two and a half inches long, their inner ends lapping each other a short distance and separated by a very small space. These form the discharge plates of the arrester and are held in position and kept clean and dry by sealing them into a small glass tube. Two soft rubber plugs serve to attach the arrester to the porcelain cover, by fitting tightly into properly spaced holes, and the outer ends of the wires are so knotted and cut to length that, with the cover in position, they approach but do not touch the carbon rods which form the line and ground terminals. To bring the fuse arrester into operative position, a wedge shaped piece of carbon is brought to rest against each end of the top fuse, at the same time making connections with the carbon rods. In this position the arrester offers a free passage to earth for a lightning discharge, but will not ground the normal current. In operation, the arc caused by the lightning discharge starts a short circuit which immediately consumes the wire and allows the two carbon wedges to drop and adjust themselves to the next arrester. As shown in the cut, there are fuses for ten consecutive discharges, which are considered more than sufficient for one locality during a severe thunder storm. The fuses are replaced with the cover detached, avoiding possibility of a shock from contact with the wires. The destruction of the fuse in circuit is complete, when acted upon by lightning and the dynamo current as described, but the remaining fuses and porcelain pieces remain unharmed, as they are totally fireproof and not in electrical connection.

National Fare Box.

It is predicted that a great many street railway companies operating a small number of motor cars will find it necessary to dispense with conductors and depend upon the fare box as a collector of nickels. A fare box to serve its purpose well must keep its fares after they are deposited, and this claim is made particularly for the improved form made by the National Fare Box Manufacturing Co., Chicago. The box is thoroughly illustrated by the accompanying cuts. The especial feature of the box is that shown in Fig. 1. From the roof of the box hangs an automatic closing door, A, on hinge, B. When the door is pushed back it discloses the opening of spout, C, into which the fare is deposited. At the same time that the swinging door is pushed back, the platform, D, which is attached to the bottom of the swinging door, passes under the lower end of the spout (inside of box), this disclosing the bottom of the spout at the same moment that the top is uncovered, so that when a coin or ticket is dropped into the spout it remains there until the swing door is released and falls back into place, by its own weight, over the mouth of the spout; and at the same moment the platform, being attached to the door, swings from under the spout, and the coin or ticket drops to the first dump or hopper. A gong rings when A is pushed in. The arrangement being such that the top or bottom of the spout is always closed, it is impossible to withdraw any coins.

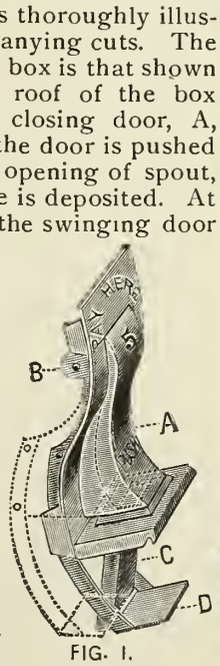


FIG. 1.

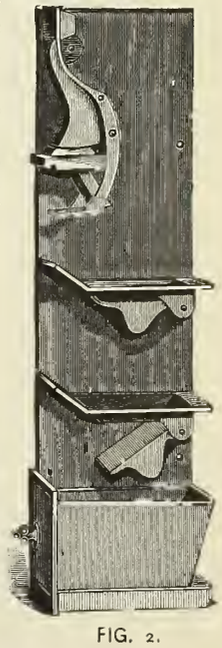


FIG. 2.

There are two drops for fares as, Fig. 2 shows. The fare falls into the upper drop and is turned into the second by the driver, the latter holding all the fares for

the entire trip. The construction is such that when the driver turns the lower drop, the upper one turns also, so no money can be left in the latter.

The cash drawer in the bottom is locked by a Yale lock. The key cannot be taken out of the drawer until it is locked, which will guard against the possibility of a collector leaving it unfastened. By opening this drawer, and removing a screw, the glass and frame in the front part of the box can be taken off, the drops taken out, and the box easily cleaned. The fare box is twenty-two inches in height and six and a half inches wide. Fig. 3 shows the fare box as viewed by the passenger; and Fig. 4, the appearance with top locked, when the car is going in the opposite direction and when the other fare box should be used.

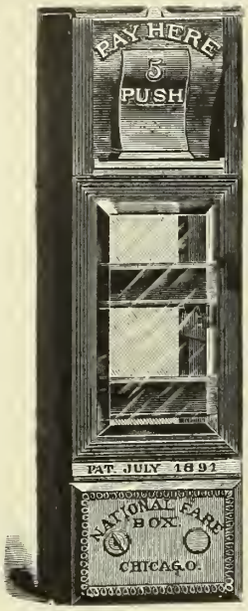


FIG. 3.

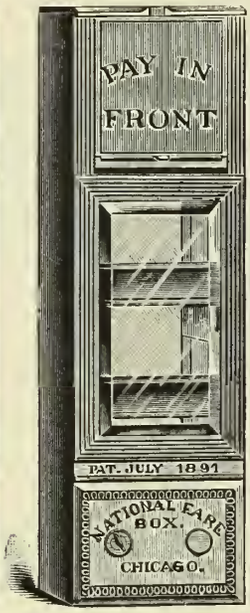


FIG. 4.

An Improved Feed Water Heater.

The Goubert Manufacturing Co., of New York, have introduced an improvement in their feed water heater, consisting of arched or convex tube plates. In this form the plates are strong enough to resist any pressure that can be brought to bear upon them without depending on the tubes as stays. By this improvement the tubes are relieved of all strain at the joint, and absolute security is obtained against the cracking or bulging of the tube plates. Our illustration shows a sectional view of this heater in its improved form.

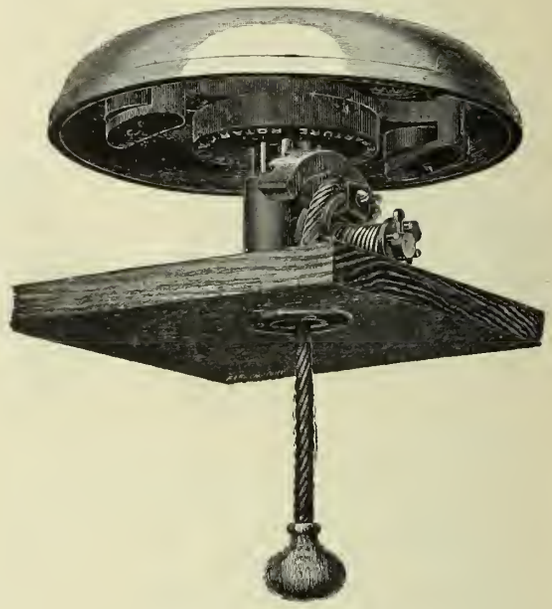

GOUBERT FEED WATER HEATER.

Elevation of Illinois Central Tracks in Chicago.

The Illinois Central Railroad Co. have decided to accept the ordinance of the Chicago City Council requiring them to elevate their tracks from Fifty-first to Sixty-seventh Streets, a distance of about two miles. A vexatious problem to the World's Fair authorities is thus removed. It, perhaps, should be stated for those unfamiliar with the location of the World's Fair grounds at Jackson Park that the tracks of the Illinois Central are at present but a few hundred feet west. If the tracks were not elevated all the carriages, pedestrians and street cars would, of necessity, have to cross the tracks at grade unless viaducts were constructed. During the fair, when trains will be passing almost continually, a crossing at grade would be, of course, out of the question. It has been assumed that eventually the company would be compelled to elevate their tracks, but even if an effort at compulsion had been made when the Fair project had first assumed definite form they might have made a successful resistance for several years; so the World's Fair authorities are congratulating themselves on the removal of an obstacle that menaced the success of the Exposition. This improvement means that the cable cars of the City Railway Co., going to the Fair, will pass under the elevated tracks.

Overhead Car Bell.

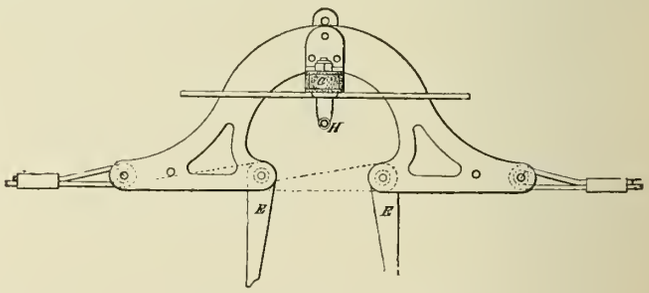
An overhead car bell on the same principle as the New Departure Rotary bell has recently been brought out by the New Departure Bell Co. and is for sale by John H. Graham & Co., of New York. An illustration of the device is presented herewith. The diameter of the gong used is nine inches, and it is made of bell metal. The bell is especially adapted for use in places where a foot gong could not be employed. The bell gives the same succession of blows as the standard foot rotary gong.


OVERHEAD NINE INCH BELL.

Insulated Trolley Crossing.

A new type of insulated crossing for intersecting trolley wires has been recently patented by R. M. Jones, of Salt Lake City, the general details of which are shown in the accompanying engraving.

The trolley wire for one road is at H, where it is separated from the rest of the frame by the insulating material shown at C. The rest of the frame forms part of the second railway circuit. A car, using the upper trolley wire, has uninterrupted access to it, since the arms, E E, are normally held in the position shown, through the force of gravity.



INSULATED TROLLEY CROSSING.

When a car, however, passes the crossing upon the line, of which the frame of the frog forms part of the circuit, one of the arms, E E, bridges the aperture, taking the position shown by the dotted lines.

As the crossing works equally well for cars going in both directions, it is particularly adapted for use at the intersection of single trolley lines belonging to competing companies.

THE Brooklyn City Railway Co. have recently completed the construction of a handsome fireproof building at the corner of Montague and Clinton Streets., which they will occupy for office purposes.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

The $350,000 Cable Road and the $46,000 Electric Road.

June 17, 1892.

EDITORS STREET RAILWAY JOURNAL: -

In April, 1891, the Census Office published Bulletin No. 55, entitled "*The Relative Economy of Cable, Electric and Animal Motive Power for Street Railways.*" It fell like seed on prepared soil, tilled by husbandmen with every resource of modern agriculture from the electric plow and cultivator to the arc light, and the crop, forced day and night, has nourished thousands.

The average man wearies of indefiniteness. He finds relief in the unqualified. He accepts thankfully a definite outline for Heaven, and he rejoices in a rule without exceptions.

When the electric man found or thought he had found in Census Bulletin No. 55, that a cable road costs $350,324.60 and an electric road $46,697.59 per mile he was at rest on that point for the time being. There was nothing to do but to spread the glad tidings. He has built cable roads since without number (usually for a business most unfavorable for their financial success) and they have all cost $350,324.60 per mile of line; and their operating expenses have been 14.12 cents per car mile, "or with interest added" just 20.91.

Turning to the source of the information, Census Bulletin No. 55, we find the first cable road mentioned cost $683,846 per mile of line; a figure so far superior to the stereotyped $350,324.60 that I can't help thinking of the exclamation of Clive when he recalled some of the wealth of India he had *not* appropriated: "By God, Mr. Chairman, at this moment I stand astonished at my own moderation."

At the first blush it seems as if the only thing to do with a road that has swallowed 13,676,920 nickels "per mile of line" is to close the slot, stretch the trolley wire, and try to save something out of the wreck. But the last lesson of this case may be that it is a healthy sort of a system that can stand up under such a load. I shall have more to say of this later.

Further investigation reveals the fact that the cost of roads was fixed forever by taking the average of ten cable roads and ten electric roads. They are given below.

The last column in each table, "cost per mile of line" is added by the writer. It may be noted that the figures given for Electric No. 10, a storage battery line, are not used in any of the "averages" of the Bulletin.

Upon what principle the selection of roads was made I know not. The cables range from $159,000 to $684,000 and the electric from $9,000 to $99,000.

On a slight examination of these tables it will be apparent that to draw any useful conclusion from them as to "the relative economy" of cable and electric railways is work for the man who can solve the problem, "Given

A.—CABLE RAILWAYS.

1.—DESCRIPTION AND COST.

No.	DESCRIPTION. LENGTH. Length of Line—Street Length (Miles).	LENGTH. Length of all Tracks, including Sidings (Miles).	STEEPEST GRADE. Per Cent.	STEEPEST GRADE. Length in Feet.	NUMBER OF CARS. Grip.	NUMBER OF CARS. Trail.	NUMBER OF CARS. Average Total Used at Once.	Indicated Horse Power of Engines.	Total Cost of Road and Equipment.	Cost per Mile of Line.
Total,	75.22	142.92	.....	.....	601	832	583	13,300	$26,351,416.62	
1	8.50	17.00	10.00	1,300	116	380	118	1,450	$5,812,693.77	683,846
2	5.75	11.50	10.40	412	65	76	50	500	1,467,000.00	255,111
3	5.50	11.00	70.00	500	46	10	32	1,175	2,628,586.59	477,925
4	3.20	6.40	4.00	2,250	26	47	40	1,500	1,219,615.63	381,130
5	11.69	23.38	13.94	566	76	141	106	3,400	4,028,735.37	344,631
6	10.15	20.40	18.53	1,000	71	119	77	1,300	2,649,735.84	261,058
7	8.86	10.10	80.00	413	58	8	48	425	1,510,495.84	170,485
8	8.57	17.15	4.00	1,600	81	....	36	1,250	2,257,860.34	263,461
9	2.72	5.44	2.15	200	12	....	10	200	433,097.71	159,227
10	10.28	20.55	15.50	150	50	51	66	2,100	4,343,595.53	422,528

B.—ELECTRIC RAILWAYS.

1.—DESCRIPTION AND COST.

No.	DESCRIPTION. LENGTH. Length of Line—Street Length (Miles).	LENGTH. Length of all Tracks, including Sidings (Miles).	STEEPEST GRADE. Per Cent.	STEEPEST GRADE. Length in Feet.	NUMBER OF CARS. Motor.	NUMBER OF CARS. Tow.	NUMBER OF CARS. Average Total Used at Once.	Indicated Horse Power of Engines.	Total Cost of Road and Equipment.	Cost per Mile of Line.
Total,	55.56	67.22	.....	.....	118	34	78	2,370	$2,426,285.12	
1	11.71	16.35	12.50	7,920	47	..	32	1,050	1,156,354.28	98,749
2	4.11	7.54	5.20	475	12	15	9	125	266,730.10	64,898
3	5.00	5.22	6.50	1,200	12	4	6	80	125,801.27	25,160
4	10.00	12.13	8.00	800	21	6	14	450	382,600.00	38,260
5	6.00	6.36	6.00	500	7	4	4	300	115,694.20	19,282
6	3.00	3.26	7.50	300	4	..	3	100	95,225.16	31,742
7	4.25	4.50	4.00	500	6	..	5	80	73,000.00	17,176
8	2.80	2.80	6.50	250	3	2	2	....	106,407.15	38,003
9	4.25	4.50	3.00	300	4	3	2	150	65,368.44	15,381
01	4.44	4.56	7.00	300	2	..	1	35	39,104.52	8,807

the captain's name and the year of our Lord, to find the longitude of the ship."

The writer has a decent respect for "averages." He knows the statistics of the last twenty years afford a fountion for an estimate on the fires, murders, and gasoline stove explosions, for the next five. But everybody who has used averages, not like a machine, but for some real purpose and with some interest of his own at stake, is alive to the fact that from the fires of the 1st, 11th and 13th of last month we cannot guess whether next Wednesday will bring burnt window curtains or Chicago in ashes.

If the tables had included every road built to date would they show the relative cost of the average cable road and the average electric road? Yes; just as statistics now available show the relative cost of the average boat built on the Clyde and the average boat built along the Erie Canal.

Would they throw any light on the necessary investment under each system to handle a certain business? Without the application of considerable intelligence to the study of details, no. Can you substitute a $46,000 electric road for a $350,000 cable? Can you substitute for the average Clyde built steamer the much cheaper boat of the Erie Canal? *That is the impression persistently cultivated for the last fifteen months by the street railway papers, the engineering papers and the monthly magazines.*

We find on inspection that the $46,000 electric road consists of one mile of single track (certainly unpaved), plus one-quarter mile of side track, with 2.93 cars, all told, making 177 car miles per day. This is a car each way every twelve or fourteen minutes. Little confidence will be placed in these figures by those familiar with the carelessness, the incomprehensibleness of returns made on blanks sent out for such information as is embalmed in these tables. But that this is closely the $46,000 worth of electric road can be verified by the papers and books of writers on the electric railway.

The cable roads appear to have nineteen cars to the mile and to make 847 car miles per day. Again I say the figures of the Bulletin are of little worth. No distinction is suggested between four wheel and eight wheel cars. Of the latter, road No. 8 has eighty-one, No. 9 probably twelve, No. 4 a large number, No. 1 a large number, and so on. I have little doubt that, reduced to equivalent numbers of "standard cars" and miles, we shall find the cable figures at least twenty-one cars and 1,000 car miles per mile of line per day, or a car each way every two and a quarter minutes.

Now, the nine electric roads averaged in the table have 62.66 miles of track. If we consider this as 31.33 miles of double track, for the purpose of closer comparison with the cable road, the $46,000 swells at once to $76,170. If we leave them otherwise as they stand and add three-quarters of a mile of (cheap) second track and pave them like the cable roads the $46,000 becomes easily $76,000. If we add fifteen or eighteen cars to the three, an added investment of $150,000 per mile is necessary; not for cars alone, but for the cars and what is necessary to run them. We are now beginning to fit up the canal boat for the business of the other boat.

If we add a horse railroad absorbed, what kind of a figure does that cut in "cost of road and equipment?" A

A.—CABLE RAILWAYS.

2.—STATISTICS OF OPERATION.

No.	Length of Time Covered by Operating Statistics (Months).	Car Mileage.	NUMBER OF PASSENGERS CARRIED.		OPERATING EXPENSES.		
			Total.	Per Mile Operated.	Total.	Per Car Mile (Cents).	Per Passenger Carried (Cents).
Total.....	..	23,272,654	101,995,695	1,355,965	$3.286,461.64	14.12	3.22
1	12	6,290,172	36,218,807	4,261,036	$1,063,834.59	16.91	2.94
2	12	1,653,303	10,030,491	1,744.433	355,415.13	21.50	3.54
3	12	1,413,280	8,229,809	1,496,329	200,093.65	14.16	2.43
4	12	1,404,000	4,607,587	1,439.871	145,299.39	10.35	3.15
5	12	4,698,120	12,662,044	1,083,152	441,151.59	9.39	3.48
6	12	3,355,435	9,505,979	936,550	344,229.99	10.26	3.62
7	12	1,244,750	8,113,655	915,762	272,721.43	21.91	3.36
8	12	1,595,650	6,781,683	791,328	225,069.39	14.11	3.32
9	12	310,331	1,346,820	495,154	57,697.94	18.59	4.28
10	12	1,307,613	4,498,820	437,628	180,948.54	13.84	4.02

B.—ELECTRIC RAILWAYS.

2.—STATISTICS OF OPERATION.

No.	Length of Time Covered by Operating Statistics.		Car Mileage.	NUMBER OF PASSENGERS CARRIED.			OPERATING EXPENSES.		
				Total.	PER MILE OPERATED.		Total.	Per Car Mile (Cents).	Per Passenger Carried (Cents).
	Mos.	Days.			For Period Covered.	Per Year.			
Total.	..	..	2,442,106	8,031,214	.....	222,648	$326,961.26	13.21	3.82
1	6	..	702,720	2,752,382	235,045	470,090	$95,109.48	13.53	3.46
2	9	23	317,656	826,756	201,157	248,047	31,030.30	9.77	3.75
3	12	..	257,793	1,041,978	208,396	208,396	28,531.04	11.07	2.74
4	12	..	634,000	1,680,000	168,000	168,000	94,700.00	14.94	5.64
5	6	..	92,400	465,713	77,619	155,238	12,640.57	13.68	2.71
6	12	..	85,668	323,244	107,748	107,748	19,694.47	22.99	6.09
7	12	..	186,400	400,000	94,118	94,118	15,550.00	8.34	3.89
8	12	..	71,375	221,415	79,077	79,077	10,114.76	14.17	4.57
9	12	..	74,340	259,509	61,061	61,061	12,470.87	16.78	4.81
10	11	..	19,754	60,217	13,562	14,795	7,119.77	36.04	11.82

few horse railroads from "Poor's Manual of Street Railways, 1891," will show how they *may* figure:

HORSE RAILROADS.

NO.	ROAD.	"COST OF ROAD AND EQUIPMENT" PER MILE OF LINE.
1	Binghamton & Pt. Dickinson	$5,167.
2	Babylon, N. Y.	7,547.
3	Atlantic Ave., Brooklyn	185,720.
4	Brooklyn City & Newtown	192,787.
5	Rochester Ry. (Not Rochester Electric)	206,527.
6	Dry Dock & East Broadway	284,985.
7	Central Park, North & East River	290,122.
8	Broadway & Seventh Avenue	515,609.

When the electric road begins to absorb horse railroads "costing" perhaps $185,000 to $500,000 per mile, and when tunnels, bridges and viaducts come in, as already they do in some of the ten cable roads selected for Census Bulletin No. 55, the $46,000 electric road will cease to be "standard" even on paper.

Turning to Operating Expenses of the twenty roads we find the tables A2 and B2 opposite.

Any general manager of a cable road reading this statement of cable railway operating expenses must congratulate himself.

The writer has studied the subject and he does not happen to know of a road whose "operating expenses," exclusive only of interest on bonds, come up to ten cents per "standard car" mile, unless it be the solitary instance of one of the Los Angeles roads; but he does know of cable roads operating at from 9.5 cents down to 6.4 cents with four wheel cars.

To examine a few of these cases in detail: No. 4 operated both eight wheel and four wheel cars. Its 10.35 cents would probably reduce to less than 9.5 cents per "standard car" mile. No. 5 has four wheel cars; its operating expenses are given 9.39 cents, but the company's annual report for 1891 gives 8.50 cents. No. 8 has eight wheel cars only. It operating expenses are given as 14.11 cents. In the company's annual report for 1891, the figure is 13.70 cents per *combination car mile*, which is equivalent to 6.85 cents per "standard car" mile.

Turning to the electric roads: No. 1 gives its operating expenses as 13.53 cents. This is an instructive case. The operating expenses of this road were given in the STREET RAILWAY JOURNAL *Souvenir*, October, 1891, as follows, "based on the experience of the last six months of 1890":

Conductors and motormen	6.80
Motor and electric repairs	1.68
Mechanical repairs	1.14
Motive power	1.54
Overhead system	.45
Maintenance of way	1.08
General expenses	.88
Stables	.46
Officers' salaries	.84
Interest	2.71
Tolls	.25
General labor	2.43
	20.26

and the report continues in the words of the president of the road, "*separating the above into strictly operating expenses and fixed charges, we have operating expense* 12.74 *cents per mile*," *etc.*

Now I detect nothing in this 20.26 not properly included in operating expenses but "Interest 2.71"; and I would like to see the process by which that 20.26 is boiled down to 12.74. This report is copied in full in *The Electric Railway* without correction or comment. The same company's operating expenses are given in the STREET RAILWAY JOURNAL March, 1892, for the year 1891, as "22.35 cents per mile or, excluding interest, 19.79 cents." It seems probable that at the time the report was turned in to the Census Office as 13.53 cents this company had not yet learned what "operating expenses" means.

A recent work on the electric railway says: "At the time of the Buffalo convention our managers and superintendents made statements concerning their operating expenses which actually staggered one another. One would state that on his line operation cost so much per mile; another would state that it cost his company a different sum per mile. The first had included, perhaps, the repair of cars with the wages of motormen and conductors, while the second might have omitted repairs of cars and included the cost of operating the power house, with or without the cost of repairs on the dynamos. There was and is now no way in which a comparison can be made between the costs of operating our various street railways. * * *" (Note, that they "staggered one another," and consider what the effect must be on men unaccustomed to taking 500 volts with a smile and "It never touched me!")

A writer in the *Street Railway Gazette*, April 23, 1892, says: "It should be stated that these estimates * * * include the cost of the car drivers, which is a very considerable amount, and is not infrequently omitted in estimates of cost of traction."

In a pamphlet on a certain new motor I find,

"ESTIMATED COST OF OPERATING, INCLUDING INTEREST ON INVESTMENT AT 6 PER CENT.

Cable system	8.9 cents per car mile.
Horse "	9.8 " " " "
[Our] "	2.7 " " " "

Remarkable as our figures may seem we still think they can be greatly reduced." It is fair to say of this case that the cost per car mile was merely estimated, as it was found on trial impossible to make a whole car mile by the system. But what *this* writer understood by operating expenses, we can only guess.

With the exception, possibly, of "Rent of Leased Roads," of all the items on which the question arises I would omit from operating expenses only "Interest on Bonds" Such interest should be considered apart because it is a large item with a most indefinite relation to cost of road or cost of operating. But the West End road omits "Taxes;" and in a long list of reported electric expenses, I miss both "Taxes" and "Car Licenses;" and whether "Miscellaneous Expenses" does not cover a multitude of sins of omission, it is hard to guess, but we have seen on high authority what the possibilities are. Will any man be satisfied with comparison of things so indefinite?

Next we note that the price of coal and rates of wages are ignored by nearly every electric writer.

COST OF COAL AT A FEW PLACES.

Scranton, Pa. (culm coal)	.10 per ton.
Pittsburgh, Pa. (slack alone)	.65 " "
Allegheny, Pa. (nut and slack)	.95 " "
Cleveland	1.25 " "
Denver	2.10 " "
Richmond	3.00 " "
Providence	4.25 " "
San Diego	7.92 " "
San Francisco	8.50 " "
Los Angeles	10.50 " "

These are specimens. From ten cents to 100 times ten cents.

On the lines of a certain company operating both cable and electric cars I find the coal burned, per 1,000 passengers, 600 lbs. for the cable to 2,200 lbs. for the electric. But if the former had the $8.50 coal of San Francisco and the latter the $1.25 coal of Cleveland, the electric exhibit would be very respectable.

Wages on cable roads are, speaking generally, from 33 per cent. to 50 per cent. higher than on the electric; for the reason that the cables are in large cities and the electric in the small towns and country.

On nine electric roads I find the average wages:

Engineers	26	cents.
Mechanics	21	"
Conductors and motormen	16	"
Labor	13	"

and nearly 70 per cent. of all expenses wages.

Sticking to conductors and motormen, in November, 1891, we find at Terre Haute, Ind., conductors striking for an advance on 11 cents and motormen tired of 12.5 cents. On another electric road I find conductors and motormen rated at 9 to 11 cents. On another:

Motormen	$25.00 per month
Conductors	37.50 " "

There is hardly a cable road paying gripmen less than 20 cents and some of them pay 22½ to 25 cents per hour for both conductors and gripmen.

It is easy to see how idle a comparison must be which neglects cost of coal and rates of wages. The mere variation in the last item may count for three or four cents per car mile in favor of the suburban electric against the Metropolitan cable road.

Having thus merely pulled up a few weeds, I defer further cultivation of the field. I intend to show, among other things, that for the small business now done by the cheap, half built electric road with its occasional car, the cable system cannot compete; that for a cable railway business the cost of a cable road is not ten times, or five times, or two times, or one and a half times the cost of an electric road; that in such a business the saving of $1 in interest may mean the losing of $5 or $15 in net revenue. And when I get through perhaps we shall not so often find in papers that ought to know better, the $350,000 cable road versus the $46,000 electric.

CABLE RAILWAYS.

(To be continued.)

Handsome Cars.

We recently addressed the accompanying letter to the managers of a few street railway companies. Some of the replies follow, and will be found of great interest as bearing upon this subject.

NEW YORK, May 20, 1892.

DEAR SIR:—We should be pleased to have you give us for publication in the STREET RAILWAY JOURNAL your opinion of the relative merits of highly finished, handsome street cars, as traffic promoters, in comparison with the ordinary plainly finished cars.

We would like to have you give any points relating to the subject that are the outcome of your experience or observation. Very truly yours,

STREET RAILWAY JOURNAL.

OFFICE OF
THE TWENTY-THIRD STREET RAILWAY CO.,
621 West 23d Street.

NEW YORK, June 1, 1892.

EDITORS STREET RAILWAY JOURNAL:—

Replying to your favor of May 21: As a result of my experience and observation, I have no hesitation in stating that in my judgment, handsomely finished street cars tend to promote traffic. The most popular lines are those equipped with handsome cars, neatly uniformed conductors, good horses, harness, etc. Very truly yours,

THOS. H. MCLEAN, General Manager.

MINNEAPOLIS STREET RAILWAY CO.

MINNEAPOLIS, MINN. May 25, 1892.

EDITORS STREET RAILWAY JOURNAL:—

Your letter with reference to cars received. There can be no question but what large, nicely furnished cars will greatly increase the traffic on any road. We have noticed this very perceptibly when we have increased the size of our cars. We have always had our cars finished in the very best manner, and we think it a good business policy for any road to adopt. Very truly yours,

C. G. GOODRICH, Vice-president.

WEST CHICAGO STREET RAILROAD CO.,
89 West Washington Street,

CHICAGO, May 23, 1892.

EDITORS STREET RAILWAY JOURNAL:—

Answering your favor of the 21st concerning highly finished cars, I do not believe that such cars as I understand by your inquiry to be meant, give any additional travel. I do, however, believe that street cars should be made plain and comfortable and always kept clean.

My experience with a handsome street car is that people do not pay much attention to it; but if handsome or plain, a dirty car attracts their attention very quickly.

In my judgment a plain, clean and comfortable car is the best adapted for street railway purposes.

Respectfully, etc., JNO. B. PARSONS,
Vice-president and General Manager.

OMAHA STREET RAILWAY CO.

OMAHA, NEB., May 30, 1882.

EDITORS STREET RAILWAY JOURNAL:—

Replying to your inquiry of 21st inst. relative to the merits of "highly finished, handsome street cars as traffic promoters:"

Nearly all street railway managers, so far as my observation goes, have settled on a strong, durable, light weight car, elegance in fittings being a secondary consideration. In practical street railway parlance all men are equal. The artisan with his tools has the same consideration as the rich, and to my mind, based somewhat on our own experience, the cars with what would be called a "handsome make up" draw very little, if any, better than the plainer ones, besides requiring a larger repair account. We have always believed in a thoroughly good car, kept in the best repair possible, with a reasonable degree of elegance. Respectfully,

W. A. SMITH, General Manager.

THE
MILWAUKEE STREET RAILWAY CO.
MILWAUKEE CITY DIVISION.
209 West Water Street.

MILWAUKEE, June 2, 1892.

EDITORS STREET RAILWAY JOURNAL:—

When I first came to this city from New York, some four years ago we had very old fashioned horse and mule cars, and you can well imagine how odd they looked to me. Our business was comparatively small (so were the cars), but now we have our lines almost completed with electricity and have the finest cars that can be built. First we ordered sample cars from all the best makers from the East and West, and together with handsome new cars, fifty in number, made by the Brownell Car Co., of St. Louis, Mo., and now in operation, the road presents a very handsome appearance; the cars being handsomely upholstered and lighted by handsome clusters of electric lights, and our business has improved greatly. I am of opinion that if you have highly finished, handsome cars and everything looks inviting and you are giving the public good rapid service, you will do all the business you can take care of. This has been my experience out this way. I came out here from New York to improve the service, and I have labored hard to bring it up, and I think (not to be conceited) that I have accomplished something. People out this way are riding who never patronized a mule or horse car. Give the people good, clean cars, nicely finished (with rapid transit) and every one will want to ride. Very truly,

GEORGE W. HOMMELL, Manager.

Plain vs. Contracting Chill, for Making Cast Iron Wheels.

The report of the committee of the Master Car Builders' Association on cast iron wheels, which was presented to that body on its recent session in Saratoga, is of considerable interest to street railway men.

To the questions sent out by the committee in a circular letter, answers were received from sixteen railways and thirteen wheel makers. Among the questions and answers of most importance were the following:

"Do you use what is known as the "contracting chill" in the manufacture of cast iron car wheels, and if so, what percentage of your product is made in such chills, and whose design of contracting chill do you use?"

Of the sixteen railways, eleven use the contracting chill, two the plain chill and three did not reply. Of those using the contracting chill, one uses the Canda, one the Whitney and nine the Barr. Of the thirteen wheelmakers, five are using or arranging to use the Barr chill, one the Whitney, one the non-expansive chill and

five the plain chill. This gives a total, of both railways and wheelmakers, of fourteen using the Barr chill, two the Whitney, one the Canda, one the non-expansive and seven the plain chill.

"Do your foundry or service records show that there is any advantage in using the contracting chill which is not had with the older form of fixed chills, either in percentage of loss, or uniformity and quality of product?"

Those using the contracting chill and its products agree (with one exception) that foundry loss is decreased. Some place it is as high as 50 per cent. The one exception is a road that was noted for its success with cast iron wheels before the introduction of contracting chills. It is of the opinion of the committee that the evidence at hand goes to prove an advantage in this respect. As regards uniformity and quality of product, nothing can be said by the committee.

Do you grind or balance wheels before you ship them to the purchaser, or before you put them in service?

Of the twenty-nine who answered the letter, seventeen grind all or a part of their wheels, four neither grind nor balance, and eight did not reply. The committee regrets that this question was not more generally and fully answered, as upon it, in their opinion, exists about the only difference of any importance between the advocates of the contracting chill and the plain.

What do you consider the proper depth and distribution of the chill on wheel?

It appears from the replies to be generally considered that a model wheel should have a five-eighths inch chill. The practice varies, however, from three-eighths to one-eighth inch on the tread, and from one-fourth to three-fourths inch in the throat.

The Paper on the Gearless Motor Before the Chicago Electric Club.

Some misconception has been occasioned by an engraver's error in the published account in our May issue of Professor Short's paper on the gearless motor read this spring before the Chicago Electric Club. The error referred to was in the block before we received it and occurred in numbering the ordinates of the curve on page 314, Fig. 7, giving the horizontal effort and speed. As the curve appeared in the printed article the ordinates numbered were 500, 1,000, 1,500, etc. As they appeared on the blue prints distributed by Prof. Short while reading his paper they were numbered 50, 100, 150. It is not surprising that the curve as it appeared in print occasioned comment, as according to it the motor was rated at ten times its proper capacity. As the cut was sent us by the Secretary of the Chicago Electric Club, we considered ourselves justified in assuming it correct.

Street Railway News.

General.

Asbury Park, N. J.—The charter of the electric street railway company allows them to run cars on Sunday. This the company have recently commenced to do, and all the ministers living tnere have signed a remonstrance against Sunday cars, and some of the people opposed to work on Sunday have threatened to appeal to the State authorities.

Baltimore, Md.—The City Passenger Railway Co. have purchased a location for the North End power house for the Blue Line cable.

A DEED has been recorded conveying to the Baltimore Traction Co. all the property, rights and franchises of the North Baltimore Passenger Railway Co. and the Baltimore & Pohawtan Railway Co. The Traction company purchased all the shares of capital stock of the North Baltimore Co. some time ago, and secured a legal title to the property by the deed.

Beatrice, Neb.—The Beatrice Rapid Transit & Power Co. lately secured an extension of the contract for the purchase of the old company's interests. The extension also carries with it the right to proceed with the equipment of the old line for electric service.

Brooklyn, N. Y.—The new steam branch of the Brooklyn City Railroad running from Ridgewood to Richmond Hill, on Myrtle Avenue, has been formally opened. The new electric line on Hamilton Avenue is also running very successfully.

Chicago, Ill.—Alderman Sexton recently introduced in the Council an ordinance changing the name of the Chicago & Evanston Electric Railway Co. to the Chicago North Shore Street Railway Co., and amending the ordinance so as to permit the company to place a double track on Evanston Avenue and Clark Street.

THE first fatality on the South Side Elevated Road occurred June 19, when Leroy Barker, a fireman on Engine 4, was struck by his locomotive and killed.

Colorado Springs, Colo.—The rapid transit company have received five of the six new cars ordered from the Pullman Palace Car Co.

Fishkill, N. Y.—Work on the Citizens Street Railway Co.'s line has been commenced by the contractor.

Harrisburg, Pa.—Judge Simon, June 4, granted the city an injunction restraining the Harrisburg Street Railway Co. from changing their motive power from horses to electricity.

Lancaster, Pa.—The Lancaster & Lititz Electric Railway Co. have decided to start at once to build their road.

Lebanon, Pa.—On the Lebanon & Annville Street Railway the total number of passengers carried during May was 72,811, over 6,500 of whom were carried on Memorial Day. This is an increase over April of nearly 15,000, or about 400 per day.

Lowell, Mass.—The new power station for the Lowell & Suburban Street Railway Co. will have a capacity of 2,000 H. P. Its equipment is to consist of six Thomson-Houston generators. Three Cooper-Corliss cross compound engines will furnish motive power at the station. The entire work is being done by the Thomson-Houston Electric Co. of Lynn, under the direction of C. W. White,

Memphis, Tenn.—The injunction suit of the Citizens' Street Railway Co. against the Raleigh Springs Railway Co., which was appealed to the United States circuit court was recently decided by Judge Jackson at Nashville. He refused to grant the injunction, but requires the Raleigh Springs company to give bond in the sum of $10,000 to cover the amouut of any damage that may be done by the company in building its road over the street in controversy.

Mineral Ridge, O.—The contract to build the street railway from Mineral Ridge to Niles has been let to the Thomson-Houston Electric Co. The road is to be in running order by the 15th of September.

Newark, N. J.—The Newark & South Orange Street Railway Co., purchased by a Newark syndicate recently, are commencing the re-equipment of their road. The Field Engineering Co. have been appointed their engineers in charge of construction, and the contract for motors and generators has been awarded to the Westinghouse Electric & Manufacturing Co., car bodies to the John Stephenson Co., trucks to J. G. Brill Co., engines and boilers to local manufacturers, poles to Syracuse Tube Co. The road will be equipped with about forty cars and the station will have 1,000 H. P. capacity. Everything is being done by the company to make their equipment a model one in every respect, and a private car, which is to be named after Judge Krueger, will be one of the features.

New Britain, Conn.—Dolan Brothers, managers of the Tramway Co , have bought the entire stock of the company and are now sole owners.

New Orleans, La.—Notice has been published that on September 6 the extension of the franchises for twenty-five years, now owned by the Crescent City Railroad Co., will be sold at public auction to the highest bidder.

Norfolk, Va.—A. D. Field of the Lewis & Fowler Co. has returned to Brooklyn after the completion of the construction of a section of track for the Norfolk City Railway Co. The Company are well satisfied with their new rails, and the way they are laid.

Plainfield, N. J.—The Plainfield Street Railway Co. are rapidly completing their line, and by August 1 electric cars will be running through all the principal streets. The promoters will extend the line into the suburbs. North Plainfield has petitioned to have the road extended into its streets, and this will be done.

Pittsburgh, Pa.—The Thomson-Houston Electric Co., of Pittsburgh have taken a ninety day's option on the two Mt. Pleasant electric street railways. The prospects are now very bright for an electric road to be built in the near future.

Red Bank, N. J.—The Red Bank & Seabright Street Railway Co. who proposed to build a surface road between Red Bank and Seabright before summer, have abandoned the enterprise. A number of residents of Red Bank, Fairhaven and Oceanic, through which towns the road was to run, opposed the movement.

St. Louis, Mo.—In a recent copy of the St. Louis *Globe-Democrat* there was an item on the saving of a child's life in that city, on June 1, by one of the cable street car fenders manufactured by the Brownell Car Co. These fenders are in use on all the cars manufactured by the Brownell Car Co., St. Louis and elsewhere, and have been instrumental in protecting in many cases against accident and loss of life.

Saginaw, Mich.—The street railway company here charge four cents for regular tickets, carry mail carriers for two and a half cents, firemen for one cent and policemen free. They also sell labor tickets for two and a half cents.

Sandusky, O.—A new 100 H. P. generator was recently placed in position at the power house for the Sandusky Street Railway Co.

Saratoga Springs, N. Y.—A suit of the village of Saratoga Springs against the Union Electric Railway Co., brought to test the legality of the franchise of that company, will be tried at Ballston Spa next October.

Scottdale, Pa.—Eastern capitalists want to purchase the charter and rights of the Scottdale, Everson & Broadford Street Railway. The road will be built.

Tallahassee, Fla.—R. L. Bennett, president of the Tallahassee Street Railway Co. is arranging to construct a belt line around Tallahassee, with dummy service both ways.

Wheeling, W. Va.—A majority of the shares of the Wheeling and the Citizens' railway companies was sold last month to capitalists from Cincinnati and Cleveland. The purchasers known in the transaction are W. R. Kimball of the Thomson-Houston Electric Co. of Cincinnati; W. W. Hazzard and James McClymondo of Cleveland, and A. M. Jolly and A. R. Lyda of Beaver Falls. The presidents elected at the following meeting were: Wheeling Railroad Co., W. R. Kimball; Citizens' Railway Co., John J. Jacob.

Winnipeg, Man.—The construction of the electric street railway has been commenced. It is to be finished by the end of July.

Worcester, Mass.—Pierce Bros. of Leominster have been awarded the contract for the electric supplies for the road from Worcester to Millbury.

Extensions and Improvements.

Albany, N. Y.—The Albany Railway Co. want permission to lay tracks down Clinton Avenue, from North Pearl Street to Broadway, to make connection between the two lines.

Anderson, Ind.—The Anderson Electric Street Railway Co. have applied for a twenty years' franchise. The company now hold an eight year franchise, but promise, if a twenty year franchise is granted, to extend the electric line all over the city where horse cars are now run.

Ashland, Wis.—The Ashland Lighting Co. and the Ashland Street Railway Co. have consolidated. The purpose is to change the motive power of the street car line to electricity.

Beverly, Mass.—It is quite probable that the Beverly & Danvers Street Railway will soon be put in operation and fitted with a new system of electric cars.

Binghamton, N. Y.—The Binghamton & Port Dickinson Railroad Co. have received permission to run their road through the the city of Binghamton, towns of Union and Dickinson with electricity.

Camden, N. J.—The Camden Horse Railroad Co. will extend their line a distance of three miles and will add eight electric cars during the coming year.

Chester, Pa.—The Union Railway Co. will extend their line fifteen miles, and will add twelve motor cars soon.

Chattanooga, Tenn.—The Chattanooga electric railway will add ten miles of electric road and five cars during 1892.

Chicago, Ill.—A petition and ordinance was lately presented in Council granting to the West Chicago Street Railway Co. right to lay tracks along Crawford Avenue between North and Grand Avenues.

THE Jefferson & Urban Rapid Transit Co. desire an extension of their franchise. The line now runs on Kedzie Avenue to Maplewood, and they desire to go a mile and a half farther north to strike Avondale.

THE Alley "L" company are considering an extension of the line to Englewood, in response to a demand of the citizens of that place.

Columbus, Ga.—The North Highland Railway Co. contemplate the extension of their line three miles during the next few months, and will install six electric cars.

Concord, N. H.—The Concord Street Railroad Co. have purchased land for a new park in the vicinity of Penacook, to which the electric road will be extended.

Covington, Ky.—The South Covington & Cincinnati Street Railway Co. expect to add from forty to fifty new cars and from ten to twelve miles of electric road during the coming season.

Dayton, O.—The Oakwood Street Railway Co. will probably extend their horse line half a mile soon.

THE Wayne & Fifth Street Railway Co. are relaying part of their line with a sixty-five to seventy pound Johnson girder rail.

Decatur, Ill.—The City Electric Railway Co. will build one mile of electric road during 1892.

Duluth, Minn.—The Duluth Street Railway Co. propose to build sixteen miles of electric road during 1892, and will add about the same number of electric cars.

Durham, N. C.—The Durham Street Railway Co. contemplate changing from horse to steam dummy power, laying a heavier rail and extending their track two miles.

Erie, Pa.—The Erie Motor Co. have purchased a site for a new car house to cost $6,000. It will be 80 × 100 ft. and will have a capacity of fifty cars.

The Erie Electric Motor Co. are extending their lines.

Findlay, O.—The Findlay Street Railway Co. are contemplating the installation of electric power on their horse line.

Fort Wayne, Ind.—In addition to the new power station of the Fort Wayne Electric Street Railway Co., a car house 30 × 150 ft. will be built adjoining, and another building 64 × 150 ft. will be built at the east terminus of the line on Washington Street.

THE Fort Wayne & Belle Isle Street Railway Co. have let contracts for the equipment of the road with the trolley system.

Framingham, Mass.—The Natick & Cochituate Street Railway Co. have applied for permission to extend their tracks into the village of Saxonville in the town of Framingham, where connections will be made with the Framingham Union Street Railway and the Natick Electric Street Railway.

Harrisburgh, Pa.—The East Harrisburgh Passenger Railway Co. will put another 500 H. P. engine in the plant between Steelton and this city. Two 268 H. P. Edison generators will also be substituted for the smaller ones now in use. These additions are due to the extensions being made.

THE ordinance granting the Citizens' Passenger Railway Co. the right of way on certain streets has been passed finally by both branches of Councils.

Hoboken, N. J.—The electric extension of the North Hudson Railway Co. will include about four miles of track and sixteen electric cars. The company are also in the market for a considerable number of horses.

Holyoke, Mass.—The Holyoke Street Railway Co. will extend their line one and a half miles soon and add four cars.

Hutchinson, Kan.—The street railway company are arranging for motor cars, owing to increased business.

Kansas City, Mo.—Arrangements have been made for changing the motive power of the Kansas City & Independence Rapid Transit line to electricity. The Thomson-Houston system will be used.

Lancaster, O.—The Lancaster Street Railway Co. have recently completed their track construction on Broadway, which gives a length of three and three quarters miles. They expect to have this in operation by electric power by September 1.

Lawrence, Mass.—The directors of the Merrimack Valley Street Railway Co. have asked for the right to lay a double line of tracks through Broadway from the corner of Essex Street to the Methuen line, and also through South Broadway to Andover Street.

Leavenworth, Kan.—The Leavenworth & Suburban Railway Co. expect to commence an extension eight miles in length, soon.

Leominster, Mass.—The Fitchburg & Leominster Street Railway Co. have nearly completed four and a half miles of electric road on which they expect to operate eight cars.

Long Island City, N. Y.—Patrick J. Gleason, president of the Long Island City & Newtown Railroad Co. has made application to the Highway Commissioners of the towns of Flushing and Newtown for a franchise for an electric railway.

Manchester, N. H.—At a meeting lately of the directors of the Manchester Street Railway it was decided to build a railway to Lake Massabesic, with electricity as the motive power.

McKeesport, Pa.—Fifty-six electric cars will probably be added soon to the rolling stock of the McKeesport & Reynoldton Passenger Railway Co.

Medford, Mass.—The West End Street Railway Co., of Boston, have applied for electrical railway rights through the town.

THE North Woburn Street Railroad Co. have also applied for right to operate their cars by electricity through the town.

Memphis, Tenn.—The Citizens' Street Railway Co. have applied for permission to lay tracks on Front Street from Court to Poplar.

Milwaukee, Wis.—The Milwaukee Street Railway Co. have decided to give the contract for 200 motor cars to the Pullman Car Co.

Moline, Ill.—President Louderback, of the Davenport & Rock Island Railway Co., has expressed his willingness to extend the Elm Street electric car line eastward to Thirty-eighth Street, there meeting the Moline Central, the city of Rock Island will raise the grade of the bridge on Fourteenth Avenue.

New Haven, Conn.—Hoadley B. Ives has asked permission to double track the Fair Haven & Westville Railroad from Quinnipiac Bridge to the terminus of the road in Fair Haven.

Newark, N. J.—The Newark Passenger Railroad Co. have asked the Clinton Township Committee that they be granted a franchise to build a street railroad on Frelinghuysen Avenue from the Newark City line to that of Elizabeth.

New York, N. Y.—The syndicate of street railways, headed by John T. Crimmins, are making preparations for immediate and costly extensions. They have asked permission to use electric power on part of Ninth and Sixth Avenues. Crosstown lines are proposed at 96th Street, 116 Street and 145th Street. In addition to the lines mentioned, the company will ask for the consent of property owners to the extension of the Avenue C line from Stanton Street along Pitt to Grand, and into and along Gouverneur Street to Madison Street, to connect with the line to the City Hall and Postoffice.

THE Houston Street, West Street & Pavonia Ferry and the Chambers Street & Grand Street Ferry railway companies will lay some new track soon.

Newton, Mass.—The Newton Street Railway will build two and a half miles more of electric road.

Oakland, Cal.—A contest has been waged in the City Council between the Piedmont Cable Co. and the Oakland Consolidated Street Railway Co. for a franchise for the use of Washington Street, south of Eight, for a street railway, which has resulted in favor of the Piedmont company.

IN return the Oakland Consolidated Co. applied to the Supervisors of the county for a franchise for a road from Mather Street and Web-

ster Avenue to the Piedmont Springs. This line will compete with the Piedmont company.

THE Consolidated Piedmont Cable Co. will build five miles of electric road and four miles of cable road during 1892, and will add seven electric cars.

Olean, N. Y.—The Olean Street Railway Co. expect to equip that line with electricity soon.

Paterson, N. J.—The Paterson Electric Railway Co. have asked for permission to extend their railroad on Clay Street from its present terminus at Madison Avenue along to the Erie railroad crossing. The newly organized People's Park Railway Co. want the same location.

Petersburg, Va.—The Petersburg & Asylum railway are changing from horse to electric power, and have adopted the Thomson-Houston system. They expect to have ten cars running by July 1.

Pittsburgh, Pa.—The Allegheny Traction Co. have received the right to make extensions over certain streets on which the Transverse Railway Co. had authority to construct lines.

THE Citizens' Traction Co. have a scheme which will compete with the Pittsburgh, Allegheny & Manchester's Millvale, Etna & Sharpsburg road. The idea is to run a line from Lawrenceville over the Forty-third Street Bridge into Millvale. From there it will go to Etna.

Plymouth, Pa.—Preparations are being made by the Wyoming Valley Traction Co. to extend the electric railroad tracks through to the lower end of the borough.

Providence, R. I.—A large meeting was recently held by the citizens of Lakewood and Pawtuxet, when the question of securing the extension of the electric line across the Pawtuxet Bridge and through the Warwick side of that village and over to Lakewood was discussed.

Richmond, Va.—The Richmond Railway & Electric Co. will extend their Clayton Street line across the new Barton Heights viaduct.

Rochester, N. Y.—The Rochester Electric Railway Co. will add one-half mile of track and four trail cars soon.

San Francisco, Cal.—The Market Street Cable Railway Co. have received permission to make several important extensions.

Sarnia, Ont.—The Sarnia Street Railway Co. are extending their line to Tunnel Station, a distance of two miles, and are installing a forty-five pound T rail.

Savannah, Ga.—The Electric Railway Co. have leased the line of the Savannah & Isle of Hope line, and it will be equipped with electricity or steam to Thunderbolt.

Sherman, Tex.—The Sherman City Railway Co. may extend their line shortly.

Springfield, Ill.—The Bates Machine Co., of Joliet, are building a 450 H. P. engine for the People's Electric Railway Co. It will be in position at the power house by August 10. A foundation for another dynamo is also being laid at the power house.

Springfield, Mass.—A contract for ten new motor equipments has been given by the street railway company to the Thomson-Houston company.

St. Cloud, Minn.—The Thomson-Houston Electric Co. will put in a branch line of electric railway from this city to Sauk Rapids. The project had been given up once on account of lack of support from Sauk Rapids property owners, but they have at last made the concessions asked for.

St. Joseph, Mich.—The St. Joseph & Benton Harbor Electric Railway & Light Co. will build three miles of electric road and increase their rolling stock by six cars during the coming season.

St. Joseph, Mo.—The People's Street Railway Electric Light & Power Co., will add fifteen electric cars soon.

St. Paul, Minn.—It is said that an extension of the street railway will probably be built to Como Park.

THE St. Paul Street Railway Co. propose to add thirty electric cars and seven miles of electric road during the year.

Tampa, Fla.—The Tampa Street Railway & Power Co., a new company, of which J. H. Ahearn, of Tampa, is president and J. R. Rutter, of Philadelphia, vice-president, have come into possession of the street railway. The purchase price was $100,000. They propose to supplant the present system with electricity and build eighteen miles of new road in the city and suburbs.

Terre Haute, Ind.—The Board of County Commissioners have granted the Terre Haute Street Railway Co. the right to construct a street railroad track on certain streets. The company have the right to use either electricity or animal power.

Tonawanda, N. Y.—The Tonawanda Street Railway Co. will build ten miles electric road and add eight electric cars during the coming year.

Topeka, Kan.—The Topeka Railway Co., which is the consolidated company formed by the union of the Topeka City Railway Co. and Topeka Rapid Transit Railroad Co., will change their entire horse car line to electric during 1892.

Troy, N. Y.—The Gilbert Car Manufacturing Co. have just finished five fine excursion cars for the Troy City electric railroad.

Utica, N. Y.—The Utica & Mohawk Street Railway Co. expect to relay one mile during the coming season.

Waterbury, Conn.—The Waterbury Street Railway will be equipped immediately with electric power if necessary rights can be obtained.

Watertown, N. Y.—The Watertown Street Railway expect to purchase eight electric cars.

Webb City, Mo.—The Twin City Street Railway Co., have decided to equip their road with electric power and add several miles of track.

Wilmington, Del.—The Front & Union Street Railway Co. now operated by the Wilmington City Railway Co. will probably be changed to an electric road this season.

New Roads.

Austin, Tex.—A franchise for a street railway, to be operated, presumably, by electricity, has been granted to J. Seyes Haulenbeck.

Bay City, Mich.—At a recent meeting of the Common Council two aldermen stated that a new corporation stood ready to encircle this city with a system of electric railways. This corporation is the West Bay City Electric Railway Co. who will ask permission of the Common Council to use certain streets.

Brooklyn, N. Y.—The Brighton & Bensonhurst Electric Railroad Co. were incorporated recently with a capital of $250,000. This corporation is a reorganization of the Sea Beach & Brighton Railroad Co., which was purchased by Henry W. Slocum, William Marshall, Henry W. Slocum, Jr., and Dennis Sullivan under foreclosure sale.

Canton, O.—A plan is on foot to build an electric railway from this city to Cleveland by the way of Akron, taking in several summer resorts. The line will be some sixty miles in length. It is proposed to have the line in operation before the close of the summer.

Chester, Pa.—There has been chartered the Chester & Darby Electric Railroad Co. of Chester; capital $50,000. Some of the incorporators are Edward Mellor, Philadelphia; Charles H. Warren, Fall River, Mass; Henry C. Davis, New York; Edward A. Colby, Newark, N. J.

Chicago, Ill.—The Chicago & Suburban Rapid Transit Co. have filed articles of incorporation. The incorporators are Irus Coy, James H. Ashby, C. P. Caldwell, M. J. Tearney and George C. Lagear, of this city. It is proposed to build a railroad from Lake Street, near Halsted, south to 130th Street, near Blue Island, with a branch west on Thirty-ninth Street. The capital stock is $5,000,000.

Columbus, O.—An ordinance has granted a twenty-five year franchise to the Columbus & Westerville Railway Co. to build and operate a street railway from here to Westerville.

Columbia, Pa.—The Columbia & Marietta Electric Railway Co. has been incorporated; capital, $50,000. The line will extend from Columbia to Marietta. Directors, Joseph H. Black, Robert T. Ryon, James A. Ryon, Columbia; J. K. Sigfried, George W. Ryon, Pottsville; James Duffy, Marietta.

Covington, Ky.—The new street railway company will build an electric line from Covington to Independence and possibly on to Walton.

Cuyahoga Falls, O.—A company with a $100,000 capital stock has been incorporated under the name of the Cuyahoga Falls & Akron Railway & Power Co. The incorporators are W. J. Price, G. F. Parmelee, G. F. Harris, James Anthony and C. M. Hubbel, who are Chicago and Kansas City capitalists. They announce that the line will be built and in operation August 1.

Defiance, O.—The project of building an electric road from Defiance to Evansport is in favor. D. Coy of this city is interested.

Delaware, O.—A company to construct and operate an electric system has been incorporated. Among the incorporators are J. K. Newcomer, V. T. Hills, J. D. Van Deman and B. W. Brown. The capital will be $60,000.

Denver, Colo.—A franchise has been granted to the South Side Railroad Co. to construct an electric line from the city limits to Fort Logan. John C. Montgomery, James Leonard, Stanberry Sherwood, Frank B. Gibson and Calvin B. Butler are incorporators. The capital is placed at $150,000.

D. F. CARMICHAEL, John A. Thompson, Jerr N. Hill, Edward A. Reser and D. J. Carmichael have organized the Platte Valley Electric Railway Co. for express, freight and passenger traffic between Brighton and Denver.

Duluth, Minn.—The Lakeside Railway Co. have been organized with a capital of $100,000 by Charles H. Graves, Daniel G. Cash and John N. Currie, of Duluth, Minn.; William C. Sargent and George F. Chester of Lakeside.

El Paso, Tex.—J. N. Carnes, of Charleston, W. Va., has petitioned the City Council to grant him and his associates the right to construct a system of electric street railways through the streets of the city, connecting the business portion with the new military post at Fort Bliss.

Harvey, Ill.—The Harvey North Side Street Car Co. have been incorporated, with a capital stock of $30,000, by Joseph C. Bloodgood, John H. De Voe and others.

Hot Springs, Ark.—Articles of incorporation have been filed by the Fountain & Suburban Street Railroad Co., of Hot Springs, with a capital stock of $25,000. The corporators are R. Shurray, C. J. Fraser, W. D. Bell, O. L. Kirkpatrick and W. H. Ammons.

Kingston, N. Y.—The Kingston City Electric Railway Co. have asked consent to construct and operate a surface railroad on the trolley system.

Lancaster, Pa.—At a special meeting lately of the Board of Directors of the Lancaster & Lititz Electric Railway it was decided to begin the work of construction at once.

Liverpool, N. Y.—The question of an electric road between Syracuse and Liverpool is being agitated. Louis T. Hawley, Duncan W. Peck, H. A. Moyer and others are interested in the scheme. The intention is to connect the road with the People's line. If this cannot be done, it is proposed to build an independent line into the city east of the People's line.

Mansfield, O.—The Citizens Electric Railway, Light & Power Co. have been granted an electric railway franchise on certain streets.

Mt. Vernon, O.—A proposition has been submitted to the City Council by Howard Harper, of this city, and John Short, of Columbus, to build an electric railroad on the principal streets of this city. The company propose to construct the line at once, if granted the free right of way for twenty-five years.

New Bern, N. C.—A new company has been incorporated, entitled The New Bern Water, Electric Light & Railway Co., the incorporators are William C. Clarke, of Wakefield, R. I. ; Richard P. Williams, of New Bern ; Frank S. Arnold and Robert S. Fletcher, of Providence. Their capital may not exceed $160,000.

New Kingston, Pa.—The New Kingston Street Railway Co. is incorporated, with a capital of $15,000. The road will extend from Pamassno to New Kingston. Directors are : Samuel E. Moore, Bernard F. Rafferty, James P. Anderson, Howard Childs, Joseph P. Chappean, Pittsburgh.

New York, N. Y.—The scheme to connect the Cortlandt Street Ferry with the Broadway surface road by a line of street cars is practically assured. The necessary consents have been secured, and the necessary legislation enacted, and it is expected that the laying of the tracks will soon begin.

THE Fiftieth Street, Astoria Ferry & Central Park Railroad Co., have applied for a franchise to lay a number of tracks in uptown streets. It is said the company will use storage batteries.

Neenah, Wis.—Articles of incorporation have been filed by the Neenah & Menasha Street Railway Co. The capital is $150,000, and the incorporators are Colonel Garland, of Minneapolis, W. W. Reid, Curtis Reid and Silas Bullard of Menasha. The scheme is to put in an eletcric line from Neenah to Appleton through Menasha.

Newark, N. J.—Articles of incorporation have been filed of the Passaic & Newark Electric Railway Co., with a capital of $100,000.

Newtown, L. I.—The Flushing, Newtown & Long Island City Railroad Co. were incorporated last month to operate a street service from Hunter's Point to Flushing, L. I. The capital stock is $100,000. The directors are D. S. Jones, Frederick N. Smith, H. F. Jones, N. D. Swedley, G. E. Payne, A. N. Rankin, H. L. Davis, John Miller, Charles D. Durkee, S. M. Cord, Charles D. Buckingham, F. W. Scott and H. M. Thomas.

Niles, O.—The City Council has passed an ordinance granting the Trumbull Electric Street Railway Co. a franchise.

Oakland, Cal.—Robert Fitzgerald, J. L. Davie, W. H. Mackinnon and E. L. Fitzgerald have asked for franchises to build and maintain an electric railroad in this city and to Berkeley.

Oskaloosa, Ia.—A franchise has been granted here for an electric street railway.

Painesville, O.—An ordinance lately passed authorizes the Painesville, Fairport & Richmond Street Railway Co. to construct and operate a single track street railroad.

Paterson, N. J.—The People's Park Railway Co. have petitioned the Board of Public Works for permission to construct an electric road through People's Park and part of South Paterson. This company is composed of parties who are directors and officers in the Patterson Central Electric Railway, viz. : President, William Strange ; vice-president, William Pennington ; treasurer, James A. Morrisse, secretary, John R. Beam.

Philadelphia, Pa.—The bill granting permission to the Centennial Passenger Railway Co. to construct a single track railway to connect the Fairmount Avenue, Green Street & Girard Avenue lines of the People's company has been introduced in Councils.

THE Fair Hill Railroad Co. were recently chartered. Capital, $100,000. J. W. Dubarry is president.

Pittsburgh, Pa.—The Penn Street Railroad Co. of Pittsburgh is chartered. It is to be a branch of the Citizens' Traction Co. It will be an electric road about five miles in length. It will connect the boroughs of Brushton and Wilkinsburg with Pittsburgh. The capital stock is $30,000, divided into 600 shares of the value of $50 each. The directors are: James Y. Donnell of Allegheny City, John G. Holmes, H. S. A. Stewart, William B. Holmes and George C. Wilson of Pittsburgh.

THE South Side is to have a new road to the city, and it will connect with the Duquesne Line. It is the Suburban Rapid Transit Railway Co., who are building an extension from the toll gate on Brownsville Avenue down to Eighteenth Street.

Pontiac, Mich.—The Common Council of this city has granted a franchise for a street railway from Pontiac to Timber, Case and Orchard Lakes. The franchise was granted to M. D. Mills and George W. Barbour of Detroit, and John D. Norton, William G. Hinman and Thaddeus A. Smith of this city.

Portland, Ore.—A contract has been awarded to O. Pike & Co. for the construction of the Barnes Heights & Cornell Mountain Railway.

Portsmouth, O.—The City Clerk has issued an official notice that sealed proposals for the construction and operation of a street railroad will be received until July 7.

Salt Lake City, Utah.—Samuel J. Paul and others have asked the Council to grant a street railroad franchise to any reliable person desiring to build and equip a road in the southeastern part of the city.

A PARTY of engineers have been figuring on a street railway line, to start from Capitol Hill and run thence up City Creek Cañon to a point about 500 ft. down to the cañon from the city water works. It is said electricity will be used on the line.

Sharon, Pa.—An electric railway is to be built from Sharon to Sharpsville at a cost of from $60,000 to $80,000.

Shickshinny, Pa.—A charter has been granted for the Shickshinney & Huntington Valley Electric Railway Co. About six miles of road will be constructed running from Shickshinny to the Patterson Grove camp ground.

Wakefield, Mass.—The Wakefield & Stoneham Street Railway Co., which was organized in June, 1889, propose to build their tracks and commence operations this summer. The railway will be about two and a half miles in length. The motive power will probably be electricity. The capital stock is $10,000. The present officers of the company are: President, Charles F. Woodward; secretary, Ezra M. Southward ; treasurer, Daniel G. Walton.

Williamsport, Pa.—A line is projected to Wildwood cemetery by the Citizens' Passenger Railway Co., which was chartered lately. J. Henry Cochran is president of the new company.

A CHARTER has been granted the East End Passenger Railway Co. with a capital of $12,000. The road will be two miles in length and will be operated by electricity. John M. Young is president of the company and Thomas Lundy, John Boyer, John Hadtner and John R. T. Ryan, directors.

Personal.

Mr. J. W. Godfrey, general manager of the New York Insulated Wire Co , was in Chicago recently.

Mr. Antoine Bournonville, with Alfred Moore of Philadelphia, left for Europe on a vacation trip last month.

Mr. Charles E. Newton, secretary of the Jewell Belting Co., of Hartford, Conn., made a short stay in Chicago last month.

Mr. W. H. Delany, formerly connected with the Lewis & Fowler Girder Rail Co., has severed his connection with that company.

Mr. Albert E. Hay, president of the Robinson Machine Co., of Altoona, Pa., was in Chicago recently, making arrangements for opening an office and salesroom in that city.

Mr. W. F. Matteson, formerly with Wm. Hood of Chicago, has accepted a position with the Patton Motor Manufacturing Co., and will look after the equipment built for the Denver & Golden Company.

Mr. Charles T. Yerkes, president of the North and West Side Chicago street railway companies, sailed for Europe last month on the steamer "City of New York." Mr. Yerkes expects to be gone about three months,

Mr. Boyer Parks, at present trackmaster of the Baltimore City Passenger Railway Co., laid the first street railway tracks in Baltimore on May 25, 1859, and has been continuously engaged in track construction and maintenance until the present date. Mr. Parks is hale and hearty, and from every indication is still good for many years of active service.

Mr. John W. Fowler, president of the Lewis & Fowler Manufacturing Co., of Brooklyn, met with an unfortunate accident last month, by being thrown from his carriage while driving, and breaking his leg. Mr. Fowler is now at his summer residence, Northport, L. I., and at the time of going to press was feeling well and recovering as rapidly as possible under the circumstances.

Mr. H. L. Cargill has severed his connection with the Thomson-Houston Electric Co. and has accepted the position of secretary with the Duplex Street Railway Track Co., of New York. When his resignation was tendered, the managers of the Thomson-Houston company expressed regret that Mr. Cargill had decided to leave their service, but united with his former associates and other friends in wishing him all success in his new position.

Mr. Edwin A. Moore, erecting engineer of the Pennsylvania Iron Works Co. who will have full charge of the erection of all the machines which this company are furnishing for the different cable power stations in New York, is now in New York City. He is engaged at present in preparing the foundations at the Fifty-first Street station of the Broadway & Seventh Avenue Railroad Co. for the machinery which will soon be put in place.

Obituary.

Mr. E. V. Cavell died at Nassau, N. P., June 7. Mr. Cavell was well known among the street railway fraternity, was for a long time editor of the *Street Railway Gazette* of Chicago, and had recently been connected with the *Street Railway News* and *Electrical Age* of New York. His death was not unexpected. He had gone to Nassau during March in the hope of receiving some benefit from the climate, but without avail. Mr. Cavell was a native of England, where he was born about thirty-four years ago.

New Publications.

Code Book of the Interior Conduit & Insulation Co. of New York. This book gives a complete list of appliances in different sizes manufactured by the Interior Conduit & Insulation Co., and described in their catalogue No. 7, together with a code word for each, facilitating ordering by telegraph.

Directory for the Year 1892 of the Compania de Tranvias de Merida Sociedad Anonima.

This pamphlet of the Street Railway Co. of Merida, Yucatan, is published annually, and its especial purpose is to give information in regard to the routes of cars, etc., to the general public of Merida, though other interesting matter is also contained within the covers. The street railway company of Merida was established in 1880, and now has a capital of $400,000 with about fifteen and three-quarters miles of track and thirty-eight cars in operation.

Experiments with Alternate Currents of High Potential and High Frequency, by Nikola Tesla. Published by the W. J. Johnston Co., Ltd. *Times* Building, New York. Price $1.00.

This little volume gives an accurate account of Mr. Tesla's experiments in this interesting branch of electric science, as described by himself in his lecture some months ago before the English Institution of Electrical Engineers in London. It is largely to Mr. Tesla that the scientific world is indebted for what it knows in this direction, and his results and statements of the possibilities in the use of these currents will be read with the greatest interest.

The Railroad Law of the State of New York; compiled by R. C. Cumming and Michael Danaher, 1892. Price $1.00, postpaid. Half leather binding. J. B. Lyon, law publisher, Albany, N. Y.

This volume, of 294 pages, contains the railroad statutes of the State of New York, including the general corporation law, the stock corporation law, the sections of the code of criminal proceedure of the criminal code applicable to railroad companies, the rapid transit act, the interstate commerce act, etc., as revised by the statutory commission and enacted by the Legislatures of 1890 and 1892. The laws governing street railway companies occupy a considerable portion of the volume. The work is supplied with a complete index.

Verbatim Report of the Tenth Annual Meeting of the American Street Railway Association Held at Pittsburgh, October, 21-22, 1891, published from the office of the Association, Brooklyn, N. Y.

The report of the tenth annual meeting of the American Street Railway Association is issued uniform with former reports and gives all the proceedings at Pittsburgh in the same accurate and complete manner as in preceding years. The volume, as customary, has a frontispiece, an engraved steel portrait of the past president. This is especially worthy of favorable mention as the likeness of Mr. Watson is excellent. Included in the volume are also the constitution and by-laws of the Association and the list of members with their offices.

Les Chemins de Fer et les Tramways, by Adolph Schoeller, published by J. B. Baillière et Fils, Paris. 362 pages.

The first fourteen chapters of this volume, which forms a part of a series called the "Contemporary Scientific Library," issued by the same publishers, are devoted to steam trunk lines, their appliances, etc., the last five being respectively on elevated and underground steam railways, inclined plane railways, dummy lines, other surface street railways and the South London Electric Railway. These chapters, though very brief, show that Mr. Schoeller is conversant with the great advances made in this country in street railways, especially in electric railway practice, as well as with the details of recent European installations. The book is popular in character and is illustrated by a number of engravings.

Catalogue and Price List for 1892 of Presses, Drop Hammers, Shears, Dies and Special Machinery. Published by E. W. Bliss Co., Ltd., Brooklyn, N. Y.

That the manufacturing business carried on by this company is extensive will be readily believed by a glance at this catalogue. It contains views of punching, shearing, embossing and other varieties of presses, lathes, drop hammers, screw and milling machines; in fact, all the apparatus required for sheet metal working, besides many other machines for metal work as well as other articles such as fire boxes, soldering coppers, etc. The company was established in 1867, and besides their own extensive plant and business acquired in 1890, those of the Silas & Parker Press Co. of Middletown, Conn. At the end of the catalogue, which contains 392 pages and is bound in cloth, are contained a number of valuable tables of wire gauges, decimal equivalents of common fractions, etc., besides a complete table of contents

Rules for Exhibitors at the World's Columbian Exposition.

As our readers probably know, everything relating to street railways, surface, underground and elevated, at the World's Columbian Fair at Chicago, comes under the department of transportation exhibits, with the single exception of electric motors which must be shown in the department of electricity. Cars and other supplies for electric roads belong to the transportation department—a provision which may seem to be arbitrary, but which was found to be necessary. Street car and other short line systems form group 81 of Department G, which is divided into four classes as follows:

Class 504. Cable roads and cars. Construction, equipment, methods of operation. Grips and other appliances.

Class 505. Electric railway cars. Systems of track construction, equipment and supplies for electric roads, methods of operation, appliances and furnishings.

Class 506. Cars for street railways or tramways operated by horse power or other means of propulsion not specified. Construction. Equipment and supplies. Methods of operation.

Class 507. Elevated and underground railways. Plans, models and maps, showing systems of construction. Systems of operation and maintenance.

The following information for exhibitors is taken from the official circular of the chief of transportation department and will doubtless prove of interest.

SPACE.—Blank applications for space and copies of the rules and regulations of the Exposition may be had by writing to or calling at the office of the director-general and application should be made before July 1, 1892 There is no charge for space.

POWER.—A limited amount of electric power (or compressed air) will be furnished free of charge. Steam will be furnished for testing car heating systems and similar purposes—but not as motive power. As no shafting will be erected in the building, power must be taken direct, and the exhibitor must furnish his own motors.

TRANSPORTATION RATES.—The principal railway and steamship lines of the United States have agreed to charge the regular full rate on all exhibits going to the Exposition, but to return the same, if unsold, free of charge. Some lines have agreed to charge half rate each way.

AWARDS.—The following extract from the adopted report of the Committee on Awards of the World's Columbian Exposition fully explains the subject:

"The committee recommend that awards shall be granted upon specific points of excellence or advancement, formulated in words by a board of judges or examiners, who shall be competent experts; and the evidence of these awards shall be parchment certificates, accompanied by bronze medals.

"The awards of these boards of judges or examiners will thus constitute an enduring and historical record of development and progress as represented by the exhibits in question; the parchment certificate will, by sufficient terms of identification, evidence the award, and the bronze medal will serve to the exhibitor as an enduring memento of his success. These exhibits, which in the opinion of the juries and examiners do not possess sufficient excellence or intrinsic development to warrant awards, will simply be scheduled in the general catalogue of the Exposition. * * * * * * * It is recommended that there should be but one class or kind of medal; that they should be made of bronze; that they should be works of art and selected from competitive tests by the Committee on Fine Arts of the Commission, or the Joint Committees on Fine Arts of the Commission and the Local Directory, if they should seem more desirable. * * * * * The awards and the appointments of all judges and examiners for the Exposition, by the express terms of the sixth section of the act of Congress, approved April 25, 1890, fall within the exclusive jurisdiction of the Commission."

FOREIGN EXHIBITORS should in all cases apply to and deal with the commissions appointed by their own governments. In case no such government commission has been appointed, direct communication is invited by the chief of this department.

Equipment Notes.

The John Stephenson Co., Ltd., have received a number of large orders recently, and are shipping cars to many sections of the country.

Mr. James F. Shaw, formerly connected with the Newburyport Car Manufacturing Co., has opened an office for street railway supplies at 53 State Street, Boston, Mass., where he will be pleased to see his friends.

Reed & McKibbin, of New York, include among their recent orders that for the electrical equipment of an extension to the Easton, (Pa.) electric railway. They are also at work on the electrical construction for a railway at Fall River and for one at Camden, N. J.

The Newburyport Car Manufacturing Co., of Newburyport, Mass., have recently made shipments of cars to Fall River, Mass.; Allentown, Pa.; Brockton, Mass.; Providence, R. I.; Boston, Mass.; New Haven, Conn.; Norwich, Conn.; Pawtucket, R. I.; Salem, Mass., and other places, and have already taken orders for cars for the winter trade.

The Lewis & Fowler Manufacturing Co. of Brooklyn, are taking care of a large number of orders, and the many departments of their works are very busy in turning out cars, registers, trimmings, and other street railway supplies manufactured by them. They tell us that in spite of their many orders, they have been delivering goods at the times promised. Their orders are from many sections of the country.

Robert A. Keasbey, 58 Warren Street, New York, well known through his magnesia sectional coverings for steam pipes, boilers and all heated surfaces, has issued a June circular, which is very interesting, and which he will be pleased to send to any steam user upon application The circular contains mention of a number of reductions in prices in the articles sold by Mr. Keasbey. This gentleman writes us that his business during the last spring has been very satisfactory and that he has filled many orders for his magnesia coverings.

The R. D. Nuttall Co. of Allegheny, Pa., write us that they find business very good, and have received many orders this spring for their electric railway supplies. They have recently made a contract with the Brush Electric Co. by which they have secured the gear plant of the latter company and will supply all the gears which will be used by the Brush company on the new equipments manufactured by them during the next six months. These gears will be of steel. The R. D. Nuttall Co. have in view the construction of a new factory at an early date. They at present employ 125 men in their works, the greater part of whom are kept busy night and day.

John H. Graham & Co. of New York, agents for the New Departure Bell Co. of Bristol, Conn., are meeting with a large success in the sale of their rotary bell for street cars. Among other orders which they have recently received are some from the Paterson Railway Co. for the equipment of all the cars on that line; from the Columbus, O., Consolidated Street Railway Co. for about forty bells; from the Wilkesbarre & West Side Street Railway, fifteen bells; and from the Omaha Street Railway Co. They have also recently supplied the John Stephenson Co., Ltd., with a considerable number of their bells for some new cars which the latter company are building.

S. A. Day, of New York, has sent out the following circular, signed by W. R. Brixey, the recently appointed manager: "Having undertaken the general management of the long established business of S. A. Day (successor to A. G. Day), manufacturer of the celebrated Kerite insulated wires and cables, I am prepared, after an experience of thirteen years in superintending and improving their manufacture, to supply materials of the highest standard attainable. My personal close study and contact with the practical part of this business will ena ble me to meet the wants of customers in every detail, and I bespeak a continuance of favors so generously accorded in the past.

The Lewis & Fowler Girder Rail Co. of Brooklyn, are crowded with orders, and the company have recently been obliged to install some extra machinery for special work. In order to insure the delivery of goods under contract, the company were recently obliged to refuse a few orders for special work; but they advise us that by the installation of the machinery already mentioned they are now able to take care of all orders which may be sent them in the future. They tell us, that besides the companies which have installed their rails and have sent in additional orders, they have a large number of companies on their books who are about to instal the rail for the first time.

The Field Engineering Co., of New York, who are one of the largest company of constructing engineers in the country, and who make a specialty of the complete equipment of large roads, report that they are doing this year the largest business they have ever done. They have recently increased their capital stock to $50,000, and have also made several changes in their management. Mr. J. R. Craven has taken the position of secretary of the company, other officers remaining the same, this being really an addition to their force. Mr. E. J. Cook, their constructing engineer, is in charge of their engine business. They are making a specialty of the compound and triple expansion engines for large power station work, manufactured by the Lake Erie Engineering Works, at Buffalo, N. Y.

G. F. Whitney, of Boston, manufactures a soap which is widely known among railroad men as one of the best for cleaning cars. His liquid soap for wheels and axles removes the dirt and oil without injury to the paint and for repainting it leaves the work dry and perfect. His painters' white soap is intended for inside work, and is giving the best of satisfaction among a large number of roads. His amber soap is intended for cleaning the varnished surfaces, which will not be effected by it, and he claims can be washed and made ready in quicker time than with any other cleanser. Those who have not received his circular should send for it at once as it contains an offer that is worth trying, in the line of a paper weight clock, which is both handy and useful. His office and factory are at Long Wharf, Boston, Mass.

J. G. White & Co., of New York, are engaged on construction work for nearly a dozen prominent street railway companies in different sections of the country who are installing electric plants. Among the contracts for electric equipment, which this firm have closed since our last issue, are the following: for the equipment of the Lake Roland Elevated Railway of Baltimore, Md., of which about sixteen miles will be new track laid with the Duplex Street Railway Track Co's. system; for the electric equipment of seven miles of track for the Union Passenger Railway Co. of Baltimore, and for the reconstruction of the Newport, (R. I.) electric railway. At this latter city a new station will be erected for the Newport Illuminating Co., from which direct and alternating current incandescent lamps, arc lamps, stationary electric motors and electric railway cars will be all supplied with current involving an extensive distributing service.

The Ball Engine Co., of Erie, Pa., send us the following among their recent shipments: Santa Cruz Electric Light & Power Co., Santa Cruz, Cal., one 200 H. P. tandem engine; Risdon Iron Works, San Francisco, Cal., one 200 H. P. cross compound, two 200 H. P. tandem compound, one 35 H P. simple engine, one 50 H. P. simple engine; one 60 H. P. simple engine; Sandusky Electric Light Co., Sandusky, O., two 130 H. P. simple engines, one 100 H. P. simple engine; Portland Railway Co., Portland, Me., one 250 H. P. simple engine; East Liverpool Western Electric Co., East Liverpool, O., one 200 H. P. simple engine; Electric Light Co., St. Peter, Minn., one 100 H. P. tandem compound; Fremont Electric Light & Power Co., Fremont, Colo., one 80 H. P. simple engine and steam plant complete; Johnson Co., Johnstown, Pa., two 300 H. P. simple engines; one 200 H. P. simple engine, one 100 H. P. simple engine; Jackson Gas Light Co., Jackson, Miss., one 100 H. P. simple engine and steam plant complete.

The Corliss Steam Engine Co., of Providence, R. I., have received an order for two tandem, compound, condensing engines, each rated at 650 H. P., from the Lake Roland Elevated Railway Co. of Baltimore. The diameter of the cylinders is 20 × 36 ins, and the stroke five feet. The Pennsylvania Iron Works Co. have given them an order for an eighty-four inch Corliss patent vertical, tubular, water leg boiler; three of the Corliss eighty-four inch boilers have been ordered for the Havemeyer Building, Smith & Co., contractors, New York, and six eighty-four inch boilers are being constructed for the Lake Roland Elevated Railway Co. of Baltimore. Last month a 22 in. and a 40 × 60 in. engine and six eighty-four inch boilers were sent to the Jarvis-Conklin Mortgage Trust Co. of Kansas City. The 28 in. and 72 × 72 in. cross compound engine, with a 120,000 lb. wheel, were shipped to the Benedict & Burnham Manufacturing Co., of Waterbury, Conn. This flywheel was one of the heaviest ever cast in this country.

The J. G. Brill Co., of Philadelphia have been doing an active business in the West. They have recently taken the contract for thirty cars and trucks for the Fort Wayne & Belle Isle road, on which the Thomson-Houston system will be used. The road will be in operation about September 1. The company are also filling the contract for 180 cars, taken by Mr. Andrews for the Chicago City Railway Co.; the cars are to be used on the State Street and Cottage Grove Avenue lines. The open cars are being received at the present time, and the closed cars will be delivered September 1. As the Chicago City Railway Co. have not purchased cars for many years, but have built all their own cars, the award of the contract was a feather in Mr. Andrews' cap. J. F. Peavey, president of the Sioux City Street Railway Co., was recently in Chicago and placed with them an order for a number of the latest type of Brill trucks. The Chicago office of the J. G. Brill Co. has been moved from 225 to 309 Phenix Building.

The Berlin Iron Bridge Co., of East Berlin, Conn., have received the contract from Samuel F. Hodge & Co., of Detroit, Mich., for the construction of their new foundry. It is claimed that this will be the most perfect and best appointed foundry in the Northwest. The general dimensions of the building are 86 × 161 ft. On each side there is a wing twenty-three feet in width. The centre of the building is controlled by a traveling crane with a travel the full length of the building. The wings of the building are controlled by jib cranes, so that when completed every inch of the building will be controlled by power, either from the traveling crane or from jib cranes. The construction will be entirely of brick and iron. The are also building a new machine shop for the Solvay Process Co., at Syracuse, N. Y. The building will be fifty feet wide by 300 ft. long and three stories high. The side walls will be of iron and brick (combination construction) with iron floors and iron roof covered with the Berlin company's patent anti-condensation roofing.

The Reliable Manufacturing Co., of Boston, have recently received an order from the Lowell & Suburban Street Railway Co., of Lowell, Mass., to equip their entire line of new cars with the Collett ratchet brake handle. Sixty-five sets were shipped during June, and the rest will be sent forward as soon as the cars are ready. The manufacturing company have been busy the past month filling orders for the Reliable Collett ratchet brake which is giving good satisfaction and seems to be growing more popular every day. Among the companies to which the brake handles have been shipped during June are the Merrimac Valley Horse Railroad Co., Lawrence, Mass.; Briggs Carriage Co., Amesbury, Mass.; Portland Street Railroad Co., Portland, Me.; New Haven & West Haven Horse Railroad Co., West Haven, Conn.; Gloucester Street Railway Co., Gloucester, Mass.; Steinway Railway Co., Steinway, N. Y.; Lowell & Suburban Street Railway Co., Lowell, Mass.; Newburyport Car Manufacturing Co., Newburyport, Mass.; Black Rocks & Salisbury Beach Street Railway Co., Newburyport, Mass; Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Co., New York City; Boston & Revere Street Railway Co., Boston, Mass.; Allentown & Bethlehem Rapid Transit Co., Allentown, Pa. The company are now manufacturing a track switch to be operated from the platform of electric cars, they are about ready to be put upon the market. It is claimed to be just what is wanted.

The Lamokin Car Works of Philadelphia, have closed a large number of orders recently, among which are the following: With the Williamsport, Pa., Passenger Railway Co., two eight seat open motor car bodies, two sixteen foot closed, palace, mahogany finish, vestibule car bodies were delivered to this road this month, being the fifth order from this company; the York Street Railway Co., York, Pa., four sixteen foot closed car bodies; the Citizens' Passenger Railway Co., Harrisburg, Pa., four eighteen foot, palace, vestibule cars, complete with Robinson motor truck of Altoona. These cars are to be a duplicate of the Milwaukee palace car and will have Cochran's patent observation window in vestibule; Rome, Street Railway Co., Ga., one sixteen foot closed car body, and one eight seat open car body; the Bristol, Tenn., Belt Line Railway, two sixteen feet closed car bodies, mounted upon Robinson motor trucks of Altoona, Pa., Edison motors. Among their recent deliveries the Lamokin Car Works number the Akron, O., Street Railway Co., five nine seat, closed end, open car bodies, and the Zanesville, O., Street Railway Co., four nine seat, open, closed end car bodies. The increasing inquiries and orders for the cars manufactured by the Lamokin Car Works speaks well for the great improvements which they have made in the method of construction. All their closed car bodies now bear upon the corners, at guard rail their trade mark, "Patented March 8, 1892," this referring to the steel corner tie plate.

W. R. Fleming & Co, new *Mail and Express* Building, New York City, agents for the Harrisburg Foundry Machine Works, have handed us a list of a recent contracts for furnishing Ide and Ideal engines. These sales, of course, represent only a comparatively small proportion of the United States, and as the other agents of the Harrisburg Foundry & Machine Works, as well as the factory themselves have also been shipping a large number of engines, it is safe to infer that the engine is growing rapidly in favor. The list of the last few weeks' business done by W. R. Fleming & Co. alone equals over 2,500 H. P., and includes the following shipments: One 70 H. P. standard Ideal engine, one 150 steel horizontal tubular boiler, Edison Electric Light Co., No. Plainfield, N. J.; three 100 H. P. standard Ide engines, Pope Manufacturing Co., Hartford, Conn.; one 55 H. P. standard Ideal engine, Wild & Williams, New York City, N. Y.; two 225 H. P.

standard Ideal engines, Clarion Mills, Pa.; one 30 H. P. standard Ideal engine, one 50 H. P. standard Ideal engine, Naval Observatory, Washington, D. C.; one 12 H. P. standard Ide engine, Whitlock Coil Pipe Co., Elmwood, Conn.; one 55 H. P. standard Ideal engine, one 60 H. P. standard Ideal engine, Century Club, New York City, N. Y.; one 150 H. P. special railway Ideal engine, one 50 H. P. special railway Ideal engine, one 55 H. P. standard Ideal engine, Chillicothe Street Railroad & Lighting Co., Chillicothe, O.; two 60 H. P. standard Ideal engines, Hotel St. Lorenz, New York, N. Y.; five 25 H. P. standard Ideal engines, Pacific Mail Steamship Co., New York City, N. Y.

The Pierce & Miller Engineering Co., is the name of a new company having headquarters at 42 Cortlandt Street, New York, and organized to succeed to the business of the well known firm of Pierce & Thomas. The new company have issued the following notice: "The firm of Pierce & Thomas having gone out of business, and F. M. Pierce having purchased the interest of R. H. Thomas, their successor, the Pierce & Miller Engineering Co., will continue business at the old stand, 42 Cortlandt Street, New York City. F. M. Pierce, the president of the company, has associated with himself the valuable men in the old firm, i. e., John D. Miller, vice-president, formerly special partner in the firm of Pierce & Thomas, and for many years associated with Mr. Pierce in the management of the Ingersoll Rock Drill Co., of New York, and Kennedy & Pierce Machinery Co., of Denver, Colo.; F. Schmerber, chief engineer, also with the old firm, and with Mr. Pierce as designing and constructing engineer of the Ingersoll Rock Drill Co.; W. B. Hadley, electrical engineer, formerly superintendent of installation department of the Edison Electric Illuminating Co., New York.; W. H. Stalnaker, secretary and treasurer, formerly treasurer of the Valentine Varnish Co., New York. This new company will continue as the general sales agents of McIntosh & Seymour automatic engines; Porter Manufacturing Co., engines and boilers; T. M. Nagle and the Pennsylvania Boiler Works, engines and boilers; Young-Brennan Crusher Co., rock and ore crushers. They will also go more extensively into the business of engineering and contracting for complete steam plants for electric railway lighting and manufacturing purposes, also for mining machinery and the construction of plants for the equipping of mines and for the concentration and milling of ores, and in all work the new company will adhere closely to the policy adopted by Pierce & Thomas, i. e., of furnishing first class machinery specially adapted to the work it has to perform, and first class engineering and construction work, where contracts are to be executed, having in view first the economical and convenient operation of the plant, in line with the best engineering practice." The company have established a branch at 543 Drexel Building, Philadelphia, in charge of G. S. Jones, manager. They are now employed installing many steam plants for electric railways, among which are the following: 2,000 H. P. for the Globe Street Railway Co., of Fall River, Mass.; 500 H. P. for the Rock Creek Railway Co., Washington, D. C.; 800 H. P. for the Merrimac Valley Street Railway of Lawrence, Mass.; and 600 H. P. for the Rochester Railway Co., Rochester, N. Y.

WESTERN NOTES.

The Emerson Electric Manufacturing Co., of St. Louis, report an active business at the present time.

The Stirling Boiler Co., 612 Pullman Building, Chicago, have been doing an excellent business of late.

Hoffman & Billings, of Milwaukee, have sold a 24 × 48 in. Corliss engine to the Suburban Railway Co. at Portland, Ore.

The Broderick & Bascom Rope Co., of St. Louis, recently received an order for the rope for the Washington & Georgetown road of Washington, D. C.

The Electric Appliance Co., of 242 Madison Street, Chicago, are now carrying the goods of the Mica Asbetile Co. and will represent that company in the west.

The Falls Rivet & Machine Co. of Cuyahoga Falls, O., have established an office in New York City at 18 Cortlandt St., where they are represented by Mr. J. H. Long.

Wm. H. Bryan, M. E., late general superintendent of the Pond Engineering Co., has opened an office in the Turner Building, St. Louis, as consulting mechanical and electrical engineer.

The Economic Railway Equipment Co., have been organized at Chicago. The capital stock is $500,000, and the incorporators are Webster P. Moore, J. D. McIlwain and Elmer E. Kaufman.

The Cushion Car Wheel Co. has recently sold wheel equipments to several electric railways. Among the number are the Calumet Railway at Chicago and the Blue Island Electric Railway.

L. K. Hirsch, 549 Rookery, recently purchased 10,000 tons of rails suitable for street railway purposes, and is quoting favorable prices. Mr. Hirsch reports a large business in second hand railway material.

The E. P. Allis Co., of Milwaukee, have received the contract for two engines for the East Liverpool & Wellsville (O.) railway. Two Allis engines are already operating successfully in the power station of the railway.

The Standard Railway Supply Co., of the Monadnock Building, Chicago, Garson Myers, manager, are doing a large business in steel gongs. Orders are received from all parts of the country, and the bells are giving entire satisfaction.

The Lane & Bodley Co., of Cincinnati, will supply the complete power plant, including three 300 H. P. compound condensing engines, water tube boilers, pumps, shaftings, etc., for the New Orleans & Carrollton company's new electrical equipment.

Ramsay & Kenyon, of St. Paul, agents for the Belleville Steel Co. and Tudor Iron Works, have furnished all track material for four miles of street railway for the Gallatin Light, Power & Railway Co. of Bozeman, Mont. The track will be laid with thirty-five pound steel rail with angle joints.

Dorner & Dutton, of Cleveland, O., write us that their appliances are meeting with a large demand, and that they have received a large number of orders for their solid forged iron motor trucks. Their department is now crowded with orders, over 100 orders having been received during May and June.

The Enterprise Electric Co. have recently been organized in Chicago, with headquarters at 313 and 315 Dearborn Street. The president of the company is M. C. McKinlock. The company will handle electrical supplies of all kinds. They are local agents for Day's Kerite wire, western electric weatherproof wire.

Kohler Bros., Chicago, representatives of the Eddy Electric Motor Co. report an active demand for the company's products. G. A. E. Kohler has recently returned from a trip to the East. He visited the factory at Windsor, Conn., and states that the work on the new building is progressing so satisfactorily that he hopes that the company can soon make motors rapidly enough to supply the demand.

The American Car Co., of St. Louis, are working to their full capacity. Among the orders now on their books are ten cable trail cars for the Missouri Railroad Co., St. Louis; electric cars for the Cicero & Proviso Electric Railway, Chicago; Central Railway, Peoria, Ill.; Milwaukee Street Railway, Milwaukee, Wis., and thirty open motor cars for the Omaha Street Railway, Omaha, Neb. The company are busy shipping 150 open cars to the North and West Chicago street railroads.

The St. Louis Car Co. are prepared to do quick work, and the local railway companies are ready to take advantage of the fact when necessary. On the night of June 14, the car house of the St. Louis & Suburban Railway Co., at De Hodiamont, burned to the ground, and all the cars enclosed in the structure were completely destroyed. As soon as all hope of saving the cars was abandoned, Mr. Charles H. Turner, president of the company, gave an order for forty motor cars with double trucks to the St. Louis Car Co. An order for the electric motors was telegraphed the same night to the Thomson-Houston Electric Co., with instructions that they be sent at once.

Arthur S. Partridge, who has had many years experience in the manufacture of street cars, and with a prominent street railway supply house, has established himself in the latter business with headquarters in the Bank of Commerce Building, St. Louis. He represents many of the best known manufacturers in the country, and is prepared to furnish promptly and at bottom prices, every article used in the construction and operation of electric and horse railways. His experience and established business character, together with the high class of material produced by the parties whom he represents, will insure thorough satisfaction to parties who favor him with their patronage.

The Shultz Belting Co., of St. Louis, have sent us a copy of a recent letter received by them from Mr. Charles H. Turner, president of the St. Louis & Suburban Railway Co., St. Louis, Mo., in which he says: "In answer to your inquiry, will say we are running two of your seventy-two inch main driving belts, each 154 ft. long; two thirty-four inch and ten sixteen inch generator belts, all heavy, double, and we are happy to state that we have never been stopped or delayed one moment on account of the belts. They are giving us entire satisfaction, running noiseless, straight, smooth and driving full power. The seventy-two inch developing from 200 to 300 H. P. more than your guarantee; in fact, we believe that we have as good, if not the best belted power station in this country."

The St. Louis Car Co., of St. Louis, are at present very busy, and the majority of their orders are for electric cars. The company now have orders on their books for over 400 cars. Among the street railways represented are the Atlantic Avenue railroad, of Brooklyn fifty eighteen foot cars; sixty for the Union Railway, New York; thirty twenty-eight foot cars for the St. Louis & Suburban Railway, St. Louis; fifty for New Orleans; thirty for Trenton, N. J.; twenty-five for Louisville, Ky.; thirty for Evansville, Ind.; thirty for Wilkesbarre, Pa.; twenty for Galveston, Tex.; twenty for Savannah, Ga.; twenty grip cars for the Mt. Auburn Cable Railway, Cincinnati, O.; ten motor cars for Calumet, Mich.; ten for the Southern Railway, St. Louis, Mo.; twenty for the City of Mexico and Pueblo; also minor orders for West Superior, Mich.; Sioux City, Ia., Asbury Park, N. J.; Anderson, Ind.; Marinette, Wis.; Cedar Rapids, Ia., and a large number of smaller orders. The car company have just completed a new paint shop 210 × 200 ft., capable of accommodating 100 cars. On the streets in the immediate vicinity of the works tracks are to be laid and overhead wires strung, so as to try every new car turned out of the shops before it is shipped. Cars can thus be propelled to the railroad tracks for shipment.

The Railway Equipment Co., of Chicago, report business as rushing in all departments. They have added largely to the established business of the Electric Merchandise Co., whose business they purchased some few weeks since. Owing to the fact of the standard appliances of this company having such an established reputation, a very large number of late contracts for equipment have been made with the understanding that such appliances will be used. The company report a largely increased business over the last season, but having increased their manufacturing facilities, they are able to guarantee immediate shipments. The managers of the company having devoted their entire time and attention to "electric railway supplies only" for several years, are prepared to furnish reliable and complete information to parties about to equip electric street roads. Such inquiries are

given the most careful attention, are answered fully and without charge. The company number among the recent orders they have received for appliances, two from the street railway companies of Evansville, Ind., and New Haven, Conn. They have also secured the contract for the appliances to be used on the North Baltimore Railroad, Baltimore, Md. The company have opened a New England office at 116 Bedford Street, Boston, which will be in charge of Mr. Charles E. Rowe. They have also opened a New York office in charge of Mr F. L Perine at 77 Cortlandt Street. They report for the last week orders for the complete equipment of roads in New Haven, Conn.; Brooklyn. N. Y.; Baltimore, Md.; Evansville, Ind.; Chillicothe, O.; Pittsburgh, Pa.; Hamilton, Can.; Augusta, Ga.; Kokomo, Ind., and Put-in-Bay, O. They have also made during the same time large sales for extensions of present roads. The business of this company is constantly increasing. The standard material of their manufacture is known to be reliable, and their facilities for promptly filling orders are exceptionally good. This company will be located after July 1 in their new quarters, Pullman Building, Michigan Avenue. The company will have excellent facilities for transacting business, in a most advantageous location and in one of the best buildings in Chicago. The offices will be handsomely fitted up, and the company will be in good shape to handle the business in railway supplies, which is increasing rapidly.

Robinson Radial Truck and the West End Railway Co.

We are informed on good authority that the West End Railway Co. of Boston have recently made application to the Robinson Electric Truck & Supply Co. for a license to build, at their own shops, the Robinson radial truck for more extended use on the lines of the West End Railway.

It is well known that for more than two years the West End Railway Co. have been making a thorough test of the Robinson radial truck, as well as of nearly every other truck in the market, having more than fifty of the Robinson radials in daily use during that time.

A part of the proposition made by the West End company to the Robinson company, embodies the immediate addition of 130 more of the long radial cars to the West End equipment, and the use of the radial truck under all long cars which the West End company may build hereafter, and to pay the Robinson company an agreed upon royalty for every radial truck built by the West End company.

It is not stated whether the Robinson company have decided to accept or decline the West End's proposition. The Robinson company, however, have heretofore generally insisted on building the radial truck exclusively under their own auspices.

The Robinson radial truck could not have a higher endorsement than the one implied by the above proposition of the West End company, made after such an exhaustive test of the Robinson radial in comparison with other trucks.

New Quarters of the Railway Equipment Co.

After much trying delay, the Railway Equipment Co., of Chicago, are ready to welcome their patrons to their elegant quarters in the Pullman Building. The rooms have been in the hands of the decorator and finisher for several weeks, and everything possible has been done to make them beautiful and comfortable. The offices front upon Michigan Avenue and are on the ground floor. To the immediate left of the entrance is what might be called the visitors' parlor—a space enclosed by a neat railing and containing table and chairs for the comfort and convenience of callers. This office fronting on Michigan Avenue makes a pleasant waiting room for visitors. The general manager's office is also in front and just back of the visitors' parlor and is well lighted and ventilated by one of the large avenue windows.

To the rear of the general manager's office is that of the secretary and treasurer, agreeably accessible to customers. Next in order upon the right is the bookkeeping department, with the necessary desks and files. Enclosed by the bookkeeping department is a neat space for the use of the stenographers. The purchasing agent occupies the rear of the main office on the left, where he is conveniently near the store rooms and shipping department. A youthful usher at a desk to the right of the doorway is at your service upon your entrance. The same side of the office furnishes enclosed desk room for the salesmen, and also a space for a large show board, where is exhibited all the various pieces used in electric railway construction. If one desires to see quantity rather than to examine the quality of the company's wares, a door at the farther end of the offices admits him to a store room where bins and shelves, filled with the many devices handled by the house, line the walls. Much of the more bulky material is kept in the spacious store rooms in the basement. The rooms are well lighted by electricity throughout, and will make a delightful home for the new company. Moving into such commodious and pleasant quarters is the natural outcome of the growth of the company's business, and a witness of their popularity with the trade.

Three years ago, under another name, but with the same general manager in charge, the company started in a unique business, the handling of electric railway supplies exclusively, and since then have done an ever increasing business. Less than a year ago their quarters were found insufficient, and were doubled; again it became necessary to better the facilities. Irrespective of the pushing qualities of the company, their prosperity is undoubtedly largely due to their honest intention to furnish the best possible quality of material to purchasers.

All friends of the Railway Equipment Co., and of the general manager, Mr. W. R. Mason, will extend congratulations upon the appearance of their new home and bright prospects.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, MAY 24, 1892, TO JUNE 21, 1892, INCLUSIVE.

MAY 24.

Advertising Card Rack, Delavan S. Foote, Chicago, Ill. 475,726
Cable Grip, George F. Elliott, U. S. Navy 475,684
Chair for Railway Rails, Maynard E. Clemons, Attleboro, Mass. 475 539
Electric Locomotive, Thomas A. Edison, Llewellyn Park, N. J. 475,491
Electric Locomotive, Thomas A. Edison, Llewellyn Park N. J. 475,492
Electric Locomotive, Thomas A Edison, Llewellyn Park, N. J. 475,493
Electric Motor Car, William H. Patton, Chicago, Ill. 475,702
Electric Railway, Thomas A Edison, Llewellyn Park, N. J. 475,494
Signal for Street Cars, Charles H. Smith, Lansingburgh, N. Y. 475,474
Switch for Overhead Wires, Alphonzo O. Hoyt and Paul W. Leffler, Minneapolis, Minn. 475,504
Switch for Street Railways, Russell H. Snively, Louisville, Ky. 475,475
Traction Engine, Julius J. D. McNamar, Newark, O. 475,597
Trolley for Electric Railways, John W. Newhouse, Indianapolis, Ind. 475,467

MAY 31.

Cable Grip, Julius Schirra, Pittsburgh, Pa. 475,896
Car Axle, David M. Miller, Fairfield, Cal. 475.965
Conduit for Electric Railways, Walter F. Carr and Charles F. Ferrin, Minneapolis, Minn. 476,128
Device for Automatically Operating Power Car Brakes, Brenton C. Rowell, Boston, Mass. 475 893
Electric Railway Motor, Jabez F. Shawhan, Detroit, Mich. 475,970
Grip Mechanism for Duplex Cables, Andrew Bryson, Jr., New York, N. Y., John H. Pendleton and Alfred R. Benn, Brooklyn, N. Y. 475.846
Hanger for Electric Railway Wires, Charles B. Elliott, Boston, Mass. 476,192
Rail for Railways, John T. O'Shea, Cleveland, O. 476,165
Safety Attachment for Railway Trolleys, Melvin A. Yeakley, Cleveland, O. 476,028
Swivel Pull-off for Overhead Wires, Charles B. Elliott, Boston, Mass. 476,193

JUNE 7.

Brush Holder for Dynamo-Electric Machines and Motors, Frank B. Daggett, St. Joseph, Mo. 476,368
Car Step, Frank H. Stanwood, Chicago, Ill. 476,323
Car Truck, Frederick A. Baier, St. Louis, Mo. 476 596
Conduit for Electric Railways, William Bradley, Fort Wayne, Ind. 476,603
Electric Locomotive, Thomas E. Adams, Cleveland, Ohio 476 437
Elevated Railroad, Eliphalet L. Arnold, Georgetown, Tex. 476,720
Equalizing Device for Car Trucks, John A. Brill, and Walter S. Adams. 476,244
Fare Register, Joseph H. Greenleaf, New Haven, Conn. 476,741
Frictional Gearing for Street Cars, George B. Brayton, Chicago, Ill. 476,243
Motor Truck for Cars, William A. McGuire and Moses G. Hubbard, Jr., Chicago, Ill. 476,480
Rail Joint, John N. Lewis, Coulee City, Wash. 476,753
Railway Rail Joint, Gustave Bouscaren, Cincinnati, O. 476,241
Station Indicator, Rudolf G. Hourtney, Chicago, Ill. 476,537
Tramway Switch, John R. Wiggington, Washington, D. C. 476,713
Trolley Support, Spencer C. Crane, Philadelphia, Pa. 476,367

JUNE 14.

Anti-Friction Bearing for Car Axles, Henry B. Williams, Rochester, N.Y., 477,037
Car Heater, William C. Baker, New York, N.Y. 476,973
Conductor for Elevated Railways Thomas A. Edison, Llewellyn Park, N. J. 476,989
Electric Locomotive, Thomas A. Edison, Llewellyn Park, N. J. 476,987
Electric Railway, Richard W. Barkley, Brooklyn, N. Y. 476,776
Elevated Railway, Adolphus Davis, London, England 476,982
Electric Railway, Charles P. Tatro, Spokane, Wash. 476,935
Heating Apparatus for Cars or Buildings, William C. Baker, New York, 476,972
Means for Propelling Electric Cars, Thomas A. Edison, Llewellyn Park, N. J. 476,986
Pole for Electric Wires, Julius Meyer, New York, and Carl Binder, Chicago, Ill. 476,889
Rail Cleaning Attachment for Cars, Palmer Wardman, East Saginaw, Mich. 476.909
Railway Spike, John M. Fennerty, Washington, D. D. 477,171
Street Railway Switch, Martin A. Cutter, Allegheney, Pa. 477,046
Trolley for Electric Railways, Thomis A. Edison, Llewlleyn Park, N. J. 476,985

JUNE 21.

Car Wheel, William Halles, Albany, N. Y. 477,539
Chilled Cast Iron Car Wheel, Luther R. Faught, Philadelphia, Pa. 477,324
Feed Regulator, William Gribben and Joseph M. Galgh, Crosswell, Mich. 477 327
Feed Water Heater, Joseph Bell, Troutdale, Ore. 477,491
Fender for Street Cars, Bartholomew Sullivan, Boston, Mass. 477,467
Heating Apparatus for Cars, James H. Sewall, Chicago, Ill. 477,464
Journal Box, Edward Jones and Chalkley Dawson, Bellaire, and Henry Stanton, Flushing, O. 477,329
Mechanism for Propelling Cars, Elmer E. Miller, Canton, O. 477,260
Motor Tram Car, James M. O'Kelly, New York 477,444
Rheostat, George K. Cummings, Chicago, Ill. 477,247

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, June 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co	50	1,250 000	Q.—J.	1½	.....	109	.....
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	240	.....
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	187	190
Coney Island & Brooklyn R. R. Co	100	500,000	.....	...	.....	140	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.	.....	140,500	M & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	104
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	500 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	101	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	107	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	103	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	108	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	113	115
Watervliet Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort.	1865	40 000	J. & J.	5	1905	103	.....
" " " 2d Mort.	1873	20,000	M. & N.	7	1893	102	.....
" " " 3d Mort.	1875	28,500	J. & J.	7	1895	105	.....
" " " 4th Mort.	1880	11,500	M. & S.	6	1905	105	.....
" " " 5th Mort.	1888	50,000	M. & S.	5	1913	105	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	104	.....
" " " Debenture.	1891	200,000	M. & N.	6	1901	109½	111
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	112½	115¼
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	108	109½

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, June 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue	100	2,100,000	Q.—J.	2	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1	.....	125	130
Christopher & Tenth	100	650,000	F. & A.	1¾	.....	134	135
Central Crosstown	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery	100	1,200,000	Q.—F.	2	.....	112	116
42d & Grand St. Ferry	100	748,000	Q.—F.	3	.....	250	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	49	52
Eighth Avenue	100	1,600,000	Q.—J.	2	.....	240	.....
Houston, W. St. & Pav. Ferry. Leased to B'way & 7 ave	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue	100	1,862,000	J. & J.	5	.....	112	115
Sixth Avenue	100	1,500,000	M. & S.	3	.....	190	200
Third Avenue	100	2,000,000	M. & N.	6	.....	204	207
23d St	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue	100	800,000	.....	3	.....	128	133

Bonds.	Date of Issue	Amount.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry	.....	700,000	J. & J.	7	July, 1900	110	113
B'way & 7th Ave., 1st mort.	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.	.....	500,000	J. & J.	5	July. 1914	104	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	105	.....
Additional	.....	1,000,000	J. & J.	5	July, 1905	95	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	116	120
Christopher & Tenth	.....	250,000	A. & O.	7	Oct., 1898	108	110
Central Crosstown	.....	250,000	M. & N.	6	Nov., 1922	115	117
Dry Dock, E. B'way & Battery. 1st mort.	.....	840,000	J. & D.	7	June, 1893	100	101
Scrip	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.	.....	1,200,000	J. & J.	6	1915	57	59
Eighth Ave., Scrip	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	100	107
Second Avenue	.....	1,600,000	M. & N.	5	Nov., 1909	103	105
Third Avenue	.....	5,000,000	J. & J.	5	Jan., 1937	112	114
23d St	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	87½	88
West End Com'n	50	9,085,000	J. & J.	5	1890–1892	74	74½

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, June 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co	100	$270,000	New.	...	Oct., 1887	92½	95
Union R. R Co., Prov	100	2,000,000	Q.—J.	2	1862–1863	200	210
Providence Cable Tramway	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co	100	$360,000	J. & J.	4	.....	245	250
Holyoke Street R. R.	100	200,000	J. & J.	4	.....	200	225
Northampton Street R. R.	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	3	.....	.....	55
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
*Carrollton R. R. Co	100	800.000	Quart.	1½	1867	128	135
Crescent City R. Co	100	1,150 000	"	1¾	.866	98½	99
Canal & Claiborne R. R. Co.	40	240,000	.....	...	1888	22	25
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1880	134¾	137
Orleans R. R. Co	50	185,000	"	2	1868	57	63
St. Charles Street R. R. Co	50	600,000	"	3	1866	93	94½

Bonds.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150.000	A & O	6	1887	102¾	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93–'99	....	.....
do do new	1886	40.000	M & N	6	1896	....	.....
N. O. City R. R. Co	1879	495,200	J & D	6	1903	122½	124
N. O. & Carrollton R. R. Co.	1882	300,000	F & A	6	'92–'06	117	.....
St. Charles Street R. R. Co	1881	165,000	J & D	6	'89–'01	.....	.....

* Bids on Carrollton R. R. are ex privilege of new stock.

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	35	.....
State Street Horse R. R. Co	25	23,000	J. & J.	3	.....	25	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	26	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co	1874	20,000	J. & J.	7	Jan., 1894	104	.....
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1899	100	.....
Bridgeport Horse R. R. Co	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R Co., Deb. Series C. (Not yet issued)	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, June 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	202	205
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Period.**	**%**	**Principal Due**	**Bid.**	**Ask'd**
Montreal St. Ry.	1885	£60,000	.....	5	1965	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref.	100	$1,000,000	A. & O.	5	Jan. 1891	85	86
Louisville St. Ry. Co., com.	100	5,000,000	.....	...	Jan. 1891	22	23
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	97	95
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	114	.....
Central Passenger Ry. Co.	1888	400,000	M. & N.	6	1908	114	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	397	.....
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	97	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	213	.....
West Division City	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	168	.....
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Chicago City	.....	4,619,500	J. & J.	4½	.....	98½	99
Chicago Passenger	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,640,000	M. & N.	4½	1927	95¾	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100⅝	.....
West Division Railway	.....	3,790,000	J. & J.	5	.....	101	.....
" " " Ext.	.....	250,000	J. & D.	6	.....	100	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101¼	101¾
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	95½	.....

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, June 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co	50	1,500,000	.....	..	.....	28	.....
Citizens' Traction R. R. Co	50	3,000,000	J. & J.	3	.....	62¾	63
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	26¾	27
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	.....	5-½
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	25⅝	26
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	44	.....
West End R. R. Co.	50	200,000	J. & J	...	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	J. & J.	3	.....	51	.....
Second Avenue R. R. Co.	50	300,000	.....	...	.....	28	28½
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	.....	...	.....	.....	.....
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Citizens' Traction R. R. Co	1887	1,250,000	A. & O	5	1927	109	.....
Pitts. & Birmingham Traction Co.	1889	1,500,000	M. & N.	5	1929	101¼	101⅝
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	107	.....
Pleasant Valley Ry.	1891	1,250,000	J. & J.	5	1919	.....	102
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	105	.....
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	102½	102¾
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.	1883	125,000	.....	6	1903	103½	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	.....	.....
Monongahela Incl'e Plane Co.	1887	50,600	A. & O	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH Broker, 440 California Street, San Francisco, Cal., June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co	100	1,000,000	Monthly	5	.....	.....	115
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	95	.....
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	50	75
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	.....	40
Omnibus Cable Co.	100	2,000,000	Monthly	4	.....	.....	59
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	25	26½
Bonds.	**Date of Issue**	**Am't Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	100¾	110
Market Street R. R.	.....	3,000,000	J. & J.	6	1913	122½	.....
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	113½	.....
Powell Street R. R.	.....	700,000	M. & S.	6	1912	110	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	114½	115
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	94	.....
Cal. St. Cable R. R.	.....	.....	.....	...	.....	104	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., June 18. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine	100	$324,000	Q.—J.	3	1864	125	150
Cass Ave. & Fair Grounds	50	300,000	.....	...	1876	45	46
Citizens'	100	1,500,000	A. & O.	1¼	1887	100	105
Jefferson Avenue	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	56	60
Missouri	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central	100	200,000	.....	...	1884	100	105
People's	50	1,000,000	M. & S.	6	1889	40	45
St. Louis	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal	50	150,000	Jan.	.50	1872	15	25
Union	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban	100	2,500,000	.....	...	1891	48	50
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Benton-Bellefontaine	1891	$500,000	F. & A.	6	1911	102	102½
Cass Avenue	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	106½	107½
Lindell	1890	1,500,000	J. & J.	5	1895-1910	99	100
Mound City	1890	525,000	A. & O.	6	1900-1910	105	106
Missouri Cable	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort	1882	125,000	J. & D.	6	1902	102	105
" 2d mort	1886	75,000	M. & N.	7	1902	104	105
People's Cable	1889	800,000	J. & J.	6	1889-1914	97	100
Northern Central	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union	1885	150,000	M. & N.	6	1895-1915	102	103
Union Depot	1890	1,600,000	A. & O.	6	1900-1910	105	10-

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'	50	$500,000	Q.—J.	4	1858	260	270
Continental	50	1,000,000	J.—J.	6	1873	125	126
Frankford & Southwark	50	1,250,000	Q.—J.	5	1854	210	212
Germantown	50	1,500,000	Q.—J.	2¼	1858	102	103
Green & Coates	50	500,000	Q.—J.	3	1858	120	121
Hestonville	50	2,050,000	.....	...	1859	33	35
Lombard & South	25	500,000	A.—O.	8	1861	55	60
People's Common	25	1,500,000	M.—S.	2½	1873	49	50
" Preferred	25	750,000	M.—S.	2½	.....	49	.....
Philadelphia City	50	1,000,000	J.—J.	3½	1859	150	151
Philadelphia & Gray's Ferry	50	617,500	J.—J.	3½	1858	65	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	84	85
Ridge Avenue	50	750,000	Q.—J.	5	1872	220	230
Second & Third	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	196	200
Union	50	1,250,000	J.—J.	9½	1864	182	185
West Philadelphia	50	750,000	J.—J.	10	1857	185	190
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	116	117
Baltimore Traction	25	5,000,000	.....	1	1889	22½	23
Buffalo (N. Y.) Railway	100	6,000,000	.....	...	.....	34	36
Newark (N. J.) Passenger	100	6,000,000	.....	...	.....	26	27
BONDS.	**Date of Issue**	**Amount Outstanding**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1,250,000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	106	107
Germantown, 1st mort.	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort.	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, June 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	110½	110¾
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	109¾	110¼
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	118	120
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	40
Cin. Inclined Plane Ry.	100	500,000	.....	...	.....	89	90
" " " Pref.	100	100,000	.....	6	.....	99½	100

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	102	.....
" "	.....	50,000	J. & J.	7	July, 1894	104	.....
" "	.....	50,000	J. & J.	7	July, 1895	.....	110
" "	.....	50,000	J. & J.	7	July, 1896	108	112
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	.....
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104½	105
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	116	.....
" " " "	.....	300,000	J. & J.	6	Jan. 1914	107	108
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	93	100
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	22	22⅛

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " cons. mort.	.....	1,500,000	.....	5	.....	93	100
Balto. Traction Co. (Cable)	1899	1,500,000	M. & N.	5	1929	110	110½
Balt. Trac Co., No. Balt Div	1892	1,750,000	J. & D	...	1942	106	106¼
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	110¾	111

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co, Bankers, 1344 F Street, N.W., Washington, D. C., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	305	335
Metropolitan R. R.	50	750,000	Q. J.	...	1864	90	105
Columbia R. R.	50	400,000	Q. M.	...	1870	60	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	38	42
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	36	41
Georgetown & Tenallytown	50	200,000	.....	...	.....	.....	95
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	103	105
do. do. convert.	'83–'91	3,000,000	J. & J.	6	1899-1929	149	150
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	100	.....
Capitol & North O St. R. R.	1891	240,000	J. & J.	5	1921	105	109
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	.....	120

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	36	37
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	38	40
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	.....	25
Newark (N. J.) Pass. Ry	100	6,000,000	.....	...	1890	28	29

BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	90	95
Buffalo (N Y) Ry.	1891	5,000 000	F & A	5	1931	94	97½
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	.....	100
Newark (N. J.) Pass. Ry	1890	6,000,000	J & J	5	1930	93½	94

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	170	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	86½	87⅜
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

Financial.

THE Lebanon (Pa.) & Annville Street Railway Co. will issue $100,000 of 4 per cent. bonds.

$ $ $

THE stockholders of the New Orleans & Carrollton Railroad Co. have voted to increase the capital stock of the company to $120,000.

$ $ $

THE Detroit Electrical Works have reduced their capital stock from $1,000,000 to $750,000, and all of the latter amount has been paid.

$ $ $

ISAAC ROSS was appointed receiver of the Fort Townsend (Wash.) Belt Line by Judge Hanford last month, upon application by certain creditors.

$ $ $

THE East Oakland (Cal.) Street Railroad Co. have issued bonds for $250,000, for thirty years at 6 per cent. per annum, with interest paid semi-annually.

$ $ $

THE Watertown (N. Y.) Street Railway Co. for the first quarter of 1892 make this report: Gross earnings, $3,281.08; operating expenses, $3,817.25; fixed charges, $1,125.

$ $ $

THE stockholders of the Fresno (Cal.) Electric Street Railway Co. are requested to meet on July 15, to take steps toward issuing $500,000 bonds for the immediate construction and operation of the road.

$ $ $

The Lancaster (O.) Street Railway Co. at their stockholders' meeting on June 18, voted to increase the capital stock of the company from $30,000 to $50,000, and equip the road with four electric cars.

$ $ $

THE Connellsville (Pa.) Street Railway Co. have recently placed $50,000 worth of 5 per cent. interest bearing bonds on the market. The money is to be used in the betterment and equipment of the road.

$ $ $

THE West End Street Railway Co. of Boston have declared a semi-annual dividend of 5 per cent. on the common stock, payable July 1. The new stock recently sold at auction shares in this dividend.

$ $ $

THE new loan of the Baltimore (Md.) Traction Co. for the electrical equipment of their North Baltimore division, consisting of $1,750,000 of fifty year, gold, 5 per cent. bonds, which were sold at 105, were heavily over subscribed.

$ $ $

THE California Street Cable Railroad Co., of San Francisco, have reported to the Board of Supervisors that their gross receipts from the Hyde Street branch for the first fourteen months of operation, ending April 30, 1892, were $150 302.45.

$ $ $

THE Dunkirk (N. Y.) & Fredonia Street Railroad Co. have issued $40,000 in twenty year 5 per cent. bonds in sums of $1,000, $500

and $100 each, interest payable semi-annually at the Fredonia National Bank. The bonds were put on sale at par.

$ $ $

THE capital of the Niagara Falls (N. Y.) & Suspension Bridge Railway Co. may be increased from $100,000 to $250,000 under a decision of the Board of Railroad Commissioners. The capital actually paid in is given as $65,000, and the debts and liabilities as $61,500.

$ $ $

The New York State railroad commission last month granted the application of the Fiftieth Street, Astoria Ferry & Central Park Railroad Co. for an increase of capital from $500,000 to $1,500,000. It is the intention of the company to extend their route one and one-half miles, making it thirteen miles.

$ $ $

THE City & Suburban Railway Co., of Memphis (Tenn.) have issued $65,000 in 6 per cent. twenty year bonds. This is at the rate of $10,000 per mile and is part of a total loan of $125,000, $60,000 of which will be issued later. The company have recently consolidated with the East End dummy line, and will use part of the amount realized from the sale of the bonds for the electrical equipment of the old steam line.

$ $ $

A RUMOR has been in circulation in Chicago that a new company was to be organized for the purpose of acquiring a controlling majority of the stock of the City railway company and the Alley elevated railroad company, and the leasing of these two properties to the new organization, making a practical consolidation, and forming the basis for a large issue of new securities. The rumor was denied by officers of the Chicago City Railway Co.

$ $ $

THE daily returns for May of the Pittsburgh Traction Co., which is controlled by the Philadelphia syndicate, show a gain of $28,465 during this month in an aggregate of $65,379. This comparison, according to the Philadelphia *Stockholder*, is without important significance because the mileage is not the same as at the corresponding period of last year, and also because the business in 1891 was done on three cent fares on account of the fight with the Magee lines.

$ $ $

A PERSON who looks at the stock quotations in the STREET RAILWAY JOURNAL of about a year ago will find these figures: Chicago City Railway Co. 308; North Chicago Street Railroad Co. 151; West Chicago Street Railroad Co., 118. The quotations at the time this paragraph is written (June 18) are as follows: Chicago City Railway Co., 397; North Chicago Street Railroad Co., 213; West Chicago Street Railroad Co., 168. The market has within the last few months been exceedingly active and at times almost given up to these securities.

$ $ $

A GREAT deal of talk is current in reference to private negotiations alleged to be in progress for large blocks of street railway stocks in Chicago. A local financial paper claiming to speak with authority says: "Two of the three great properties are concerned in this deal, and it is believed the third also. It is too early to speak definitely of the matter, and it is still possible that nothing of great public interest will come of it. The movements of the parties interested, do, however, unquestionably have some influence on the current quotations of street railroad securities."

$ $ $

Notice has been given that on and after June 23, the New York Guaranty & Indemnity Co. of New York, are prepared to deliver to the holders of trust receipts issued for shares of the stock of the Edison General Electric Co. and shares of the common stock of the Thomson-Houston Electric Co., certificates for common stock of the General Electric Co. of New York, at the rate of exchange already stated, namely: One share of the common stock of the General Electric Co. for each share of the stock of the Edison General Electric Co., and three shares of the common stock of the General Electric Co. for every five shares of the common stock of the Thomson-Houston Electric Co.

$ $ $

THE quarterly report of the Troy (N. Y.) & Lansingburgh Co. for the quarter ending March 31, 1892, shows: Gross earnings from operation $86,114.20; operating expenses, exclusive of taxes, $47,570.33; net earnings from operation $38,573.87; income from other sources, $295.30; gross income from all sources, $38,869.27. Deduction from income: Interest on funded debt, $4,252.33; taxes, $1,894.13; rentals, $1,587.50, total $7,723.96; net income from all sources, $31,145.31. For the corresponding quarter in 1891 the net income from all sources was 11,199.69. The operating cost for the quarter ending March 31, 1892, was 55.22 per cent. of earnings, exclusive of taxes, as against 77.26 per cent. for the corresponding quarter of the preceding year. Including taxes, it was 57.41 per cent. of the earnings, as against 79.72 per cent. for the corresponding quarter of the preceding year.

$ $ $

$500,000 of 6 per cent. first mortgage gold bonds, of the Trenton (N. J.) Railroad Co., Consolidated, are offered for sale by Gay & Stanwood of Boston. The operations of the company by horse power for 1891 are given as: Gross receipts from all sources $131,969.52; operating expenses $86,464.82; net earnings, $45,404.69; interest on all outstanding bonds (190,000) at 6 per cent., $11,400; net surplus for the year 1891, $34,104.69. The company own and operate twenty-eight and one-half miles of track, and the real estate owned by them is valued at $144,400. A sinking fund has been arranged by which $10,000 bonds come due and are payable in 1906, and $10,000 more annually up to and including 1915. In 1916 $15,000 will be retired and the same amount annually thereafter up to and including 1925; $20,000 become payable in 1926, and the same amount for the five succeeding years, so that over one-third of the mortgage is retired prior to 1931, when the remaining $650,000 bonds mature.

$ $ $

ARRANGEMENTS have been completed for the issue of $1,800,000 bonds by the National Street Railway Co., of Illinois, a Chicago corporation which controls the principal street railway lines of St. Louis. There are four purchasers, including N. W. Harris & Co., of Chicago. each taking $450,000 of the issue. The new issue of bonds will be secured by a mortgage on the lines of the Cass Avenue & Fair Grounds Co. and will be guaranteed by the National Railway Co. In addition to that there will also be a lien on a controlling interest in the stock of the St. Louis Street Railway, which is owned by the National Railway Co. and is worth, according to its present market value, $1,250,000. The consolidated road on which the bonds are a first mortgage is twenty-seven miles long, and there will be built seven miles of extensions. The Northern Trust Co. will be the trustee of the bonds which will be issued immediately and the proceeds deposited with the trust company. Of those proceeds $550,000 will be used to redeem a like amount of first mortgage bonds issued by the companies before consolidation; $400,000 of those will be redeemed in thirty days and the other $150,000 as soon as practicable under the terms of the mortgage. The remainder of the $1,800,000 will be used to equip the line with electricity and will be paid out by the trustee on engineers' certificates. The bonds run for twenty years and are payable in gold. An annual sinking fund of $10,000 is provided. The price paid for the bonds is not made public, but they will be retailed by the bankers who purchased them at two or three points below par.

Simple vs. Compound Engines.

An editorial observation in *Power* in regard to the choice of simple engines for the large cable plants now being put down for the Broadway and Third Avenue cable roads in New York City has called out the following communication to the editors from an engineer and designer whose long experience with cable propulsion impresses an expression of his opinion with especial value.

"EDS. POWER:—In a recent editorial you wrote: 'It is a noticeable fact, and one for which it is hard to account satisfactorily, that the large plants of the Broadway and Third Avenue cable roads in New York are all to have simple engines.' Permit me to indicate a probable reason therefor.

"On the Brooklyn Bridge cable, published accounts show that the power required in a day's run varies from sixteen horse power less than nothing to 569 H. P. That on the surface lines you mention, the variation in power applied will not be so great as on the Bridge Railway, is quite certain; that, however, they will be of a range and quickness which would prevent the economical working of a compound engine, ever so wisely proportioned for the work to be done, I think is equally certain. To you, as a steam power expert, I submit these questions which designers of cable driving plants have had to answer, namely: (1) What sum of money shall be set apart, to defray the entire cost of supplying continuously the power required by a cable railroad; that is, to institute the plant, keep it in operation, make the necessary repairs, and renew the several members—boilers, engines, and driving machinery—as they wear out? and (2), Will this sum be less with compound than with simple engines? You will notice that therein is included much more than consideration of the economical working of a compound engine under the favorable conditions for which it is designed. The practical answer to these questions, by conservative engineers, like myself, has drawn forth your criticism. I am confident that they, and I am sure I, will gratefully thank you if you will in the columns of Power, conclusively set forth the nature and extent of error we have made."

REPLY.

While we have a great deal of respect for the opinion of our critic, we are still unable to believe that the conditions of ordinary cable road service are such as to preclude the benefits of the compound system, The fluctuations of the bridge service in its demands for power are extremely variable and severe. Every condition about the bridge road is, however, such as would conduce to extreme variation. The trains, which are composed of three or four heavy cars, ascend a steep grade to the crown of the bridge, and descend upon the other side, so that with two trains approaching each other at the crown we may have a pull on the cable necessary to draw them up the grade; and after they have passed, both will be pulling upon the cable and the engine as they descend. With the complications which must occur in service with the heavy traffic all one way at certain hours it is easy to see how, with this symmetrical arrangement of steep grades, the load may change very abruptly and to an excessive amount. The cable, too, is comparatively short, and runs under the best conditions as to friction, so that the load of the cable itself is a much smaller proportion of the whole load than it would be upon a street railway, where from 50 to 85 per cent of the power is constantly applied to the propulsion of the cable. We cannot imagine any combination of circumstances upon a long street car line with a large number of single light cars upon both the out-going and in-coming cables, and with its greater constant load from the cable itself, which would approach the conditions of the bridge service, or, as our correspondent says, "prevent the economical working of a compound engine ever so wisely proportioned for the work to be done." Compound condensing engines are used with en-

tirely satisfactory results, both as to behavior under load and to economical efficiency, upon cable roads and upon the equally severe service of rolling mill work ; and it would hardly seem as though, with an available initial pressure of 150 lbs. and the refinements which the compound engine now possesses for proportioning the load between the cylinders, automatically if necessary, the fluctuations should be such as to deprive the low pressure cylinder, even of a non-condensing compound, of enough initial pressure to warrant its addition, for any appreciable portion of the time. Compound non-condensing plants are in successful use for driving electric railways, where the conditions as to fluctuation of load are fully as severe as in cable service. The compound engine, too, offers advantages in the better distribution of pressures, avoiding the shock of early cut-offs and long expansions in single cylinders ; their cost of installation is not excessively above that of single cylinder engines of the same power, and an attendant who is capable of taking charge of a large cable station at all should be qualified to run them. If space is a consideration, either of the companies who furnished the single engines could have furnished compounds of equal power which would have taken less space, as will be seen by designs which we have recently published from both. The subject is one which will bear discussion, however, and we shall be pleased to hear from any of our readers who have opinions or experience in the matter. —*Power*.

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Trial of The Angomar Motor.

The Angomar motor of the Kinetic Power Co., illustrated in the April issue of the STREET RAILWAY JOURNAL, has been tested of late on the tracks of the West Chicago company in Chicago. The results of the experiments were embodied in a report which were certified to by Arthur P. Dodge, general manager of the Kinetic Power Co., B. S. Smoot, engineer and machinist of the company and J. L. Blessing of the West Chicago Street Railroad Co. The report was as follows :

1. May 25, 1892, 11:55 P. M. Started with one long, open, nine foot wheel base trail car from Rockwell Street cable power house with 170 lbs. steam pressure ; proceeded east on West Madison Street to and down through the Washington Tunnel and around the regular cable downtown loop, returning to the Rockwell power house at 12:55 A. M., having then 145 lbs. steam pressure. Distance of trip seven miles. Water level in motor receiver lowered one and three-fourths inches by evaporation. Could readily have duplicated said trip once and probably twice upon one charge of water. Amount of fuel in fire box twenty-six pounds of anthracite coal which was about one-half consumed.

2. May 26, 1892, 8:40 P. M. Started from power house with similar trailer, the motor having a steam pressure of 165 lbs. and in its fire-box thirty-seven pounds of anthracite coal which was about two-thirds consumed. Proceeded east, as above, through same tunnel and loop ; thence west on West Madison Street to West Fortieth Street through cable loop house and returned to Rockwell, where the trailer was dropped ; thence to Western Avenue and Van Buren Street ; thence back north on Western Avenue, making a "Y" north of Madison Street, thence to Rockwell power house, arriving at 10:15 P. M., with 135 lbs. steam pressure. The water charge was lowered by evaporation (and the numerous leakages around cylinders, branch and throttle pipes, etc., which of course in no wise relate to the power principle), three inches. The water connection for charging motor takes water from feed pipe at the bottom of stationary boiler giving into motor dirty water, sediment, etc., and there are not as yet any means of taking a charge of dry, hot steam, as desirable. On this second trip we made forty-five stops, and both cars were crowded.

A Luxurious Car.

Speaking of the Private Compartment Cars, we quote from the San Francisco *Daily Report* of January 20, 1892, the car being identical with those in daily service on the New York & Chicago Limited over the Lake Shore Route :

"Isn't this too lovely for anything !" exclaimed a very pretty Oakland girl yesterday afternoon as she entered the Wagner compartment car attached to the Wagner vestibule train of sleepers which brought out the Eastern press delegates last week.

A D. R. reporter, standing near, at once became interested, for whatever receives so favorable a comment from an æsthetic damsel residing in the Athens of the Pacific must needs be lovely. The girl was right. Standing in one of those luxurious compartments, with everything so bright, attractive and comfortable, an irresistible desire to travel in a Wagner car seized the reporter. "All the comforts of home" and everything that the heart of the traveler could desire was there. Hot and cold water within two feet of him as he reclined indolently on what in the daytime was the most comfortable of lounges and at night is miraculously changed into the softest and most sleep inducing kind of bed. Cut off from the curious stare of his fellow travelers, the tourist can gaze his fill at the passing scenery and, when wearied of that, he can turn his gaze inward and amuse himself by wondering how the ingenuity of the Wagner people must have been taxed to devise so many comfortable things and put them in so small a space.

Even the most æsthetic tastes could not find subject matter for offense in a Wagner compartment car. All the colors blend nicely, the dark, handsomely stained wood of the car harmonizes with the elegant frieze covering of the seats.

The compartment car is in the same style as those run on the famous limited train between New York and Chicago. It has ten connecting staterooms, furnished in different styles of woods, upholstered with silk damask to correspond with the wood. The seats are covered with the finest kind of frieze plush.

The car is steam heated, and each compartment is lighted by gas and contains a lavatory, hot and cold water, closet, etc.

Oh, yes—the reporter forgot about that pretty Oakland girl. He was just in time to catch her last sentence as she stepped off the train, and this was it, honor bright : "I vow, I'll never travel in a Pullman sleeper again."

Visit of Electrical Engineers to Chicago.

The ninth general meeting of the American Institute of Electrical Engineers was held in Chicago June 6, 7 and 8. The Eastern delegation, which reached the city by special train, was large, and the visitors greatly enjoyed their stay in the city. Several papers relating to street railway work were presented, the most important of which are given in abstract in another portion of this issue. The visitors enjoyed two excursions. The first was that to Pullman, where they were shown through the immense works of the Pullman company. On Wednesday afternoon they visited the World's Fair grounds at Jackson Park.

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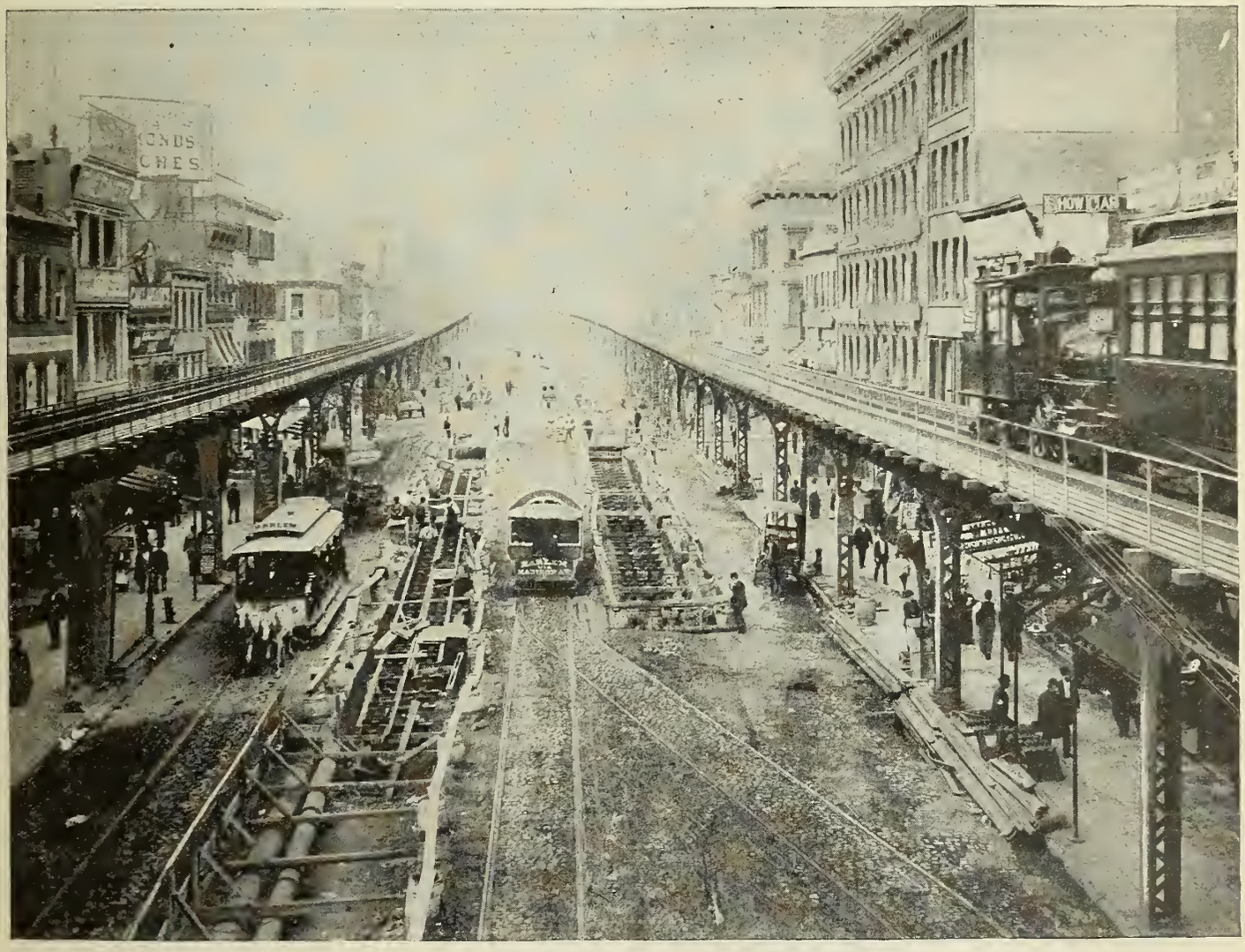
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THE STREET RAILWAY JOURNAL

Vol. VIII. *NEW YORK & CHICAGO, AUGUST.* *No. 8.*

Third Avenue (New York) Cable Construction.

In order to give some idea of the difficulties met with as the work of cabling this important line progresses, we present a view on the Bowery looking north from the elevated railway station at Grand Street. In the foreground a nest of water and gas pipes is shown, and farther along the elaborate crossover switch which has been put in to accommodate the cars of the Fourth Avenue line, which turn into the Bowery at Grand Street and continue parallel to the Third Avenue tracks to Sixth Street. Other interesting details that were referred to in our last issue are shown in the illustration. The work is progressing down the Bowery as fast as circumstances will allow, the excavations having passed Chatham Square and extending nearly to City Hall. The balloon loop and terminal pit at the Post Office are well under way. The excavation for the pit being carried on by means of a shaft and temporary platform, air for the support of the workmen being forced into the excavation by means of Sturtevant fans. An effort is being made to divert all the traffic from Park Row for the present in order that the cable construction may be hastened.



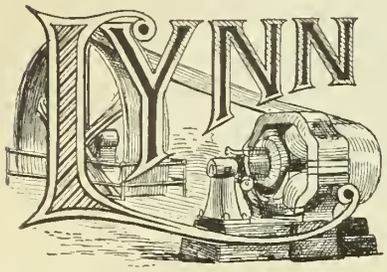
VIEW SHOWING CABLE CONSTRUCTION—BOWERY, NEW YORK CITY.

The contractor, Thomas E. Crimmins, and his engineer, F. S. Washburn, deserve much credit for the manner in which they are conducting the work, and the careful attention given to prevent the obstruction of street traffic as much as possible.

The zone tariff system is to be introduced on the lines of the Vienna Tramway Co. The district is to be divided into three zones, and the fare for one is to be two and a half cents, for two zones about three and three-eighths cents, and for three zones five cents.

RAILWAY DYNAMOS AND THEIR MANUFACTURE.

Part I.—Shop Practice as Found at the Thomson-Houston Electric Co.'s Works, Lynn, Mass.



has become famous as the home of the extensive works of the Thomson Houston Electric Co. This company has a unique history, and in many respects without a parallel in American industries. When we compare its crude beginnings of only a few years ago with its present capacity for manufacturing and developing dynamos and other electrical appliances, the wonderful power of inventive genius, when coupled with skillful financial management, is strikingly illustrated. In order that our readers may share with us the pleasure of a recent visit to this bee hive of industry, and become acquainted somewhat with the details of shop practice and the successive steps in the manufacture of the exceptionally fine railway power appliances which are being turned out, we propose to illustrate and describe, in a series of articles, so so much of the railway department as will accomplish these results. The present article will be confined chiefly to the generator construction, and will be followed with illustrations and a study of motor construction, together with a history of and reference to the future prospects of this remarkably successful manufacturing company, and the system of discipline which it exercises over its 4,000 employes.

A dynamo is a very simple machine, and the relation of all its parts can be readily understood by a novice. We have simply to revolve a loop of wire between the poles of a magnet without touching them, and in some mysterious manner, beats or pulses of electricity will be induced in the wire, which may be collected and sent into a circuit; so we call this a dynamo-electric machine. But it may be further defined as a machine for the conversion of mechanical energy into electrical energy, and *vice versa*. When used for producing an electrical current, it is called a generator; but when it converts electrical energy into mechanical, it is called a motor, and the machine may be employed as a generator or a motor, as the case may be. In fact a good generator is usually a good motor, and will act as a motor when a current of electricity is conveyed to it in a proper manner; but for motor purposes, the shape and weight of its parts are usually modified to suit the class of work for which it is designed. While electricity, as an element in nature, is shrouded in mystery, there is, as stated above, no mystery involved in dynamo construction; so we invite our readers to accompany us on a brief run through the shops while we describe the details of construction, and we have no doubt they will be as interested in what will be seen, as we ourselves were.

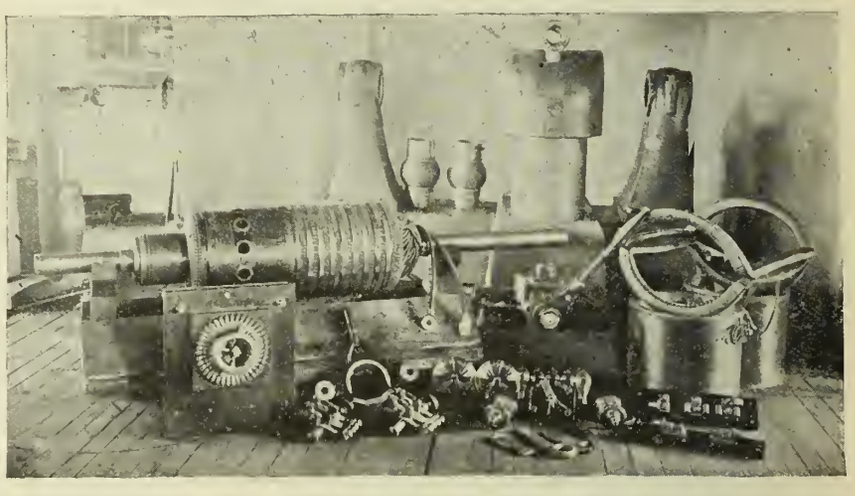


FIG. 1.—BIPOLAR GENERATOR.

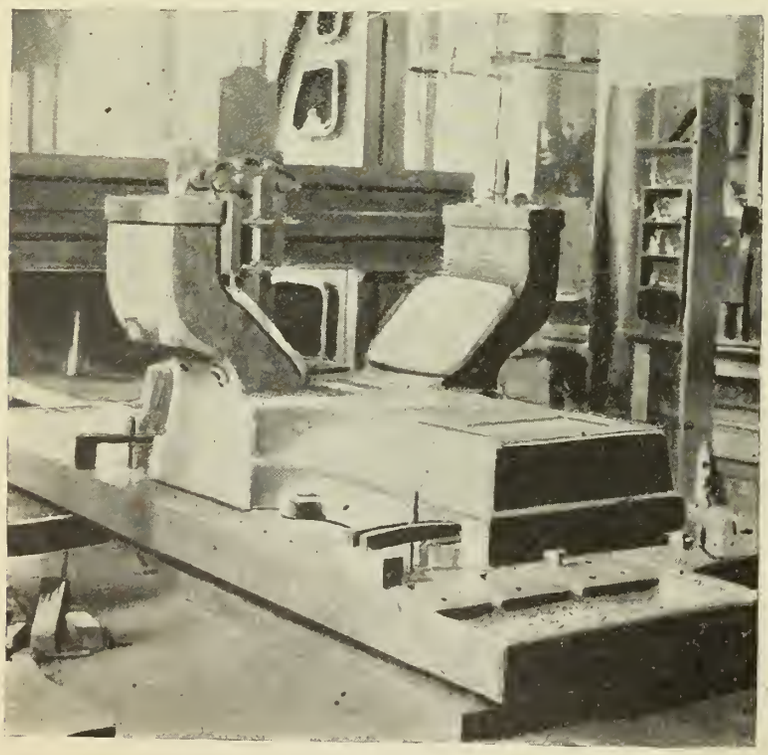


FIG. 2.—PLANING FRAME OF MULTIPOLAR GENERATOR.

It borders on the marvelous to think that bits of metal, iron and copper, when assembled in certain relations to each other, and, when certain parts are put in motion without any previous doctoring or electrifying, an electric current will be generated which may be conveyed by means of a conductor to a long distance and then be converted into power, light or heat, as the case may be. One would suppose that the parts would at least have to be magnetized before the machine would operate successfully, but usually no magnetic qualities are imparted to the iron other than it has picked up, or what has been induced from hammer blows as the frame has progressed through the shop.

If we study a commercial generator we find that it is constructed of a few general parts. We have first the stationary parts, which include the iron frame which supports the magnetic poles, called fields, spools of wire surrounding these and stands for the journal bearings. The armature, or movable part, which consists of a shaft bearing a gun metal spider to which is attached a core of laminated iron which, in turn, is surrounded by coils of wire, each of which is connected by other flexible wires to the bars of a commutator mounted on the shaft

which is designed to collect the beats of electricity which occur in the coils and transfer them to the brushes which are held in position by a yoke attached to the frame and which lead the current into a metallic circuit.

Generators are made bipolar or multipolar. The parts of the former are shown in Fig 1, but for the present we will describe only the multipolar types, as these are the ones now chiefly manufactured, and are now known as the M. P.'s when about 100 H. P. capacity. As we pursue our studies through the shops we hardly know which to admire most, the genius displayed in the design of the generators and motors themselves or that manifested in the construction of the various tools with which the work is accomplished.

The frames, which are cast from soft gray iron, are purchased from commercial foundries, chiefly from Providence, R. I.; the Lynn works at present not being equipped for making heavy castings. The frames are in two parts, and for the M. P., 500 H. P., an extension base is

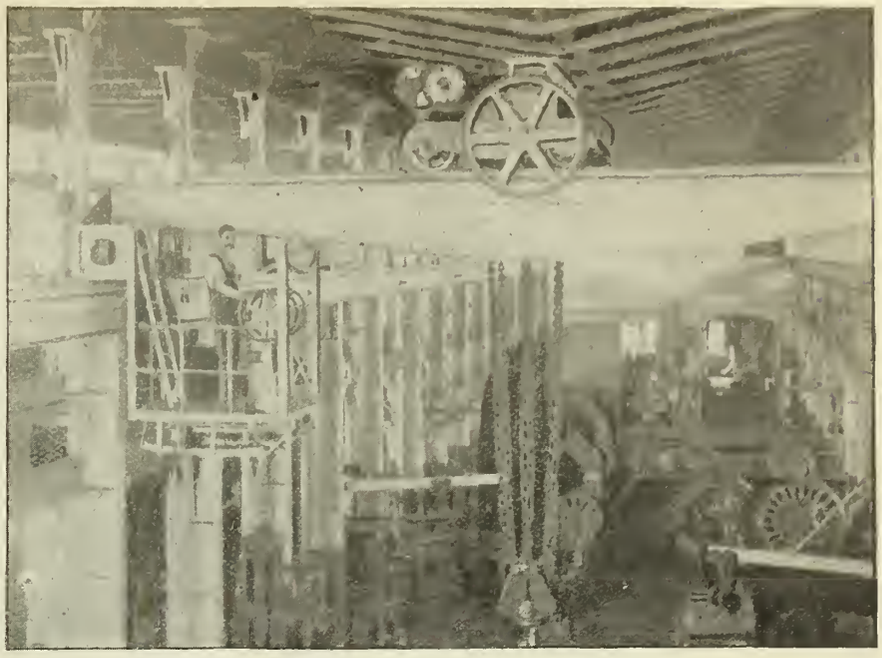


FIG. 5.—THIRTY-TON ELECTRIC CRANE.

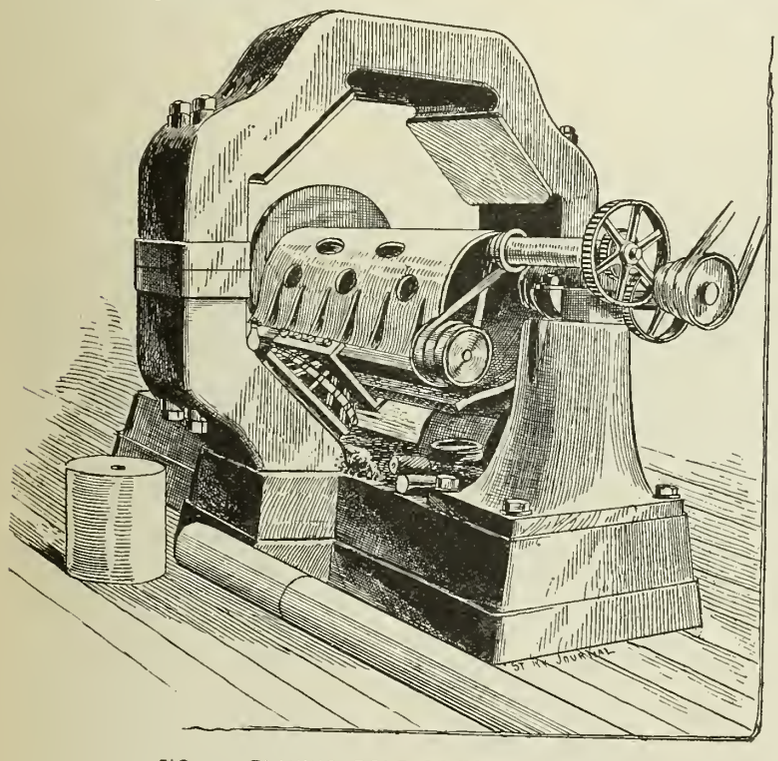


FIG. 3.—PLANING POLE SEATS.

spliced on, so that the castings complete weigh about twenty tons. On being received at the shops, they are stored within convenient reach of the planers, and the first work upon them consists in planing the different faces for joints and stands as shown in Fig. 2, for which purpose a 120 in. planer is employed.

Next, the bolt holes for attaching the stands are drilled, and if an extension is to be added the frame is transferred to a universal drill, and there the abutting ends are drilled for receiving the splicing bolts. The stands and bearings boxes are now attached, and the seats for the pole pieces are planed off on a universal boring mill which, as shown in Fig. 3, is a most interesting process; a rotary cutter (or spider) is operated on the side of a drum containing driving mechanism which is mounted on journal bearings in the position of the armature shaft, upon which it is turned, so that the cutter tool planes each seat in succession and insures their being equally distant from the centre and a uniform distance from the surface of the armature when mounted. This process being completed, the final fitting of the frame consists in chipping off the corners of the joints and other rough places by hand, when the pole pieces are bolted in place. The pole pieces are of soft cast iron with concave inner surfaces to conform to the surface of the armature. These are bolted to their seats, previously prepared, on the inner face of the frame, and surrounding these are the spools which produce the magnetic field.

The method of winding the spools is shown in Fig. 4, and at this work a large number of men are employed. The foundation of the spool consists of a thin casting or shell of gun metal of peculiar shape having flanges to support the wiring. This frame being placed on a winding form, its outer surface is covered with insulating material, when, being made to revolve, 376 turns of No. 10 insulated wire or other size, and number of turns, depending upon the size of the machine, is laid on, the wire being guided in place by the hand of the operator. The leads are soldered to the inner layer and led out at the side of the shell. Being wound the surface is covered with canvas

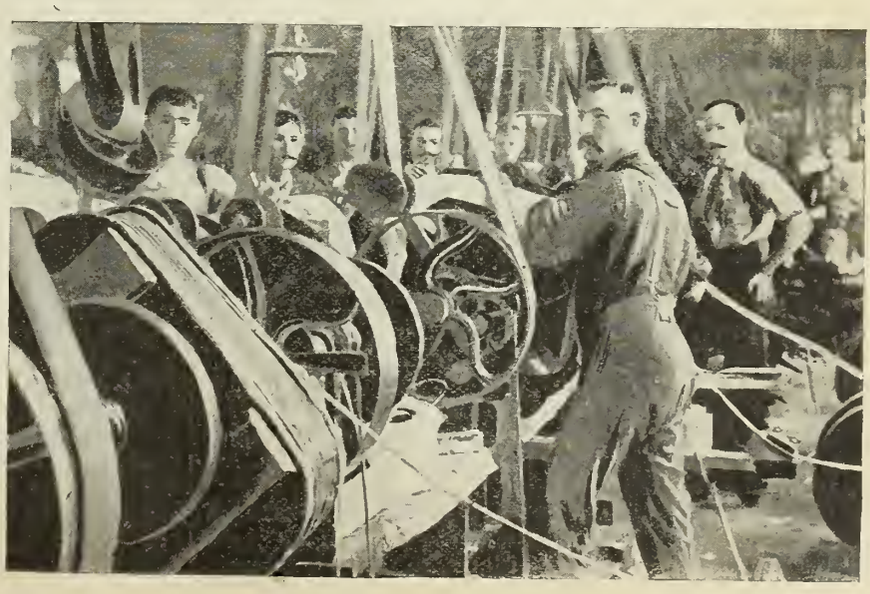


FIG. 4.—WINDING FIELD SPOOLS.

and waterproof paint, rendering the spool practically waterproof. The frame, being completed, is sent to the testing house for assembling and testing. In its journey through the shop the pieces of the heavy frame are transferred from tool to tool by means of an electric traveling, thirty ton crane, illustrated in Fig. 5, which is operated by three double reduction railway motors, and its movements are controlled by the operator from a suspended cab, as shown. Besides the electric crane, the shops are provided with wall cranes and hand hoists and narrow gauge tracks upon which low trucks are run that transport the parts from shop to shop as the case may require.

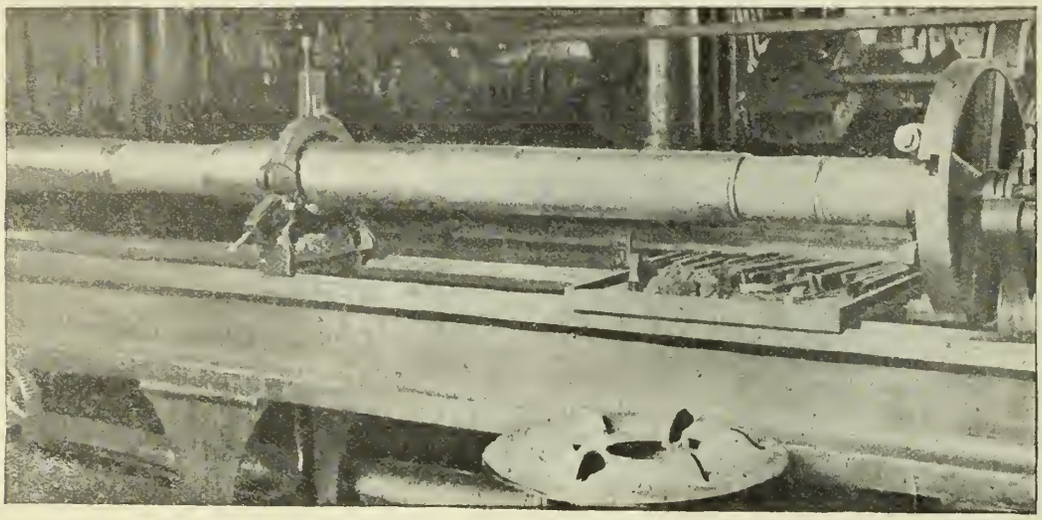


FIG. 6.—DRESSING ARMATURE SHAFTS.

The construction of the armature next claims our attention, and we will begin with the shaft, which is of forged steel, in various lengths, depending upon the size of the machine to be constructed. These are purchased from the steel mills, those for the smaller machines being forged plain, while those for the large generators are rough hammered to shape to save expense in turning. Fig. 6 illustrates the operation of turning off or dressing the shafts, the lathes being so arranged that one man can oversee the work of two machines. The key seats are then cut, and the shafts are ready for the spider which carries the armature core. This is cast of gun metal in two parts (Fig. 7) and is keyed to the shaft. One-half being in place, the process of building up the core will follow, but we must first repair to the punch and press room where thirty or more presses (Fig. 8) are employed in stamping out from sheet iron or mild steel the segments or discs from which the armature cores or rings are constructed. The plates for small armatures are cut round, with notched edges and bolt holes, so that when laid up the completed core has channels for receiving the wiring, thus saving the expense of milling out the channels. The large armatures, such as those for the ten pole generators, are eight feet in diameter, and the plates for these are stamped in segments about four feet long and then notched in a separate press. The plates are then placed in the annealing ovens, where they remain for twenty-four hours, and are then allowed to cool gradually.

The next process is shown in Fig. 9, and consists in laying up the segments about the core and shaft by hand. with tissue paper between the plates, so that the notches come opposite each other and form a continuous channel across the face for receiving the winding. The large armature cores are not built up solid, but about every three or four inches a gun metal grid, one-fourth of an inch in thickness, is inserted between the layers, which provides an air duct for ventilation, and reduces the tendency to heat. A sufficient thickness having been obtained, the second half of the spider is put on, and the plates are pressed firmly together by hydraulic power, an ordinary hydraulic wheel press being employed for the larger generator cores, and an ingenious arrangement of hydraulic pressure is provided for the smaller cores, which will be illustrated in connection with motor armatures. The core being removed from the press and the plates secured by bolts, it is mounted in suitable bearings, and the exposed portions of paper in the channels are burned off by means of a gasoline blow lamp, and the channel surfaces are mechanically smoothed out by means of shuttle files which are operated by a pulley and rocker arm.

The object of building up the armature core from thin plates, or of employing a laminated core, as it is termed, instead of a core of solid metal, is to prevent the induction of eddy or parasitic currents which would cause the core to heat and reduce the efficiency of the machine.

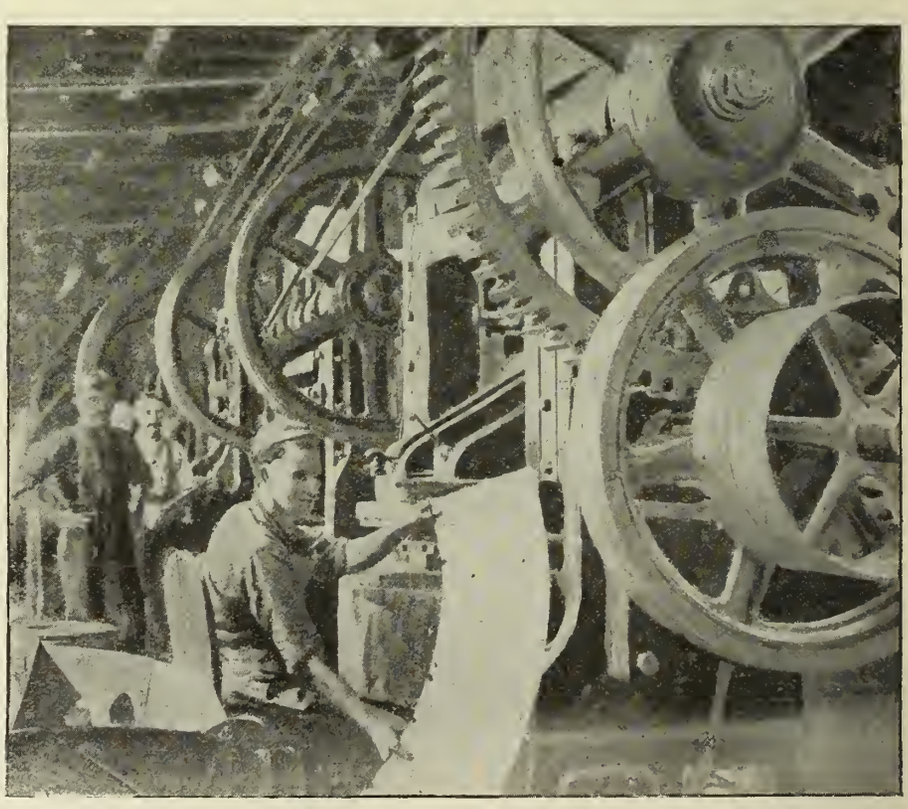


FIG 8.—STAMPING CORE PLATES.

The core is now ready for the winding, and it is transferred to another shop for this purpose. The cross sections of the channels in the face of the core, which are designed to receive the wiring, are of special shape, being larger at the bottom than at the top, so that when the wiring is in place it can be securely held by a wedge shaped wooden rod which is driven in from one end, and

prevents the possibility of the wire being thrown out by centrifugal force. In the manufacture of all the M. P. generators above 100 H. P., flat copper rods are employed instead of wire for the bobbins, and in the armature of the 300 H. P. machines, these rods are about half an inch wide, one-eighth of an inch thick and two feet long. Four of these, separated by insulating material, are placed in each channel, which is first lined with an insulating material about one-sixteenth of an inch thick, but before being put in position, a flat, insulated, ram's horn connection is riveted on, by which connection is readily made with its mate at the adjoining quarter. The bars are connected in series, so that when finished they form one continuous conductor entirely around the core. Suitable connections are attached to one end of each set of bars or bobbins, as they are termed, which serve to lead the current to the bars of the commutator. The commutator—various sizes of which are shown in Fig. 10—is a drum composed of copper bars insulated from each other, which is mounted on the shaft to one

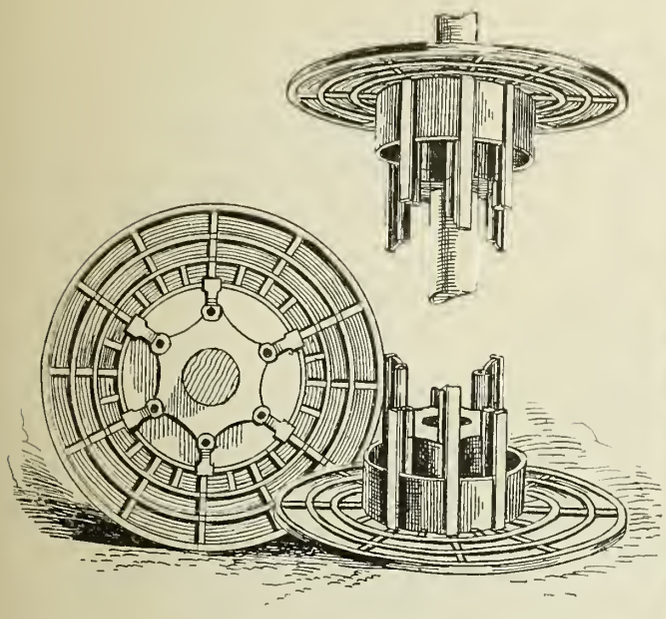


FIG 7.—GUN METAL SPIDER.

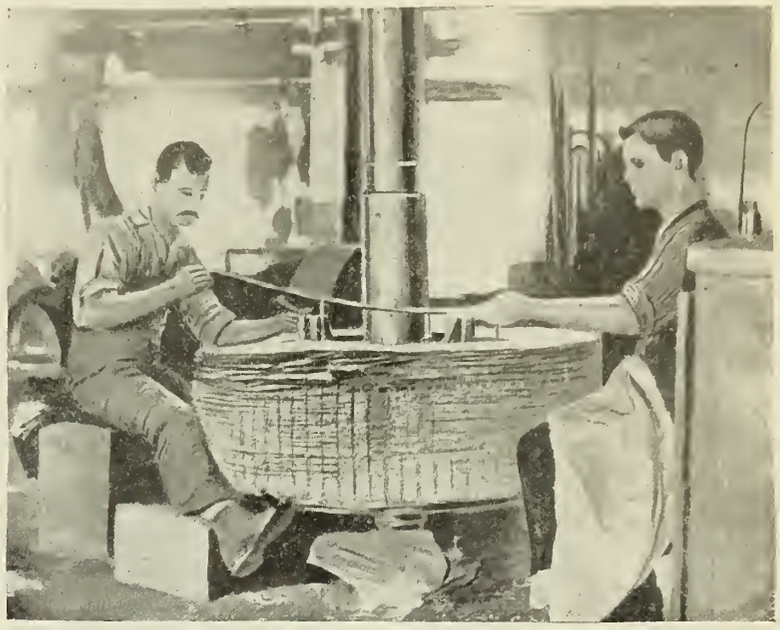


FIG. 9.—BUILDING UP ARMATURE CORE.

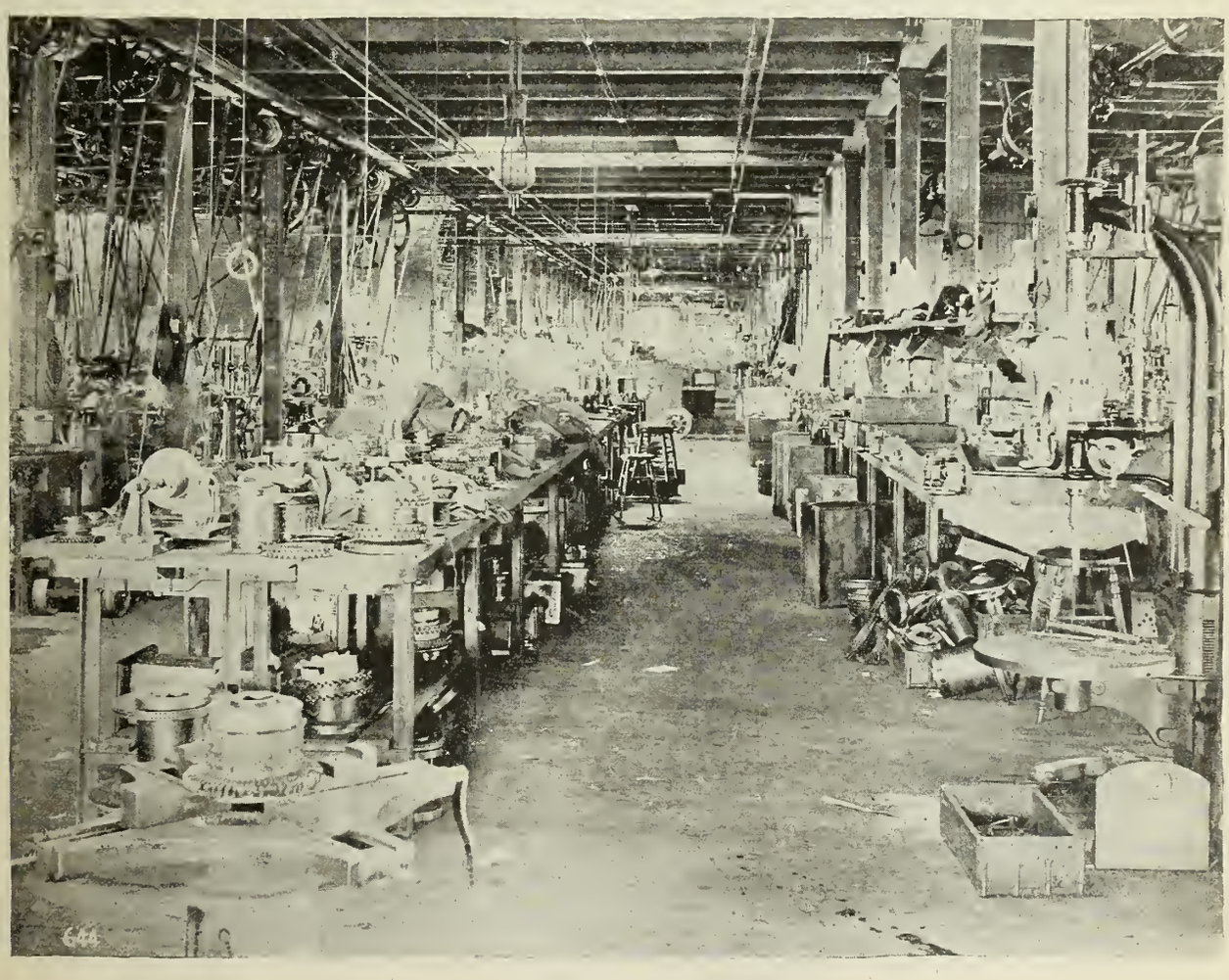


FIG. 10.—COMMUTATOR DEPARTMENT.

side of the core, and serves to collect the currents induced in the individual bobbins, and transmit them to the brushes.

The making of the commutator is a very interesting process, and one never tires of watching the details. and consists of placing the bars, separated by mica and shellac insulation, within iron rings which are provided with numberless set screws by means of which the bars are firmly set together when the arc is completed.

The sheets of mica which insulate the bars of the



FIG. 11.—FINISHING COMMUTATOR BARS IN PROFILING MACHINES.

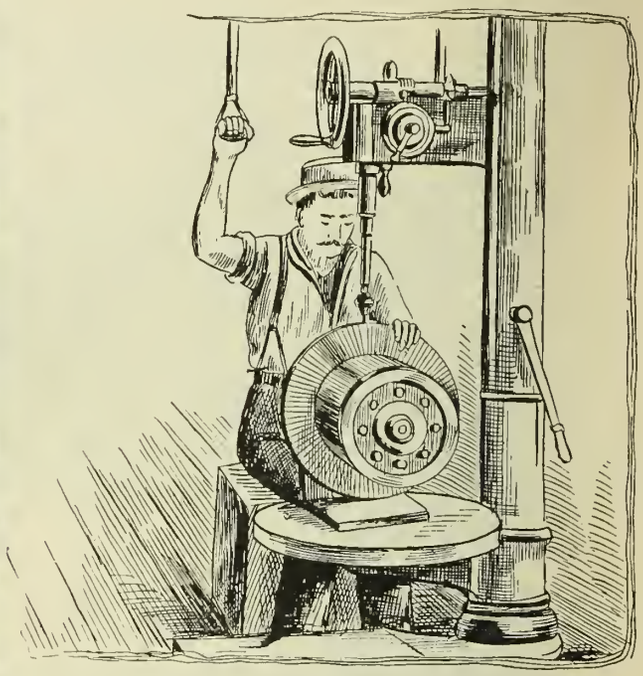


FIG. 12.—DRILLING COMMUTATOR BARS.

Wedge shaped, rolled, copper bars of suitable length are purchased from the manufacturers and on being received at the shop are first inspected and straightened by being placed on a flat steel plate and dealt a few deft hammer blows. A short ear of copper is then riveted on one end of the bar at an obtuse angle, the parts being first halved commutator are stamped out to correspond in shape with the bars and ears, the two parts, bar and ear, being joined by trefoil dovetail, a most ingenious arrangement which prevents the mica plates from breaking or pulling asunder. This method of joining the mica plates has been adopted after a good deal of experimenting, and illustrates very

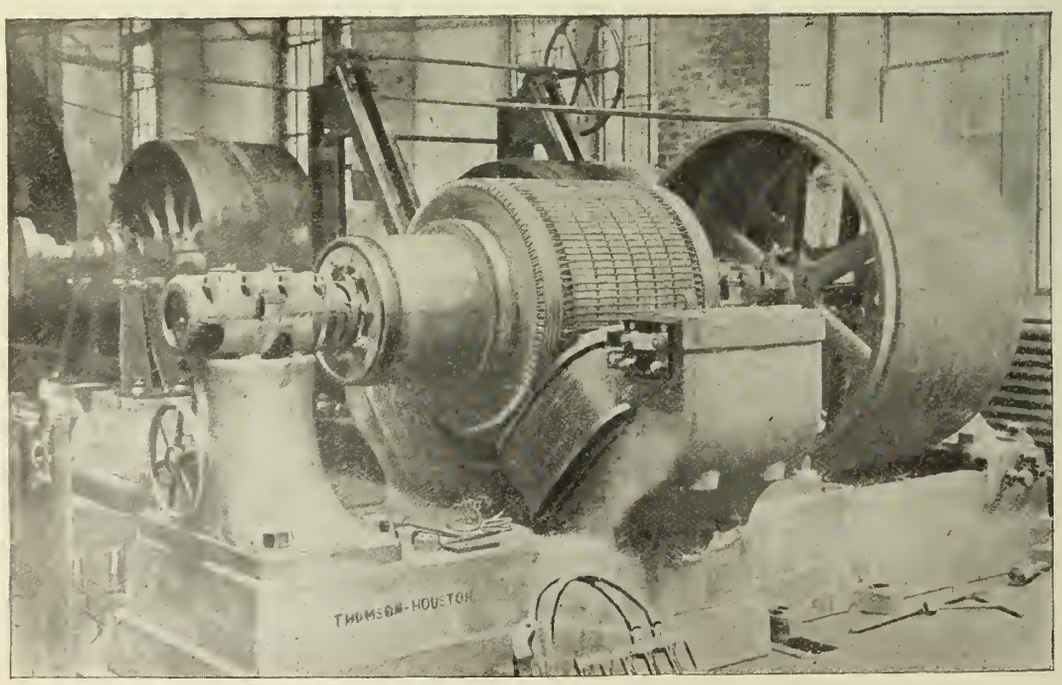


FIG. 13.—ASSEMBLING PARTS OF GENERATOR FOR TESTING.

out on a small milling machine so that they fit closely together. The bars are then passed through a series of profiling machines (Fig. 11) upon which the surfaces are brought to a smooth, uniform plane. The profiling tool consists of a vertical spindle having milling teeth cut in the lower end, which, being made to revolve rapidly, is brought down upon the face of the bars and quickly trims it off. The laying-up process is next in order (Fig. 10) forcibly the care and attention which are given to the minor details in the process of manufacture, thus insuring a reliable product.

It will be noted that mica performs an important office as an insulating material in the manufacture of generators and motors. The supply of this mineral is obtained chiefly from Canada, and is at first carefully sorted, when it is split into its ultimate sheets, young girls being

chiefly employed on this work. A number of sheets are then cemented together by shellac and baked, when they are ready for stamping into the required forms. The object of splitting the mica, mixing and then reuniting the sheets, is to prevent the possibility of a short circuit being formed between the bars by the presence of metallic ore in the mica. The commutator having been formed in the retaining rings, is placed in a lathe, and the ends are turned down for receiving the collars and following rings, which, being put on with mica insulation between, support the bars in place. The retaining rings are then removed and the surface is turned down to a required diameter, guide lines being left on each end to serve as marks for future turning. The ends of the ears are then drilled (Fig. 12) to secure the leads which connect the bobbins with the bars. The parts of the generator are then assembled, and in Fig. 13 we find the machine in the testing room and belted to an engine. The upper half of the frame being removed, the armature is placed in its bearings, and the machine is assembled with the brush holder yoke adjusted in place. The brushes, which consist of small carbon blocks, are inserted, and the adjusting mechanism, which consists of a hand wheel and worm gear, as shown in Fig. 14, is put in place, and the self oiling boxes with their interlaced linings (composed of gun metal and babbit) being adjusted and the poles joined by a metallic circuit, the engine is started, when our assembly of inanimate matter suddenly becomes, apparently, a thing of life, capable of sending forth a mysterious force which may be transformed into power or light, or which may produce a disagreeable shock to the human being who is so unfortunate as to form part of the circuit.

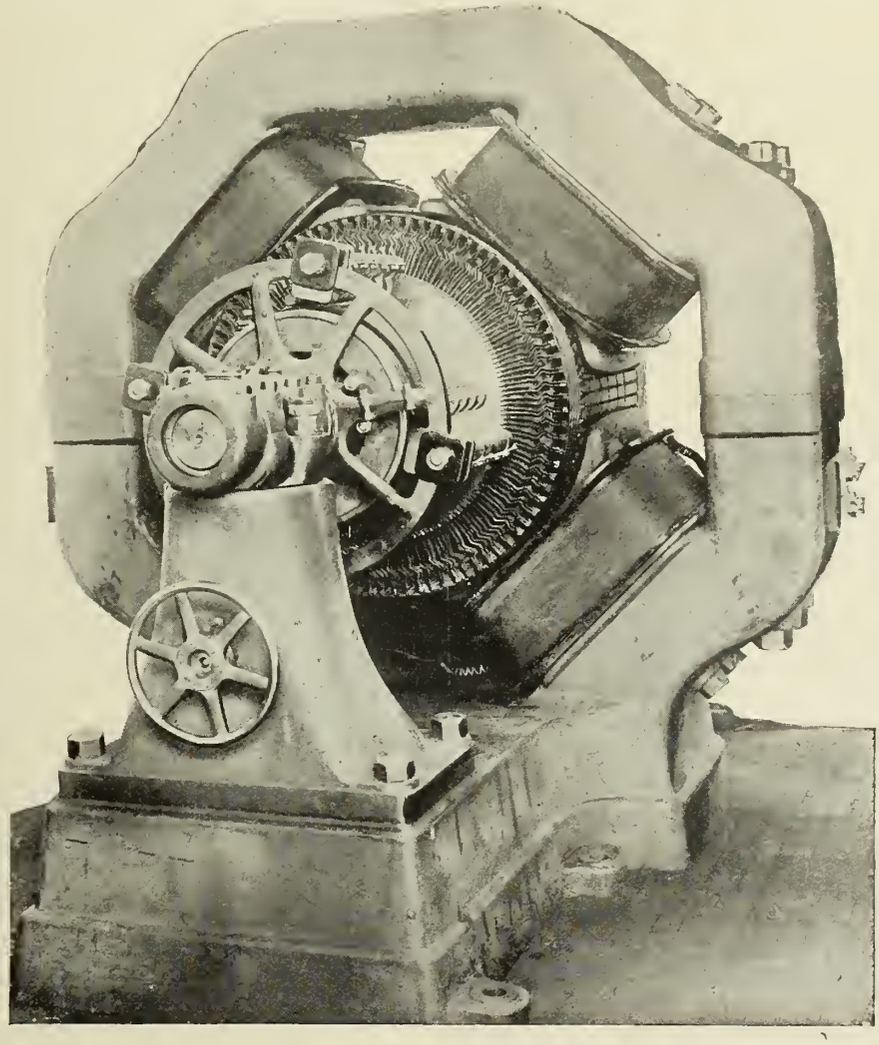


FIG. 14.—500 H. P. MULTIPOLAR GENERATOR.

We have followed our machine through its various stages of development, but have overlooked one of the most important details, and one which has contributed more than any other to the excellence of the product, and that is the rigid inspection and testing to which every part is subjected before leaving its individual department. The journals of the shaft have been callipered, the joints of the frame, etc. have been examined, the wiring has been inspected, and so on with other details. Every defective part has been rejected, and our machine stands as perfect as mechanical skill can make it.

A NEW line of street cars has been constructed at Paris, between the Madeleine church and the manufacturing suburb of St. Denis, especially for electric traction. The trial trips were recently run on a portion of the route between the Place aux Gueldres and the gates of St. Ouen, and with much success. A second service of electrically hauled street cars will be organized shortly between St. Denis and the gates of St. Chapelle.

Progress of Electric Railway Equipment in Brooklyn.

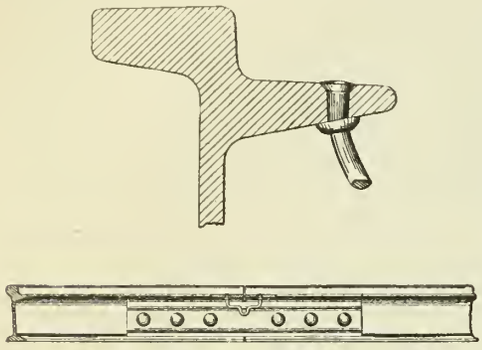
Work on the new power station of the Brooklyn City Railway Co. at the foot of 52d Street, Brooklyn, is being pushed forward as rapidly as possible, and practically all of the foundations have been completed. This part of the station is very substantial and has required in its construction about 10,000 tons of granite. The builders are now at work on the brick chimney, which is to be 213 ft. high, and are advancing in its construction at the rate of about five feet per day. The side walls, which are of brick, are also progressing rapidly, and work is about to be commenced on the iron work, which includes the the elevated gallery in the centre of the power station, about sixteen feet from the ground, upon which the generators will be placed. In the neighborhood of thirty-five miles of track have been prepared for the electric equipment, and about twenty-two miles of overhead system have been erected. This part of the work is also progressing rapidly, and the company expect to have by Christmas fifty miles in operation.

The rolling stock, which is at present being built or remodeled for the electric equipment, consists of 110 cars, each with a length of body of twenty feet five inches. Fifty of these will be new cars, half being supplied by the Lewis & Fowler Manufacturing Co., and half by the J. G. Brill Co. The other sixty will be sixteen foot cars taken from the present stock of the Brooklyn City Railway, but changed over so as to have the length mentioned above. These sixteen foot cars will have new sills, new platforms, new dashboards and new sashes, when necessary, and will be repainted and revarnished. For the interior ornamentation the company will use veneer oak or similar woods, fastening it to the old carlines of the roof, while the roof itself will be strengthened by introducing steel carlines at four different points. Of the sixty cars now being changed, fifty will be remodeled by the Brooklyn City Railway Co., and ten by the Lewis & Fowler Manufacturing Co. New trucks will be furnished for all the cars, the types of trucks selected being the Taylor, the Pearson, the McGuire, the Peckham, the Brill and the Lewis & Fowler.

The engineers of the Atlantic Avenue Railway Co. are also busily engaged in supervising the installation of their electric equipment. The company have laid a considerable amount of new rail, and are at work on the construction of their power station. The first car of those which are being built for the company by the St. Louis Car Co., at St. Louis, Mo., is expected shortly.

The bonding of the rails for an electrical return is being done by the company in a novel manner, as shown by

the accompanying cut, and a patent on the method has recently been secured by the inventor, T. J. McTighe, of Barry & McTighe, of New York, engineers for the Atlantic Avenue Railway Co. The bond, instead of being three pieces of metal, is a single piece with shoulders or rivet heads formed by upsetting the metal, or it may be made from stock, the diameter of the shoulder being swaged down to form the rivet ends, or the ends may be welded to the body piece. The bond is but from nine to ten inches long instead of thirty inches or more, and instead of being connected through the web of the rail is connected through the tram of the rail near its end. In this way the resistance of the rail bonds is reduced about three-fourths, and the whole rail bond system can be inspected frequently without disturbing the pavements in any way. To prevent the head of the rivet wearing off, the hole is countersunk.



METHOD OF BONDING RAILS—ATLANTIC AVENUE RAILWAY, BROOKLYN

Love Electric Railway System in Chicago.

The Love electric underground conduit railway is operating with great success on the Fullerton Avenue loop of the North Chicago Street Railroad Co. A few weeks ago the armature of the generator at the power station was burned out by lightning, and as it was necessary to send East for a new one, the motor cars were not run for a short time. During the interim a number of minor changes were made on the road, and, to quote Superintendent Roach, "It has since been operating without a hitch of any kind." The North Chicago Street Railroad Co. which have accepted the road are greatly pleased with its operation, and it would not be surprising if the system was installed on other lines of the North Side company. The test which was insisted upon by that company was extremely severe. They operated it entirely by "green" men. When an employe learned his work thoroughly he was removed from his position as motorman and a new hand was substituted. During the period of testing there was snow to be encountered, and rain fell on sixty days, flooding the streets through which the road runs, from curb to curb. It is stated that the motor cars now perform the work of seventy-five horses, that the services of nineteen men are dispensed with, that sixty electric lights are fed with current from the generator, and that the expenditure for coal is not over $4 per day.

The Love company have taken a contract for the installation of a road in Washington, D. C., and General Manager Wheeler states that he has been requested to furnish figures for the introduction of the system on more than 150 miles of road.

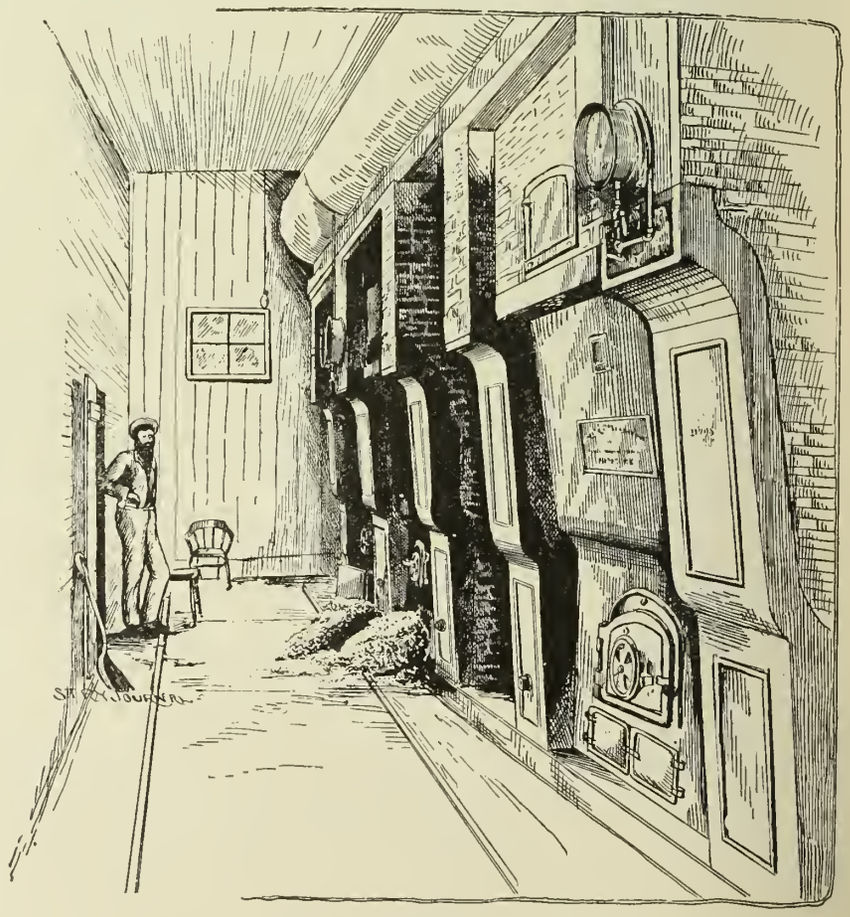
Through the courtesy of Mr. Willard A. Smith, of the Transportation Department of the World's Columbian Fair, we are in receipt of a handsomely engraved invitation to be present at the ceremonies attending the dedication of buildings at Jackson Park, October 11–13, 1892.

The Boiler Equipment at Yonkers, (N. Y.)

The accompanying engraving gives a view of the boiler room of the Yonkers (N. Y.) Electric Railway described in our last issue. The boilers are of the Stirling water tube type, and are three in number, of eighty horse power each. They are built to carry a steady working pressure of 125 lbs., and are carried on iron supports independent of the brickwork. Coal is carried directly to the furnace doors by a hand car running on the track shown in the engraving.

The construction of the Stirling boiler is a departure from that of other water tube boilers, and possesses many excellent features. The boiler consists of three upper drums and one lower or mud drum made of the best flange steel. In one end of each drum is a manhole faced elliptically, against which a manhole is fitted and held in place by wrought steel bolts and arches. The removal of these manhole plates gives access to every tube in the boiler, and the drums, being three feet in diameter, are large enough for a man to work inside conveniently. Expanded into these drums are three and a quarter inch tubes, so bent as to enter the drums at a proper radius, and to allow for unequal expansion and contraction. There is no cast metal of any kind used in the construction of the boiler, which permits a high pressure to be carried with absolute safety.

The water is fed into the rear upper drum, and, during its passage to the mud drum (which requires from twenty to thirty minutes when the boiler is working at its rated capacity), it comes in contact with the ascending gases and becomes heated to a temperature over 300 degs. At this temperature the lime, magnesia and other impurities, are separated from the feed water and deposited in the comparatively cool mud drum, where they are easily blown off. As a result, the front two banks of tubes are filled with chemically pure water and do not scale. This is a very important feature for many localities, for, given a clean heating surface inside and out, fuel economy is a natural result. There is also an absence of handhole plates, which often cause much annoyance from leakages.



BOILER ROOM—YONKERS STREET RAILWAY.

The Safety of New York Elevated Travel.

The New York Elevated Railroad, in many important particulars, affords the most perfect service in the United States. On its ninety miles of track it carried in 1891 over 550,000 passengers for every day in the year, and the business is growing every day.

The value of this elevated structure to the community, in dollars, may be inferred by noting that the tax appriasers of New York for the year 1892, put the increase of real estate in the three wards above Fortieth Street, at $22,000,000 in excess of the year 1891. As this railway service has been in existence for about fourteen years, the total increase in the assessed value of the mentioned districts reaches a colossal figure.

The greatest complaint against this service is that it is insufficient for the wants of the rapidly growing districts, which this service alone has created. Trains are frequently run at minute intervals in the busy hours of the day, made up of five passenger cars holding, when crowded, as they usually are at such times, about 100 passengers each, or 500 for the entire train. The seating capacity, however, is only 300 for each train; the aisles and platforms hold the remainder.

But the astonishing part of the whole business is, that not a single passenger's life has ever been lost (among those remaining on the cars) since the road went into existence. This record is largely due to the ability and management of Col. F. K. Hain, the road's third vice-president and general manager. This safety to human life may be appreciated by a reference to government statistics, regarding the loss of life annually on the steam surface lines. The proportion of passengers carried on the elevated road, to those carried on all the steam surface roads in the United States, is two to five. For the year ending June 30, 1890, on the steam surface lines, there were 286 passengers killed and 2,425 injured, which year is a fair average. On the steam surface roads, one passenger is killed to every 1,727,789 passengers carried, or for every 41,425,823 miles accomplished.

If the elevated road killed and injured as many passengers as the surface lines, counting a three mile trip as the average on the elevated railroads, against an average journey of 24.06 miles for each passenger on the steam surface roads, to maintain the average for that year, fourteen should have been killed and 121 injured on the elevated roads. Multiply these figures by the nearly 2,000,000,000 passengers the elevated roads have carried since they went into existence, and to maintain the country's average loss of life, etc., about 140 passengers should have been killed, and 1,210 injured.

It may be noticed, we do not refer to train hands in either case, but only to passengers; of these, as has been stated, none have ever been killed, who remained aboard the cars on the elevated road, and not half a dozen have ever been injured, and these injuries have been very slight, and of little consequence, comparatively, when the total volume of this vast business is considered.

The second electric railway using the overhead system in Belgium, will be installed between Jeuseppe and Liège. The Thomson-Houston system will be used.

The Baltimore Belt Line Tunnel.

The announcement that electric locomotives would be used in the Baltimore belt line tunnel has concentrated the attention of electric railway engineers upon that great undertaking now being pushed rapidly forward to completion in the city of Baltimore. The use of electric power upon this underground railway to draw ordinary passenger cars will mark a departure in electric railroading in this country, and seems only the forerunner of a much wider application to trunk line conditions.

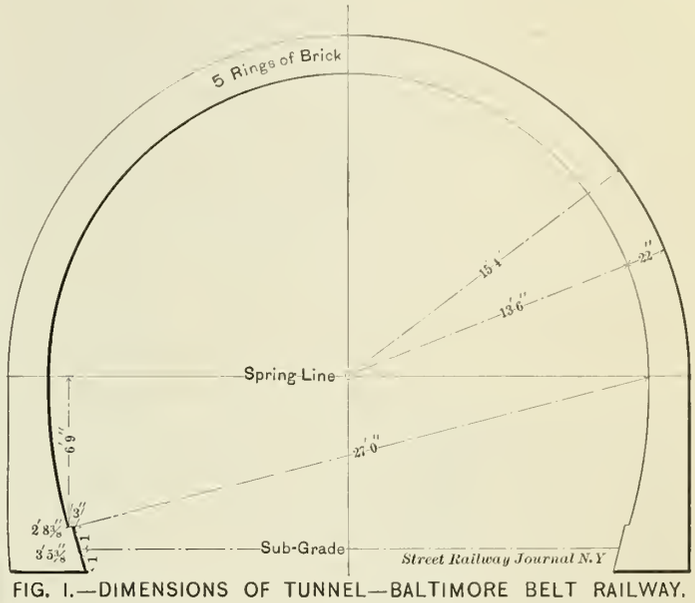


FIG. 1.—DIMENSIONS OF TUNNEL—BALTIMORE BELT RAILWAY.

The main object of the belt line is to afford the Baltimore & Ohio Railroad Co., a shorter and all-rail route to the North and to give this company and the Maryland Central Railway Co. facilities for reaching the heart of the city of Baltimore equal to those enjoyed by the Pennsylvania Railroad Co. At present the trains over the Philadelphia division of the Baltimore & Ohio Railroad enter and leave Baltimore by a ferry transfer, three-quarters of a mile in length.

The work of constructing the tunnel is under the charge of Messrs. Ryan & McDonald, contractors, who have successfully built many of the underground rail-

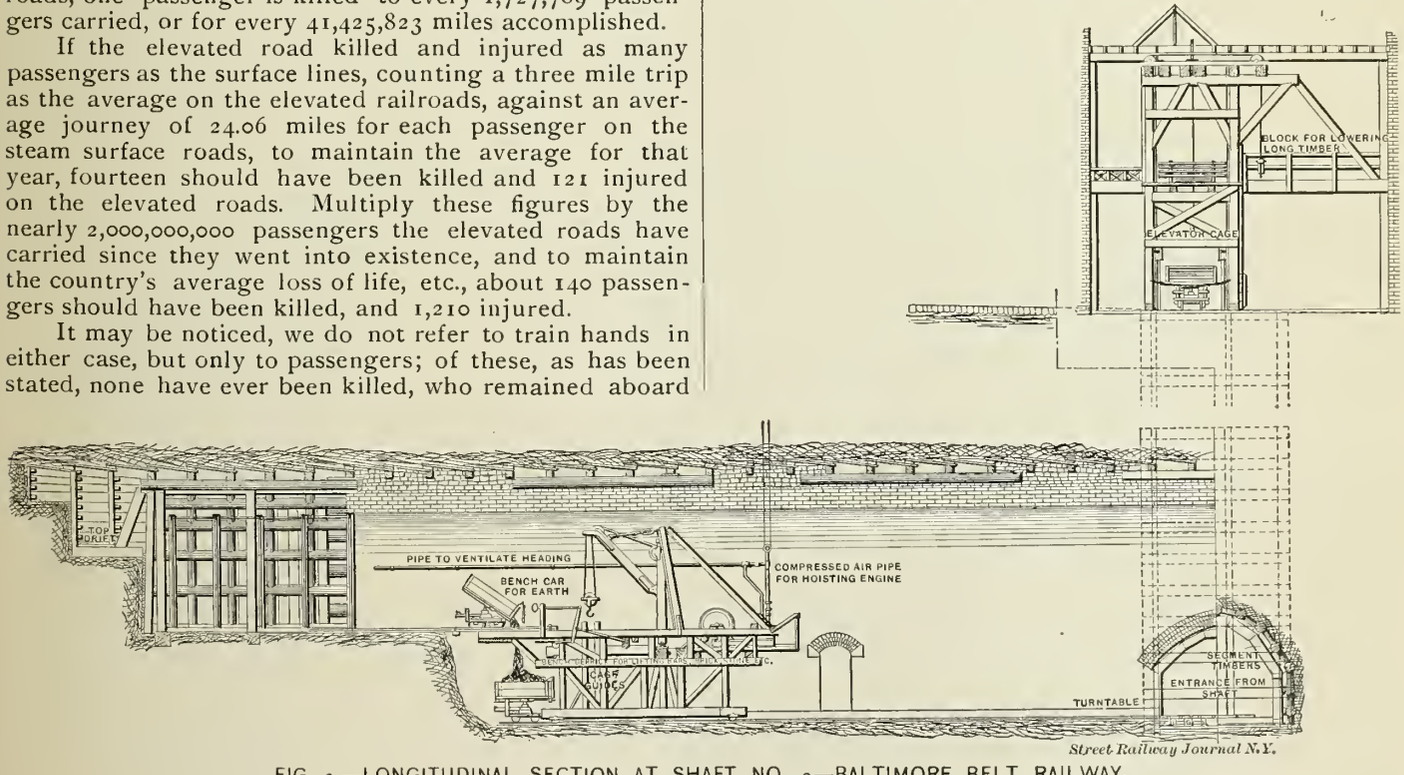


FIG. 2.—LONGITUDINAL SECTION AT SHAFT NO. 3—BALTIMORE BELT RAILWAY.

roads of the country. The belt railway commences on South Howard Street, near Hamburg Street, in the neighborhood of the yard of the Baltimore & Ohio Railroad, and runs out Howard Street beyond Richmond Market, then through open cuttings to the terminal of the Maryland Central Railroad, then along the south side of Seventh Street to the city limits and Bayview station, where it will connect with the tracks of the Philadelphia division of the Baltimore & Ohio Railroad.

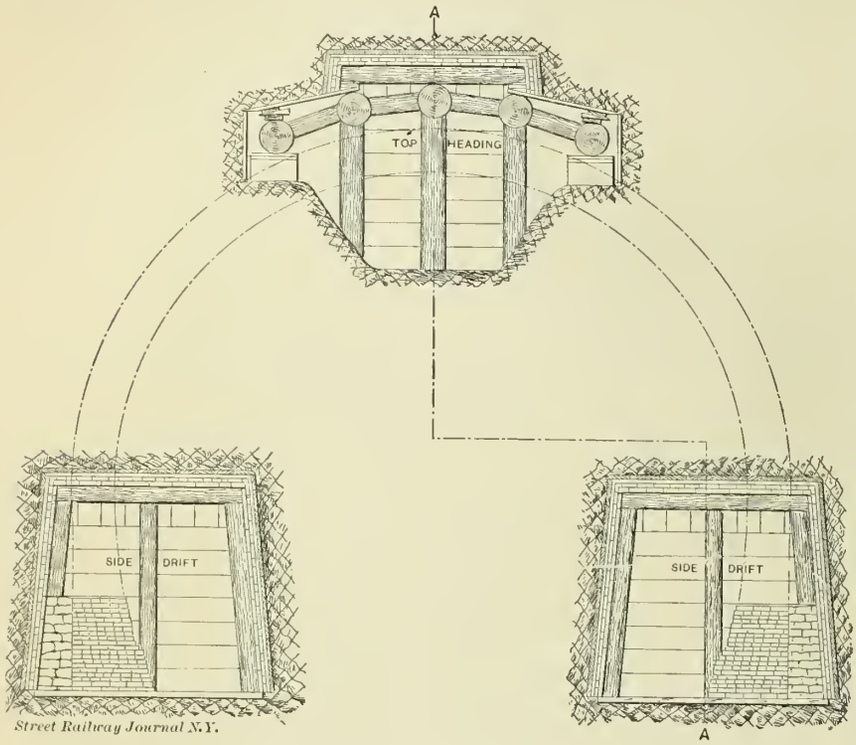
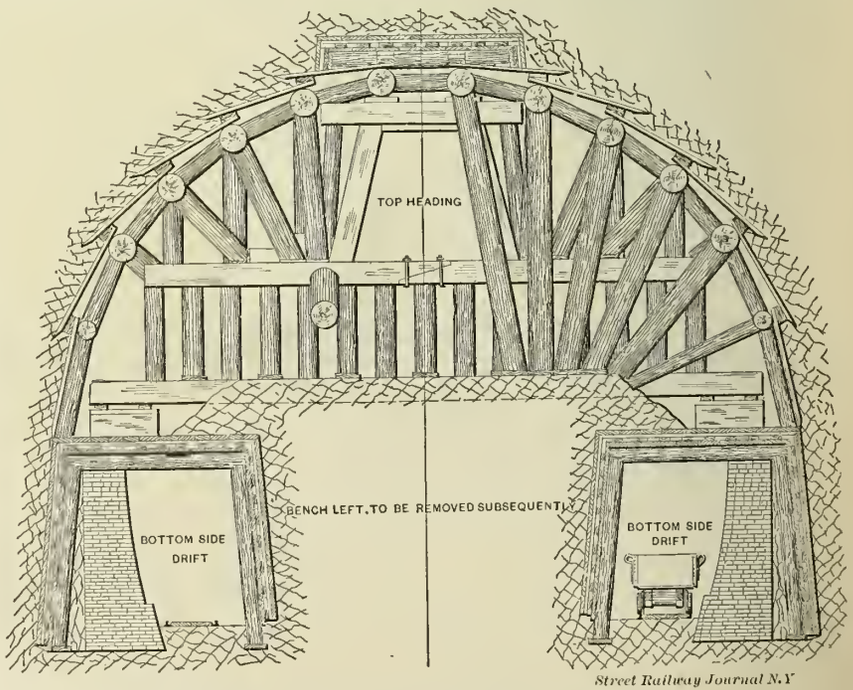


FIG. 3.—TRANSVERSE SECTION OF TUNNEL DURING CONSTRUCTION—BALTIMORE BELT RAILWAY.

To provide capital for the work, the Maryland Construction Co. was organized by officers of the railways interested and Baltimore capitalists, and John P. McDonald, one of the present contractors, was elected president. Work was commenced in September, 1890. The entire length of line is 7.2 miles, of which 8,600 ft. is underground. The estimated cost of the entire line is about $6,000,000 and of the tunnel $1,750,000.

It was in the tunnel, of course, that the chief difficulties were met. The section decided upon is shown in Fig. 1 and is twenty-seven feet wide and twenty-two feet high, maximum dimensions, the excavation necessary being from three to five feet greater than this. The greater part of the soil through which the tunnel is being driven is sand, but there are seams of gravel, clay, etc., with layers of rock, and one section where for about 550 ft. the tunnel will be driven through solid rock. The greatest distance between the crown of the tunnel and the surface is seventy feet, and as the work extends the greater part of its length under Howard Street, one of the principal business streets of the city, excavation had to be carried on without obstructing the street, adding largely to the difficulty of the work.

Five shafts have been sunk from the surface, all on one side of the line of the tunnel, and these are connected to the tunnel at the bottom by horizontal drifts. Fig. 2 shows the details at shaft No. 3, the horizontal dimensions of which are 9 × 14 ft., inside timbers, and total height of hoist, fifty-four feet. The shaft is divided into two compartments, the elevator well and a well in which to lower long timbers. The former contains a cage carrying rails for the dump car, and is operated by a Ryan & McDonald hoisting engine situated at the mouth of the shaft. Here is also placed a second engine for operating a timber derrick, as well as an electric light engine and dynamo, and the boilers for furnishing steam. The material removed from the heading is dragged by mule power in dump cars to the shaft and raised to the surface, when it is dumped into carts and afterwards used for filling on the Baltimore & Ohio Railroad. Fig. 2 also shows section of a heading with bench derrick at work. There is a similar derrick and rigging in the opposite heading. The arrangements at the other four shafts are like those described above, except that at shaft 5 buckets are used to hoist the excavated material instead of elevators, and there is no electric light plant, current for the arc lamps in the drifts being derived from the stations at shafts Nos. 2 or 3. Otis Bros., of New York City, supplied the elevators for shafts Nos. 1, 2 and 3, and Bates & Co. of Baltimore, that at shaft No. 5. Figs. 3 and 4 show sections of headings and method of driving employed. As will be seen, two bottom side drifts and one top drift are driven, the former being kept about twenty-five feet in advance of the latter. By this method the material through which the top drift is being driven is kept drained by the bottom drifts. Considerable water has been met in the construction of the tunnel, and in many of the bottom drifts enough water is constantly flowing to fill a five inch pipe. The bottom drifts are about 8 × 8 ft., affording sufficient room for two miners and a helper. By working it two ten-hour shifts an advance of from fifty to ninety feet per month can be made in each heading. The bottom of each drift is then excavated until a solid foundation is obtained, concrete, if necessary, being laid for a depth of one or two feet; the side walls are then built, and the space between the side walls and the outside lagging is packed with dry rubble or rubble masonry. As the top drift is enlarged its supports are arranged to rest on the side walls, as shown in Fig. 4, leaving the material between the two side drifts to be removed later.



F.G. 4.—TRANSVERSE SECTION OF TUNNEL DURING CONSTRUCTION, TOP HEADING ENLARGED.—BALTIMORE BELT RAILWAY.

The brick work of the arch is built in eighteen foot

sections, a section being commenced as soon as the excavation has been completed, in advance of the finished portion for the necessary distance. The arch is built in most places of five layers of Baltimore brick, but eight



FIG. 5.—INTERIOR OF TUNNEL—BALTIMORE BELT RAILWAY.

layers are used in some portions. Air for ventilation is supplied from the exhaust of the drills and hoisting engines in the headings, and also by special pipes supplied by air from a conductor located at the corner of Park Avenue and Preston Street and which also supplies hoist, drills and pumps. This condenser, the only one used in the work, has cylinder dimensions eighteen and a quarter inches diameter, with twenty four inches stroke, runs at ninety-four revolutions and furnishes 683 cu. ft. of free air per minute. It was manufactured by the Ingersoll-Sergeant Drill Co. who also furnished the three drills employed in the work. Fig. 5 is from a photograph taken by flash light of one of the top headings, and Fig. 6 shows two Ingersoll-Sergeant drills used in the removal of rock. The linear feet of the tunnel completed July 30, 1892, was 5,405.

A description of the electric locomotives to be used, and which are being manufactured by the General Electric Co., at Lynn, Mass., was given in our June issue.

Which Electric Motor?

The following quotation from a letter recently received by us, graphically describes the troubles which one street railway manager had in endeavoring to select the best electric system to use upon his road:

"Before I started on my investigating tour I thought from what I had learned from street railway men and from a good deal of reading in the STREET RAILWAY JOURNAL and elsewhere that I knew something, but what little I did know was knocked out of me by listening to the sweet words spoken in my ears by the representatives of the different motor manufacturers. I admit now that I know nothing. If I could combine the different systems together, that is, if I could pick out of each that part which is so much better than the other fellow's part, I have come to the conclusion that our cars would run without power, and we could dispense with a steam plant.

"After my return from my tour of inspection I wrote about forty letters for information to as many different street railway companies and received answers from nearly all, and I agree with the president of a street railway company who closes his letter as follows: 'I would advise you not to take much stock in the talk of sellers of equipments, but find out your own needs and put in plans to suit yourself.' I agree in part with him Talk is cheap. I am advised to put in a seventy horse power generator for my four cars, and that each car should have a thirty horse power in motors all agreed to that. But one representative motor man said: 'You ought to adopt our system because you can propel your cars with half the current required by the motors of the other manufacturers.' And to verify his statement, he pulled out a book of tables showing this motor really only took half as much power as the other motors. This was good news to me, because I thought that if this motor took only half as much current as the others, a thirty-five horse power would be amply large enough. But what was my surprise when in reply to my inquiry as to what size of generator he would recommend, he smilingly said: 'A 120 H. P. generator will do.'

"Nearly every answer of inquiry closes by saying, 'Be careful; don't believe half what the equipment men say. Make your own plans. Don't build too small a station. We could have saved thousands of dollars if we had to do it over again.'"

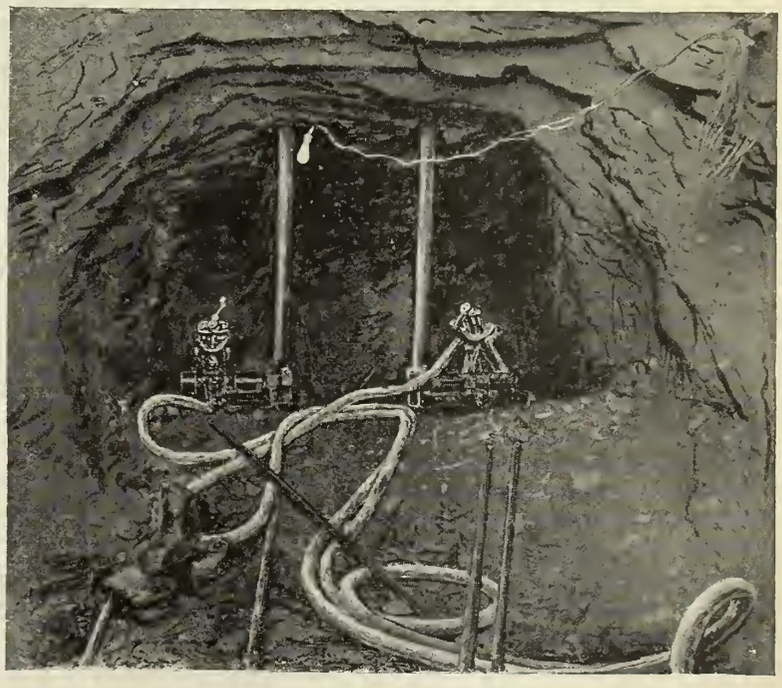


FIG. 6.—DRILLS AT WORK—BALTIMORE BELT RAILWAY.

THE contractors for the electric road from Alexandria (D. C) to Mount Vernon have been put under bonds to complete their portion of the work by September 1.

THE St. Paul City Railway Co., and the Minneapolis St. Railway Co. will soon be things of the past, and in a very short time the street railway systems of St. Paul and Minneapolis will be opened and operated by the Twin City Rapid Transit Co., which was organized several months ago. As one of the first steps in the movement, General Manager Scott of the City Railway Co. has resigned his position, and the new company will have its headquarters in Minneapolis, and will be in charge of General Manager Goodrich.

World's Fair Transportation Building.

In the March issue of the STREET RAILWAY JOURNAL appeared an engraving showing the Transportation Building at the World's Fair grounds. Since that time work on the structure has proceeded with great rapidity, and the building is now approaching completion. The cut herewith presented is a reproduction of a recent photograph of the north entrance. The entrance, it will be observed, is decorated by a number of life-size figures, some allegorical, and others of eminent men who have contributed by their inventions to the development of transportation machinery and appliances. The figure at the right is that of a helmsman, and that at the left of a brakeman.

Gas Motors in Illinois.

J. M. Roach of the North Chicago Street Railroad Co. has been elected president, and O. W. Owsley, of the West Chicago Street Railroad Co., vice-president of the Connelly Motor Co. of Illinois, mentioned in our last issue, as recently organized to build gas motors under the Connelly patents. The company have secured a factory at 197 Clinton Street in Chicago, and five motors are already in course of construction. It is expected that these will be completed and ready for use on the lines of the North Chicago Street Railroad some time during September. They will be used on the Garfield Avenue loop. When these are built the company will construct fifteen motors for use on the Sedgwick Street and Larrabee Street lines. The company hope to complete these machines so that they may be operated during next winter. The general design of the motor is the same as that operated with success by Mr. Connelly on the North Side system, but minor changes will be made in the construction, which will add to their mechanical strength.

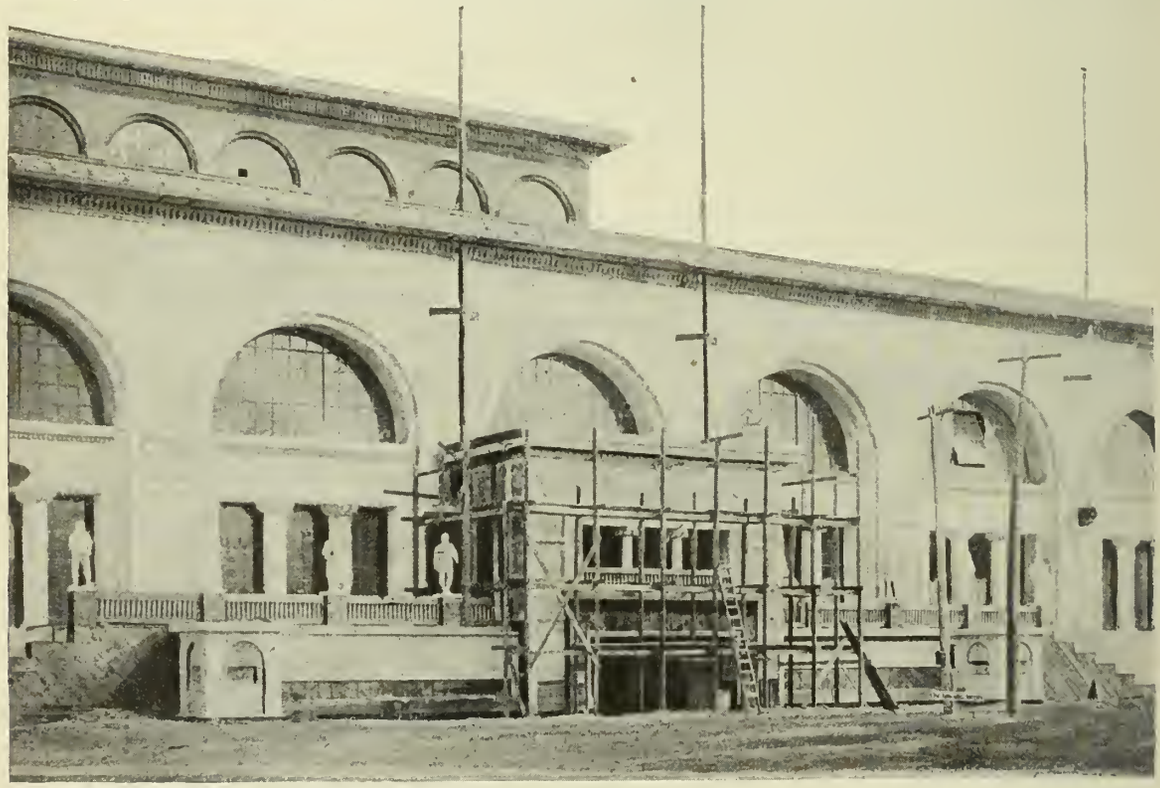
THE annual report of the General Omnibus Co., of Berlin for 1891, according to *Le Journal des Transports*, shows the number of passengers during the year to be 20, 872,701 in place of 19,193,192 in 1890. The number of passengers per vehicle per day was 414, in place of 409 during the preceding year and the receipts were $558, 553.68, an increase of $43,081.92 over 1890. In spite of the increase in cost of forage the dividend declared was 12 ⅓ per cent, the same as the preceding year.

An Air Brake for Street Railway Cars.

With the change from horse power to mechanical traction in street railway service, the greater weight and, in most cases, the greater speed of the cars have increased the demand for a quick action power brake. Trains composed of several cable cars or electric cars and trailers, weighing from six to ten tons or more, have to be stopped quickly in crowded streets so that the necessity of a power brake is almost, if not quite, as indispensable as in steam railway service. Air brakes have now practically supplanted all others in steam railway service, and in our April issue of last year we described the Genett air brake which was designed for street car service. In the accompanying illustrations is shown the same brake, improved, and as now placed on the market by the Genett Air Brake Co., of 11—23 So. Jefferson Street, Chicago, and 150 Broadway, New York.

The air compressor is small, compact and effective, and with the rest of the apparatus is so placed as not to interfere in any way whatever with the electric equipment. The air pressure in the cylinder is maintained steadily at any desired pressure without any attention from the driver. The action of the brake is instantaneous, both in application and in release, and it is capable of frequent application without fear of using up the stored air pressure. The brakes on a train of several cars can be operated by one motorman or driver, and can be applied to every wheel on the train, holding the wheels just short of the sliding point and thereby making the best possible stop without noise, jar or injury to the machinery. The brake is simple in construction, has few parts, and the cost of repairs is very small. Fig. 1, shows a car and the apparatus in place, with a section of the lower part of the car broken away to show the position of the machinery and cylinder. In Fig. 2, *1* is the air pump or compressor, *2* the eccentric which is attached to the axles of the car and furnishes motion to the piston of the air pump, *3* the jam cylinder which contains a piston attached to brake levers in such a manner that when the air pressure forces out the piston the brakes are applied, *4* the controlling valve with which the man in charge applies and releases the brake, *5* the reservoir where the compressed air is stored ready for use.

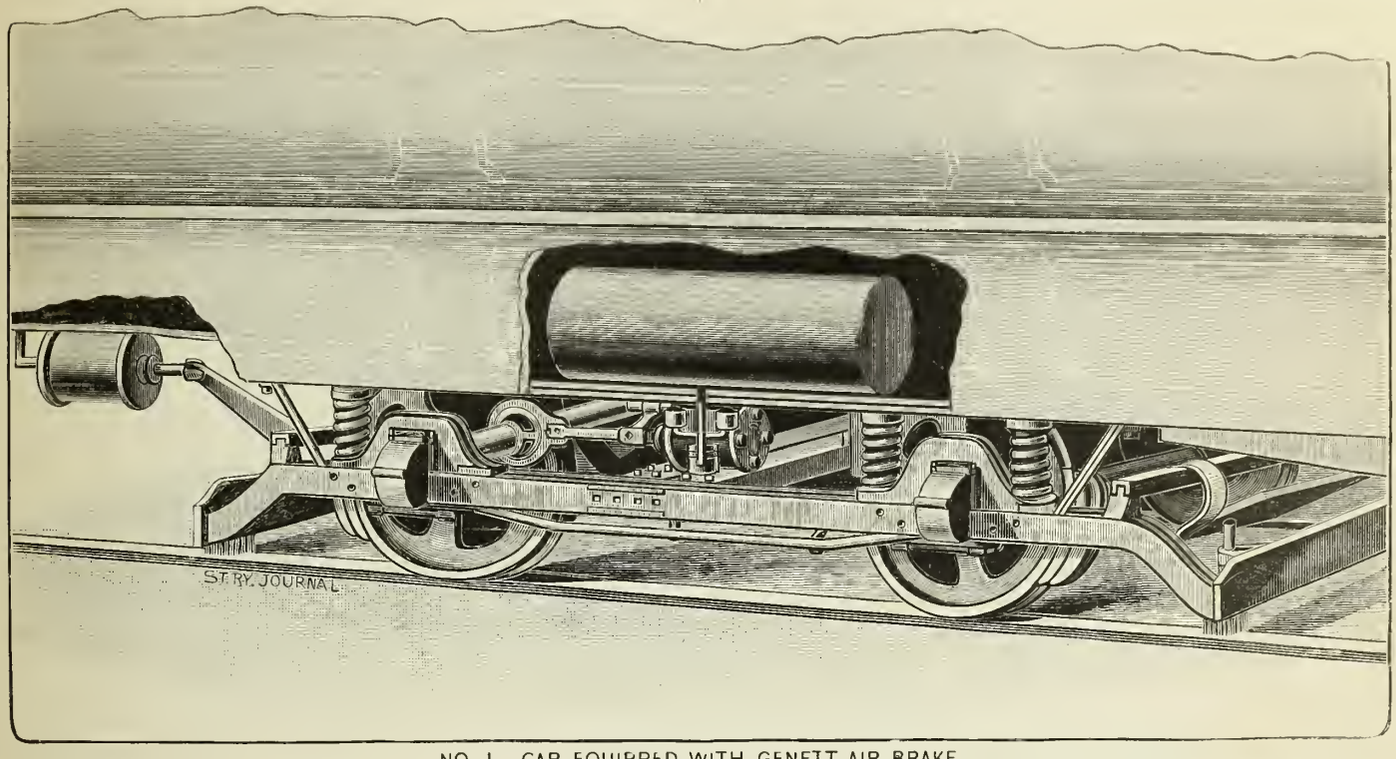
Fig. 3 shows the details of the air pump or compressor. This, as has been stated, is driven by an eccen-



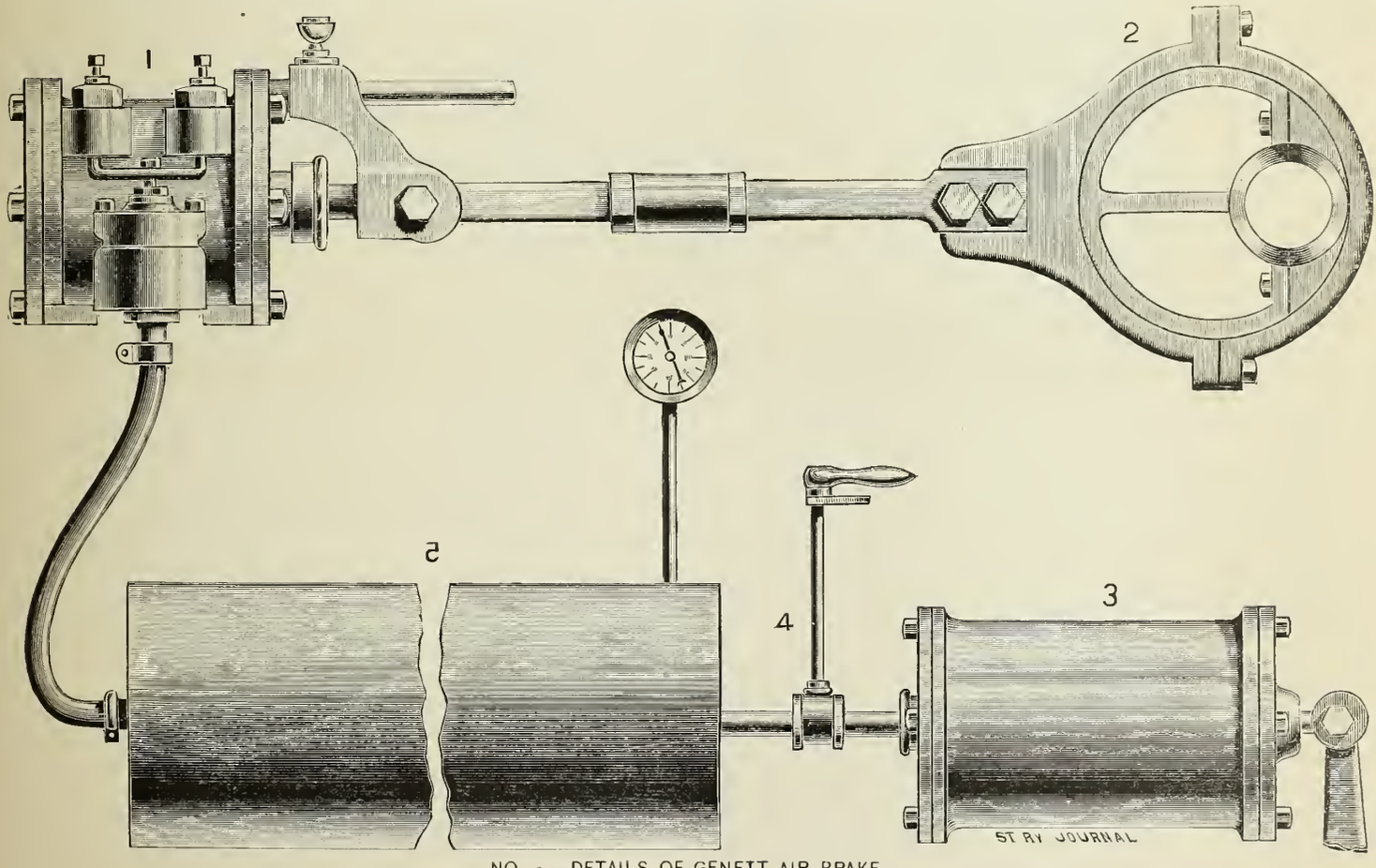
PRESENT APPEARANCE OF TRANSPORTATION BUILDING AT JACKSON PARK.

tric keyed to the car axle and has two suction and two discharge valves, such as are used in double acting pumps. It is of compact and effective design, and its special feature is the means by which the pump is prevented from working when sufficient pressure has been stored up. This is accomplished as follows: C and D represent the two rod, *9*, and can be regulated to any desired tension by regulating nut, *11*, which sets the pressure desired to be carried in reservoir.

The action of the air pump is as follows: As long as the air has not reached the set pressure desired to be carried, the pump compresses direct into the reservoir and



NO 1.—CAR EQUIPPED WITH GENETT AIR BRAKE.



NO. 2.—DETAILS OF GENETT AIR BRAKE.

suction valves, E and F the discharge valves which discharge the air into a single passage or port, O, leading through the governing cylinder, B, into the reservoir. This governing cylinder, B, contains a piston, *8*, the under side of which is held against and actuated by the air pressure in the reservoir. A standard spring encircles the piston will continue until such pressure is reached. When the pressure exceeds the tension of the spring it forces upward the governing piston, *8*, and with it yoke, *12*, which automatically lifts suction valves, C and D, from their seats. This opens the air cylinder and allows the air piston to move in free air, doing no work until the air brakes are

applied. Any use of the brakes reduces the pressure, and causes the suction valves to return to their seats, when the compressor is ready to restore the pressure again. The action of the governor piston is so sensitive that the slightest reduction of pressure in the reservoir will start the pump to work even though it requires only one stroke to give full pressure, when it is cut out again. In starting, compressor fills the reservoir to a pressure of thirty pounds before the car has traveled 280 ft. In making a stop, only two to three pounds registered pressure is required, and this the compressor furnishes again before the car has traveled forty feet. The reservoir, moreover, holds in reserve ten times the required air to stop the car even without the additional supply, so that the air pressure is practically inexhaustible.

The eccentric can be easily attached to the axle of the car. It is made strong and durable, and being oval in shape between the strap and the cam, will not collect any dirt. The power of the air jam cylinder is easily calculated, and is equal to the square inch area of the piston multiplied by the air pressure carried in reservoir. Hence six inch diameter and thirty pounds air give 850 lbs. power, and eight inch diameter and forty pounds air give 2,000 lbs. power. The power may be increased by using larger diameters or higher pressures, and by arrangement of brake levers any additional power may be obtained, graded to the weight and speed of the car.

The controlling valve consists of a specially designed three-way valve, and is connected with the pipe to the reservoir, and also with the train pipe which supplies the air jam cylinder. There is also an opening to release the air from the train pipe and the jam cylinder when the valve is turned to release the brakes. A gauge in connection with the air reservoir can easily be attached to the dashboard, while the three-way valve can be placed directly under the platform where it is easily moved.

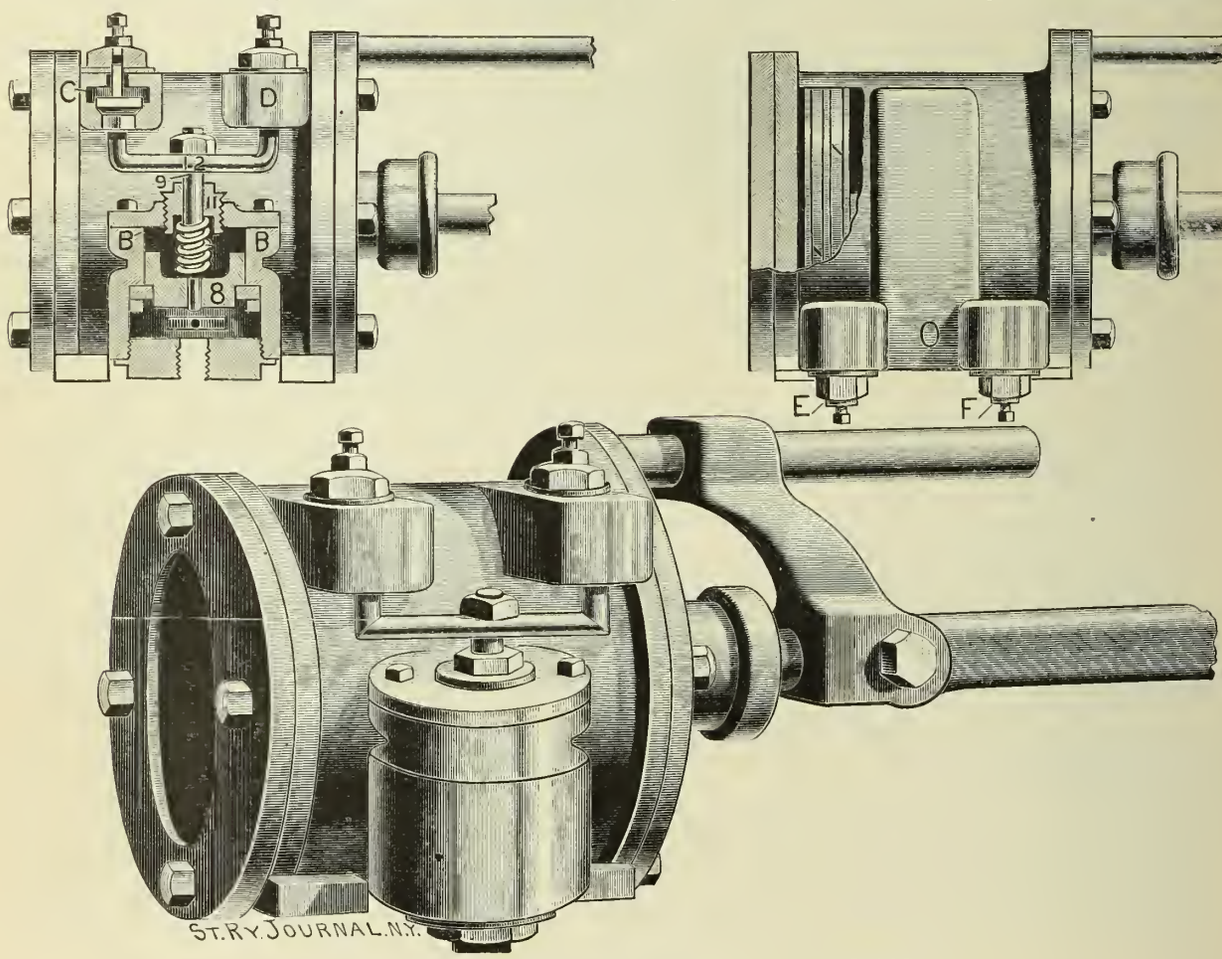


FIG. 3.—GENETT AIR BRAKE—DETAILS OF COMPRESSOR.

The petition of the Belt Line Railway Co. of Augusta, Ga., for an extension of time for the construction of the road until the 15th of last month was granted.

Short Grip Cars on the North Chicago Railway.

The North Chicago Street Railroad Co., of Chicago, have of late been experimenting with a grip car which is only twelve feet in length, and provided with seats for twelve persons, five on each side and two in front. The car was built for the experiment by the Brownell Car Co., of St. Louis, and the tests have been so satisfactory that Superintendent J. M. Roach has decided to purchase a considerable number for use on the North Side system. In a conversation with a representative of the Street Railway Journal, Mr. Roach said he favored the short grip car for the reason that by its use the jerking of a train seemed, for some reason, to be obviated almost entirely. It rounded curves easily, as the wheel base is only four feet. A train composed of the short car and trailer possessed all the advantages of a combination car, and one conductor was able to look after both without trouble. The grip car was sufficiently large to furnish accommodations for smokers, and would naturally be used by them almost exclusively so that ladies would not be annoyed by smoke. The experience he had had convinced him that the car possessed sufficient advantages to warrant its adoption on a large scale

On July 15, a disastrous fire occurred in the power station of the Penn Incline Railway, Pittsburgh, Pa., causing damage to the amount of $35,000, all insured. Considerable excitement was caused by the fact that one of the cars which was at the top of the incline caught fire, and had the cable parted the blazing car would have decended the incline and caused considerable damage; but, fortuuately this did not take place, owing to the efforts of the fire department.

Tourists will be especially interested in the announcement that an electric road to the Yosemite and Big Tree region of California has been projected by Prof. T. S. C. Lowe, of Pasadena, who has been appointed commissioner for the management of the Yosemite Park by Governor Markham.

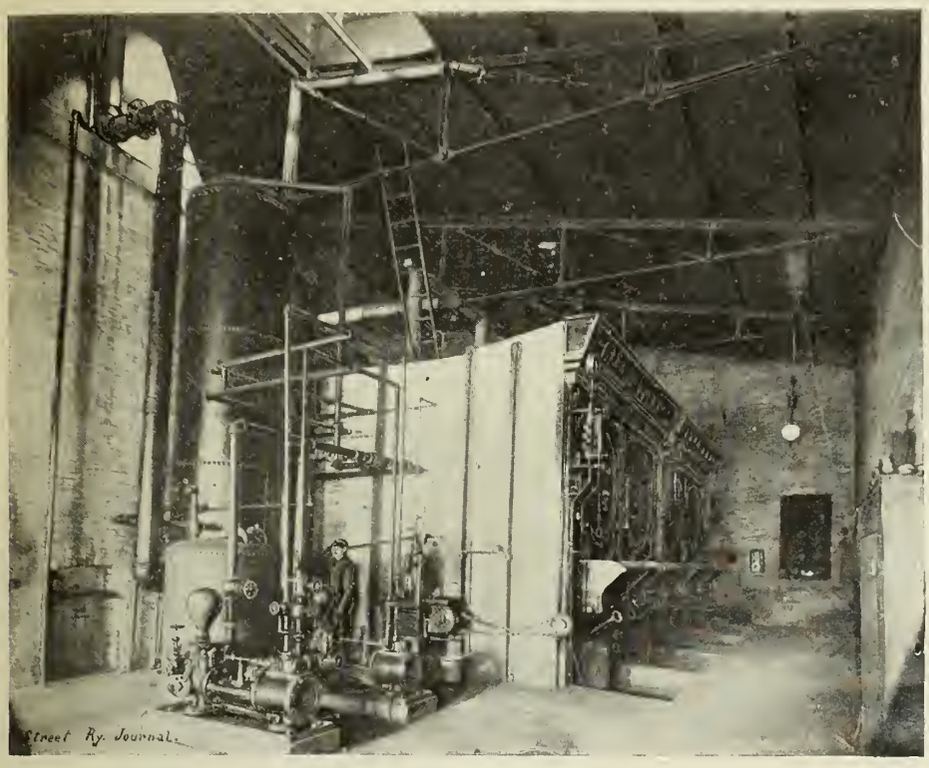
Street Railway Extensions in Chicago.

The street railway systems of the south and west divisions of Chicago are to be very considerably extended during the present year. Ordinances were passed by the City Council a few weeks ago, and work is to be begun immediately. It is not unlikely that electricity will be introduced as a motive power in both sections of the city.

The West Chicago Railroad Co. will build about forty miles of crosstown lines which will greatly improve their service. The contract for the track construction has been awarded to Wright & Meysenburg of Chicago. Johnson and Wharton rails will be used, weighing about eighty-five pounds to the yard.

It has not yet been determined how these roads shall be operated. The company hope to be able to find a motor that will be satisfactory in all respects, but nothing which has been examined has met all the requirements. The company, however, are making tests which they trust will lead the way to the adoption of a motor The track construction will be completed about November 1. If the question of a motor is not then determined, horses will be used, as the company will have plenty on their hands, as the Blue Island Avenue cable when it goes into operation will release about 900 horses on that line.

The Chicago City Railway Co. will build about twenty miles of new road. The Sixty-first, Sixty-third and Forty-seventh Street lines will be built first. Seven inch, ninety pound, Johnson rails will be used, and as they will be bonded, unquestionably electric motors will be operated. Nothing definite regarding a system can be stated at the present time.

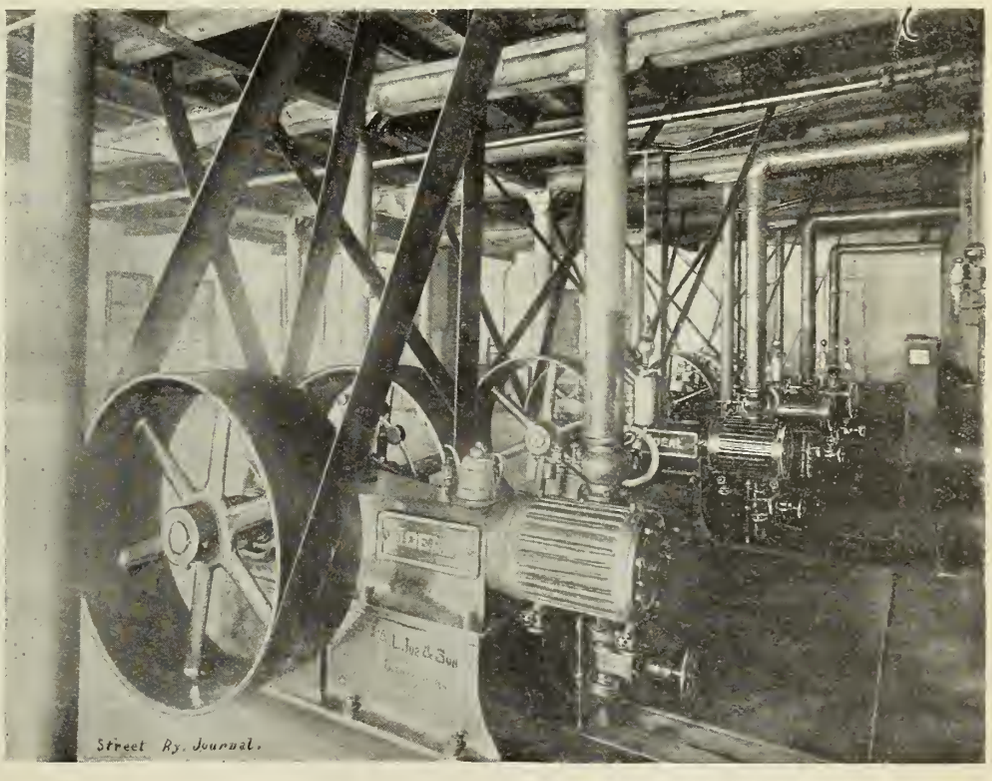


CHICAGO AVENUE ELECTRIC LIGHT STATION—SHOWING BOILERS.

A Chicago Electric Light Station.

Electric railway interests and electric lighting interests have so many points in common, and the construction of stations for the two purposes is in many respects so much alike, that many of our readers will doubtless be interested in the accompanying views of the municipal plant of the city of Chicago for street lighting, located on the corner of Chicago Avenue and Sedgwick Street. This plant has been in operation nearly two years and a half, and has been entirely free from shut-downs. The dynamos supply current to 250 arc lamps each night, covering District 4 in which there is about thirty-eight miles of underground electric lighting cable.

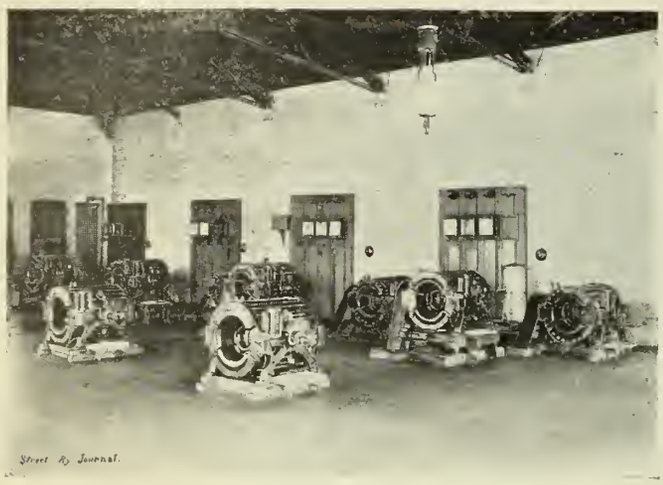
An excellent view of the eastern half of the boiler room of this station is given in Fig. 1. This room contains four steel boilers manufactured by the National Boiler Works of Chicago, each boiler being eighteen feet long, sixty-six inches diameter and having sixty-four four inch tubes. These boilers are set in brick as shown, and are provided with automatic stokers. At the left of the view is a Colles heater, made by E. G. T. Colles & Co., of Chicago. This heater is of 800 H. P. capacity and has recently been installed, with the result of appreciably increasing the efficiency of the plant. The heater is of large capacity and is capable of supplying a corresponding battery of boilers to that shown. A good idea of its unusual size can readily be obtained by comparing it with the man who is standing right near it. At the right of the heater are the pumps and surge tank.



CHICAGO AVENUE ELECTRIC LIGHT STATION—ENGINE ROOM.

The engine room is located in the front of the building and contains five engines of 125 H. P. capacity each, shown in Fig. 2. These engines are of the Ideal type and run at a speed of about 260 revolutions per minute. Each engine is belted directly upward to three dynamos, as

shown. The engines are run at a pressure of about ninety pounds. A view of the dynamo room is given in Fig. 3. This room is directly over the engine room and contains eleven dynamos of thirty-five lights capacity each, and one



CHICAGO AVENUE ELECTRIC LIGHT STATION—DYNAMO ROOM.

machine of fifty lights, all of the Thomson-Houston pattern. Eight circuits run from this station, and the switchboard connections under the floor are well insulated. B. B. Dotson, who was the engineer of the first municipal plant that the city of Chicago built in 1887, has immediate supervision of this station.

The New Anger Truck.

A new street railway car truck, the design of John E. Anger, of Troy, N. Y., has been recently brought out by the Gilbert Car Manufacturing Co., and is illustrated herewith. The truck is named after the inventor, and contains many novel features, as will be seen from an inspection of the accompanying engraving which shows it complete and ready for operation. Any tendency of the car body to oscillate is avoided through the half elliptical springs which are carried in the centre of the truck, and by the arrangement of the upper side bars which are jointed below the springs. The truck is the longest ever built, and supports the car for fifteen feet between centres of end springs, touching the body in twelve different places. This makes the truck very easy running and adds materially to its life.

The ease with which the motive machinery is accessible is another important feature. For repairing the motors or the truck, the lower side pipe truss rod is removable, allowing access underneath the truck from the side. The cap under the journal box is also removable so that the axle can be dropped out. This is especially important where gearless motors are used.

Although the truck has been in practical use for over a year, little has been said before by the manufacturers in regard to it, because they were anxious to first thoroughly test the truck in actual service. Use on street railways in Albany, N. Y., and Paterson, N. J., during the last twelve months, however, have proved the desirability of the various points embodied in its construction, and the manufacturers will now place it on the market with confidence that it will accomplish all that is claimed for it.

Handsome Cars for Milwaukee.

The style of cars, which the Pullman Car Co. will build for Milwaukee is illustrated in the accompanying engraving. The length of the car body is eighteen feet seven inches. The inside finish is quarter sawed oak; spring seats and back covered with Wilton carpet are used. The ceiling is of quarter sawed oak, and is handsomely decorated.

The floor is covered with Everett wood matting, and the windows are screened by roller curtains. Four sand boxes will be placed on each car, and at the platforms will be removable gates. All the trimmings of the car will be of bronze. The steps will be of steel of the Stanwood type, and for heating the stove of the Standard Railway Supply Co. will be employed.

The cars are mounted on truck, type 19 F, of the McGuire Manufacturing Co., and motive power is furnished by Edison double reduction motors.



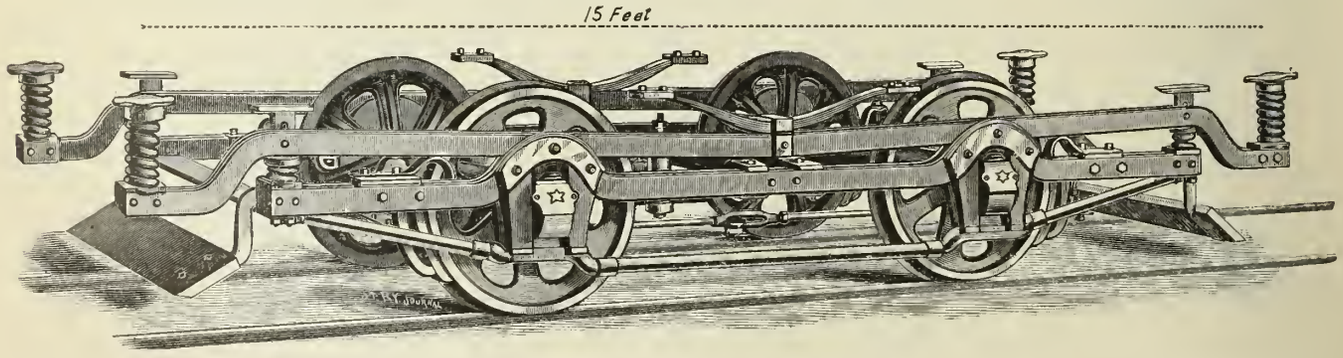
NEW PULLMAN CAR—MILWAUKEE.

The Pullman company have received the contract for supplying fifty of these cars. The order for the new open cars which the Milwaukee Street Railway Co. expect to purchase, will not be given out until some time this fall.

New York Street Railway Association.

The tenth annual meeting of the New York Street Railway Association will be held at the United States Hotel at Saratoga Springs, N. Y., on Tuesday, September 20, at 10 A. M. The secretary states that the papers to be presented are as follows:—"Recent Improvements in Cable Traction," by G. W. McNulty, engineer, Broadway & Seventh Avenue Railway Co., New York; and "Recent Improvements in Electric Traction," by L. H. McIntire, engineer, Harlem Bridge, Morrisania & Fordham Railway Co., New York. The meeting should be well attended.

15 Feet



THE ANGER STREET RAILWAY TRUCK.

Incline Railways in Switzerland.

Switzerland is peculiarly the home of the mountain railway, and many of its peaks, formerly inaccesible to the ordinary tourist, can now be easily and quickly reached by these incline railways. In spite of the enormous expense involved in construction, and the shortness of the season, these railways seem to be excellent investments judging from the number which have been built during the last few years and from the present list of projected roads. The latter include a railway to the summit of the well known Jungfrau, and another part way up the still more famous Mt. Blanc.

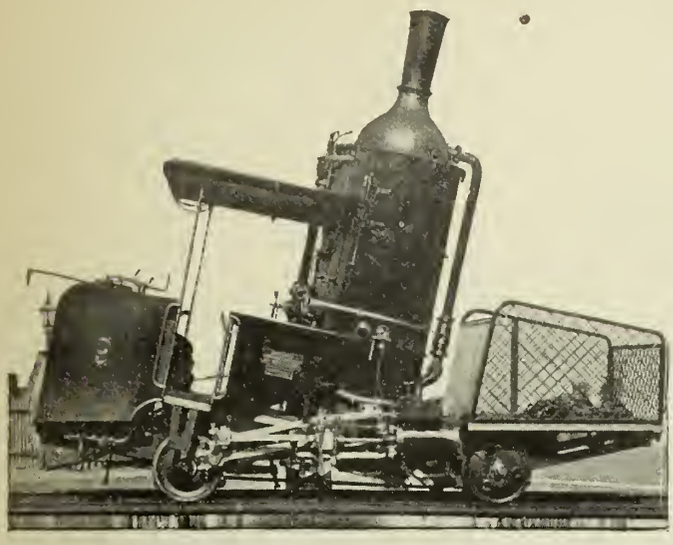


FIG 1.—LOCOMOTIVE—MT. RIGHI INCLINE RAILWAY.

The first of these roads was that built up the Righi

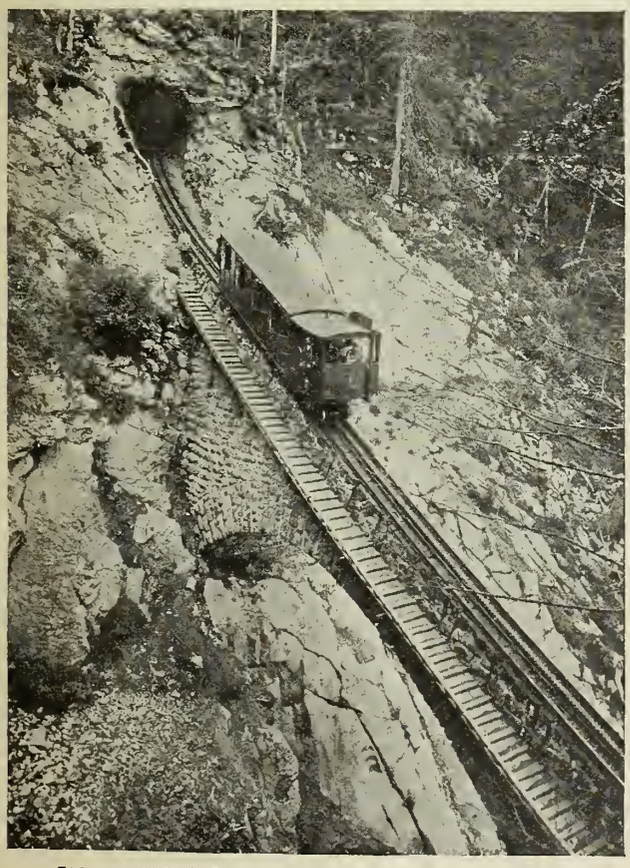


FIG. 2.—VIEW ON MT. PILATE INCLINE RAILWAY.

in 1874, and was patterned after the Mt. Washington (N. H.) railway which was built in 1868, though a few improvements were introduced.

The Righi railway starts from Vitznau on Lake Luzerne and extends a distance of three and a half miles to Righi-Kulm at an altitude of 5,905 ft.. with two or three branches to neighboring peaks. The type of engine used, shown in Fig. 1, weighs twelve and a half tons. A gauge of four feet eight and a half inches is used, and the rails weigh thirty-five pounds to the yard. The rack into which the driving pinion of the locomotive gears is located midway between the rails, and consists of two channel bars placed back to back and five inches apart. The bars are bolted together by triangular rivets of cast steel which serve as teeth. The ties are set into the solid rock or into masonry, and still further kept in place at intervals of 250 ft., by cross sleepers which are firmly anchored. The average grade on this line is 22 per cent and the maximum is 25 per cent. The average speed of a train is about three miles per hour.

The mountain railway to the summit of Mt. Pilate (so named because by tradition it was the mountain from which Pontius Pilate finally ended his life by throwing himself into Lake Luzerne), was surveyed in 1885, and was built in 1889. The grades on this line are much more severe than on Mt. Righi, being 36.6 per cent and the maximum 42 per cent. Under these conditions a simple rack railway did not present a guarantee of sufficient safety, and the builders had recourse to a new type of road invented by Colonel Locher. The rails are here placed on iron ties, the latter being firmly fastened to granite blocks on a substructure of solid masonry. In the centre of the track are placed two vertical racks back to back, into which gear the horizontal toothed wheels of the locomotive. The latter is not separate from the passenger car, but the two are combined so as to form one vehicle, the whole being carried on two axles and supoprted at three points, namely, at the leading and at the ends of the rear axle. As with the Righi railway, the motive power is in the rear of the passenger section. The car wheels are without flanges, so as to reduce friction, the train being kept on the track by the centre rack which forms a sufficient guide.

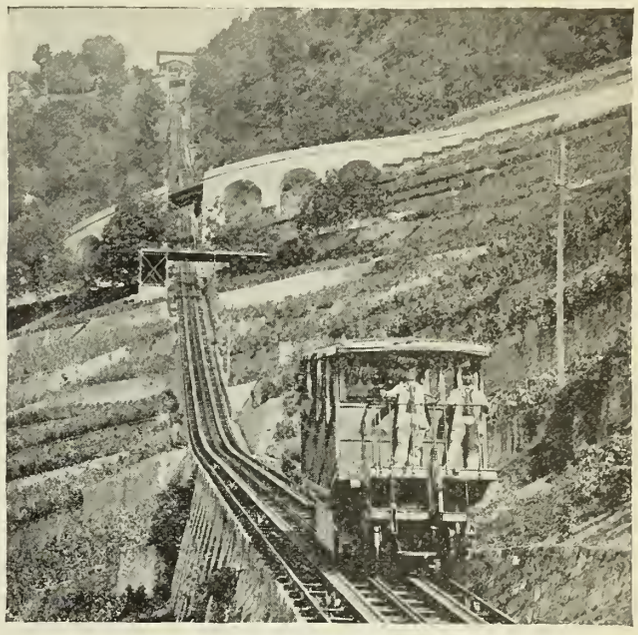


FIG. 3.—VIEW ON INCLINE RAILWAY AT GLION.

The horizontal pinions which gear into the rack are four in number, one on each side at both the forward and rear ends of the car, the latter being depended upon for the motive power. These pinions have also two flanges which run on the top and base of the channel holding the racks, the object being to steady the car. There are also specially arranged clutches which can be fitted under the rails in order to prevent the car from being blown over by the wind, if surprised by one of the furious tempests which are sometimes encountered at these high altitudes.

The boiler of the locomotive is placed transversely to the track, so as to keep the water on a level. The cars are in three compartments, each capable of holding eight passengers, and are protected by two hand brakes, one ordinary air brake and one automatic brake which fits into the gear teeth, and is operated by a wedge when the speed

exceeds three and a third miles per hour. The car, with passengers and motive power complete, weighs about 105 tons, and its average speed is 2.2 miles per hour. Fig. 2 shows a section of the road and gives a good idea of some of the difficulties encountered. The inclined plane railway at Glion, Switzerland, shown in Fig. 3, calls for no extended description, as it is a hydraulic cable railway similar to many in America. The line is single track at the top and bottom, with a turn out at the central part of the line. The rack in the centre of the track is for braking purposes.

Indianapolis Street Railway System.

The street railway company of Indianapolis, whose plucky defense of their rights against labor agitators last winter made them well known to railway men the country over, are at present operating their road very satisfactorily and giving an excellent service.

At the present time the company operate eighty-five miles of track, thirty-five of which are traversed by electric cars, the motors being of the Thomson-Houston and Westinghouse types. Fifty-five miles are operated with mule power, but it is the intention of the company to ultimately run all their cars by electricity. In pursuance of this policy, all the lines that are rebuilt are laid with heavy girder rails, and bonded for an electrical return. In an extension which the company are now making of four miles to the fair grounds, a forty pound T rail is being laid. Most of the rails at present in use were furnished by Wm. Wharton, Jr., & Co.

In the fall of 1890 the company introduced on the Irvington line two storage battery cars. They were operated four or five months, at the end of which time they were in such bad condition that they were withdrawn from service, and two mule cars were substituted. The cars were then overhauled by the company that had installed them, and the service was resumed for a second period of four or five months. The depreciation of the batteries was so great that it was then necessary to abandon them permanently. It should be said in this connection that the officers of the company still have faith in the storage system, and believe that the time is coming, and is, perhaps, not far distant, when the storage system may prove successful. The overhead wires in the streets are for the most part carried by centre poles. The car windows and platforms are properly guarded for the protection of the unwary passenger.

The power station was wisely planned to provide for considerable extension, and the wisdom of this provision is already appreciated, since the capacity of the plant was recently increased by several hundred horse power. The boilers are four in number: Two of the Babcock & Wilcox type of 300 H. P. each, and two Hazelton boilers of 500 H. P. each being used. Sufficient steam is generated in each battery to supply the engines, and each battery is run from three to four weeks while the other rests. In this way an abundance of time is secured to clean the boilers and to make such minor repairs as may be necessary.

Oil is burned under the boilers, and the company regard with great favor the use of this fuel. It is found much more economical than coal or natural gas which was formerly burned. The oil is brought in cars to tracks directly across the street from the power plant, whence it is piped to the reservoir of the station.

Until recently, power was supplied by a pair of Wheelock engines of an aggregate capacity of 500 H. P., and a single engine of the same make of 250 H. P. The demand for power has at times been so great that these engines have been called upon to develop 1,000 H. P. They have made a splendid record. The single engine which was installed two years ago has during that entire period lost only two hours in running time. Recently the management have added a second pair of Wheelock engines of a nominal capacity of 600 H. P.



FIG. 1.—TRANSFER CAR—INDIANAPOLIS STREET RAILWAY.

The entire equipment of generators was, until recently, of the Thomson-Houston type, and consisted of one multipolar, 250 H. P. and five eighty horse power machines. The Wheelock engines just installed will drive two Westinghouse multipolar generators of 250 H. P. each.

The transfer system of the company is rather unique, and the plan which is followed is one which, perhaps, would not be feasible in many cities. A general system of transfers is in use, and the public avail themselves of it to a remarkable extent. There are no cross lines in the city, and all cars, with the exception of those running on a single line, pass the transfer station on Washington Street near Illinois Street. A view of the station, which resembles a large vestibuled car, is presented in Fig. 1. Within the car, and near the doors at each end, is stationed a transfer man. Cars coming from either the east or the west stop at the platform of the transfer station, and those wishing to make a change enter the stationary car. The transfer men call the several cars as they stop, and transfer those waiting to the car that they wish to take. Persons who may wish to take cars at this point, but have not paid their fare on any car, hand their nickels to the transfer man on entering, and the latter registers it as an ordinary conductor. Passengers from the single line which does not pass the station, although it runs within a few steps of the point, are provided with tickets entitling them to admission to the station. The

tickets, which are good for only fifteen minutes after issue, are collected by the transfer men and registered by them as fares.

It would appear at first thought to a person who watches the operation of the system for the first time, as if it would be easy for those so disposed to practise a fraud on the company by slipping into the transfer station with a crowd leaving the car; but either the people of Indianapolis are extremely honest and above resorting to such a contemptible, petty bit of knavery or else they have a wholesome regard for the watchful eyes of the transfer men who guard the entrances and the exits. Certain it is that the company have no fault to find with the system on this score.

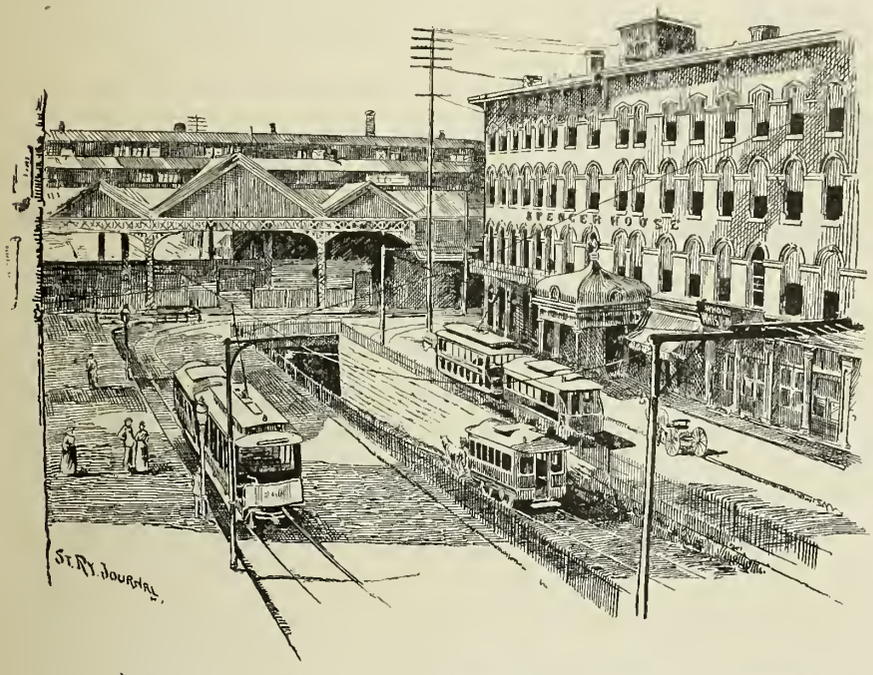


FIG. 2.—ENTRANCE TO TUNNEL ON SOUTH ILLINOIS STREET—INDIANAPOLIS STREET RAILWAY.

The company believe that this system is the most satisfactory one that could be adopted if transfers must be given. They are relieved of all the doubts that afflict a company when a general ticket transfer system is used on all the lines. The people of Indianapolis seem to regard it as an excellent institution. They have a convenient waiting room which is only a step from a car, a feature which is especially appreciated in rainy weather. The car which they wish to take is called when it reaches the station, so they do not have to watch for it. The strongest proof in support of the statement that the system is popular is to be found in the fact that the present transfer car is the last in a series. The first station was a ten foot box car which was drawn by a mule to the transfer point, and was removed at night. At all times the mule was attached to the car lest the city officials should object to an abandoned car. The plan worked well from the start; some residents, to be sure, objected to passing into the car, and protested that they would far rather pay two fares than be subjected to the annoyance of conforming to the regulations governing the transfer system. That idea was soon abandoned, and rich and poor patronized the station with increased regularity. A sixteen foot car was substituted for the original station, and this becoming too small, the present permanent structure was built in accordance with the plan of Tom L. Johnson. At the present time the great objection to the station consists in the fact that it is too small. Transferring from one car to another is a habit that grows on one, and it is hard to accommodate all the people that crowd into the stationary car at all hours of the day.

Fig. 2 shows a view of a car on South Illinois Street entering the tunnel, passing under the Union station train shed.

THE Blakely & Dickson Traction Street Railway Co.; capital $36,000, have been organized at Scranton, Pa.

The Street Railways of New York.

PART I.—*Metropolitan Traction Co.'s Lines.*

Although the Metropolitan Traction Co. does not directly operate any street railway in New York, it exercises a large influence in street railway affairs through the amount of stock in various surface street railway companies which it owns. The company has a capital stock of $20,000,000, with $12,000,000 paid up, and offices at 761 Seventh Avenue. The president of the company is Henry Thompson who is also president of the Broadway & Seventh Avenue Railway Co. The following is a list of the railway companies which the Metropolitan Traction Co. controls by ownership of stock, or by lease: Houston Street, West Street & Pavonia Ferry Railway Co., Twenty-third Street Railway Co., Metropolitan Crosstown Railway Co., Chambers Street & Grand Street Ferry Railway Co., Broadway & Seventh Avenue Railway Co., Broadway Surface Railway Co., South Ferry Railway Co., Sixth Avenue Railway Co., Ninth Avenue Railway Co.

For convenience in operation, these roads, with the exception of the Twenty-third Street Railway Co., have all been leased to one company as described below:

HOUSTON STREET, WEST STREET & PAVONIA FERRY RAILWAY CO.

This railway company is the successor of the Avenue C Railway Co., whose line was sold in 1874 under foreclosure proceedings. The company purchased the real estate, franchises, etc., formerly belonging to the Avenue C Railway Co., from Sheppard Knapp and others who were the purchasers under the mortgage sale, for $750,000, one-third of which was paid in stock and the other two-thirds in 7 per cent., twenty year bonds of the road. It has since been extended so that the main line has one terminus at the 42d Street depot and the other at the Chambers Street Ferry; branches also run to the Grand Street Ferry, East 10th Street Ferry and on Madison Street.

This line has assumed a very important position recently, on account of its having been selected by the managers of the Metropolitan Traction Co. as a lessee of the other roads controlled by them, viz., the Sixth Avenue, Broadway & Seventh Avenue, Ninth Avenue, Chambers Street lines and the Metropolitan Crosstown lines. The present capital stock of the company authorized by charter is $1,050,000 all issued. The funded debt consists of $500,000, 7 per cent., first mortgage bonds, due in 1894.

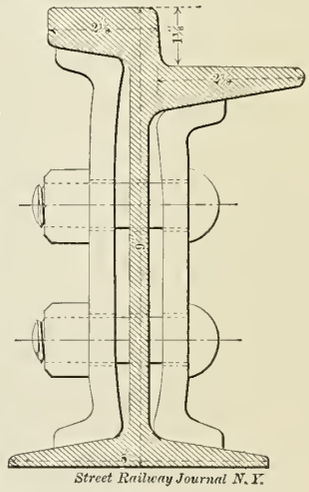


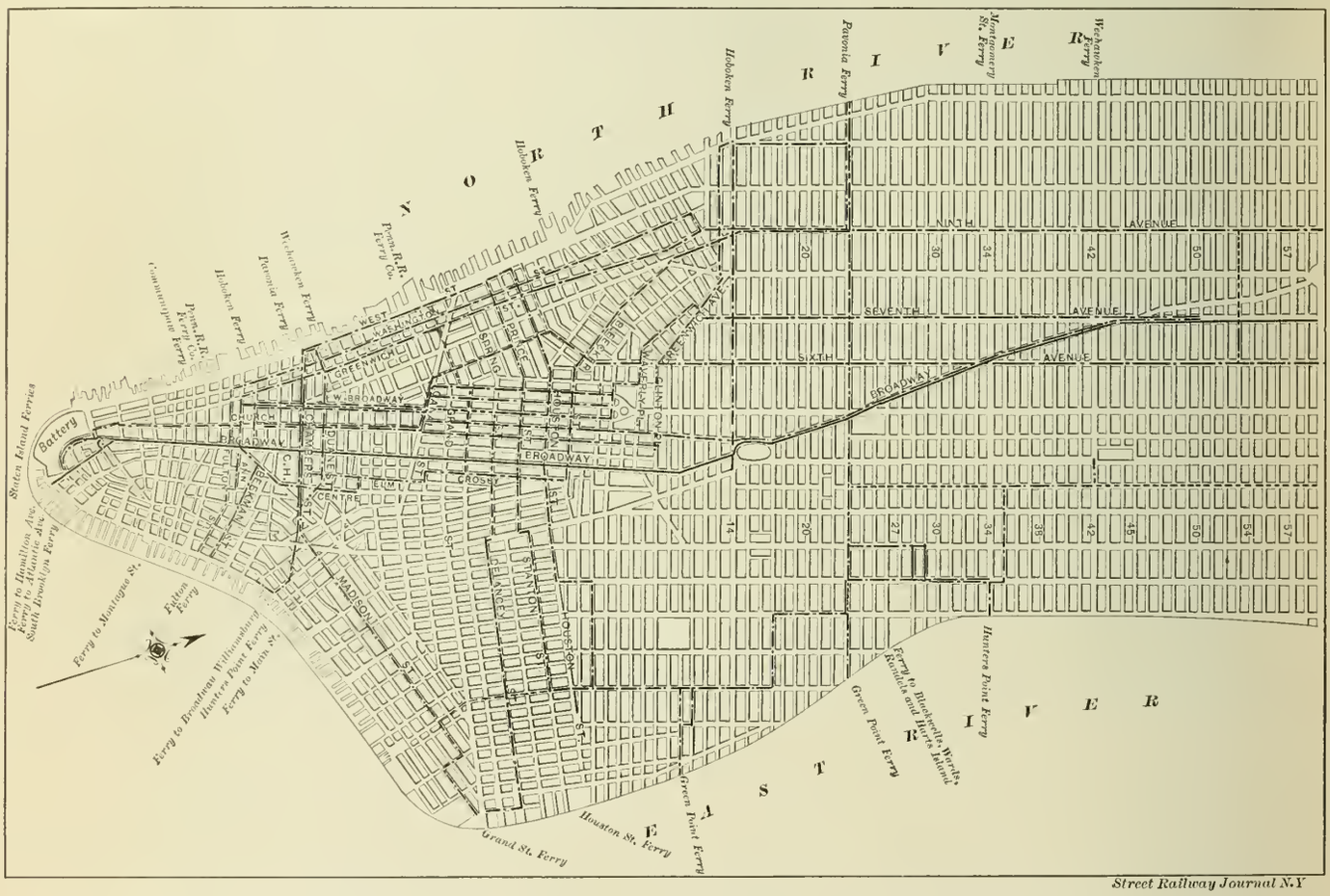
FIG. 1.—SECTION OF PHILADELPHIA GIRDER RAIL.

The length of line belonging to the company is six and a half miles double track. This is laid for the most part with sixty pound, centre bearing, tram rail. Renewals are, however, being made with the "Philadelphia girder rail," further installation of a centre bearing rail being prohibited by a recent act of the legislature. For new work the company on its various lines will use for the most part a heavy nine inch girder rail made by Wharton, similar to that adopted by the Philadelphia Traction Co., weighing ninety pounds per yard, and spiked directly to the ties. The average daily mileage of all lines controlled by the company is 38,000 on week

days and about 30,000 on Sundays. Of this number the Houston Street, West Street & Pavonia Ferry lines make 2,900 car miles per day.

The miles per horse per day average sixteen, and the employes work ten hours out of twelve. The number of passengers carried per day averages from 17,000 to 20,000. Stephenson cars are used. Since the new management has assumed control of the various roads in this extensive system, a number of important improvements have been adopted, and others more important are in contemplation. The transfer system will be extended to all the roads operated by the Houston Street, West Street & Pavonia Ferry Railway Co., just as soon as right has been granted to build the most important of the extensions contemplated, which will act as connecting links to the system. Another consequence of the consolidation has been a uniforming of all the drivers and conductors not being forgotten. The management of the company have already fitted two comfortable waiting and reading rooms for the benefit of the conductors and drivers of the road. One of these is at the depot of the Broadway & Seventh Avenue Railway Co., corner of 50th Street and Seventh Avenue, and is intended for the use of the employes of that division. The reading room is light and airy, lighted by electric lights, and supplied with a large number of the latest periodicals, daily papers, etc., with pen and ink and plenty of envelopes and writing paper. Adjoining this is a second room with boot blacking facilities, etc. Similar accommodations have been fitted up in the depot of the Sixth Avenue division at 43d Street and Sixth Avenue, and it is the intention of the company to have similar rooms at each of the depots of the other divisions.

The officers of the company are: President, John D. Crimmins; vice-president, Henry Thompson; secretary, Thomas F. Ryan; treasurer, D. B. Hasbrouck, and general manager, Thomas H. McLean.



Street Railway Journal N.Y

MAP OF LOWER NEW YORK CITY, SHOWING METROPOLITAN TRACTION CO.'S SYSTEM.

on the different lines, a custom which was before followed only on the 23d Street line. A reference to the accompanying map will show the important extensions contemplated by the managers of this company, and privilege to construct which has already been requested. The extensions proposed are shown in cut by short dashes. Horse lines in the Metropolitan Tractions Co.'s system are shown by lines made up of dots and dashes, while the location of the cable line is indicated by a full line. The most important of the extensions are longitudinal lines on Ninth Avenue, Manhattan Avenue and Lexington Avenue with crosstown lines on 96th Street, 116th Street and 146th Street. A petition has also been made for permission to operate the lines by electricity on Sixth and Ninth Avenues, the trolley wires to be attached to the elevated structures; and it is hoped that the necessary consents will be secured before long. As evidence that the property owners in these streets are in favor of an electric system, it may be stated that at two public meetings before the board of aldermen at which any protesters were invited to appear, no objectors presented themselves.

While these projects for important improvements and extensions are being carried forward by the management, the comfort and welfare of the employes of the road are

BROADWAY & SEVENTH AVENUE DIVISION.

The Broadway & Seventh Avenue Railroad Co. was chartered May 26, 1864. In 1885 it acquired, by an agreement with the Broadway Surface Railroad Co., the right to operate its cars over the tracks of that company upon a guarantee of the payment of principal and interest of $1,125,000 of first mortgage bonds, and the interest of the second mortgage bonds of the company to the amount of $1,000,000. The Broadway & Seventh Avenue line is divided into three divisions: Seventh Avenue & Park Place, University Place line, and the Broadway line proper. All three divisions are now operated by horses, requiring about 1,900 animals, but the Broadway line is now being reconstructed for cable traction, a ninety-one pound grooved girder rail being used. The tracks of the first two divisions are laid with a forty-seven to sixty pound, centre bearing, tram rail and there are about 227 box cars belonging to the road. The capital stock of the company authorized and issued is $2,150,000. The funded debt consists of $1,500,000 in 5 per cent., first mortgage bonds due in 1904, $500,000 in 5 per

cent., second mortgage bonds due in 1914, and $200,000 in bonds and mortgage at 5 per cent. In addition to this funded debt for the use of the tracks of the Broadway Surface Railroad Co. on Broadway between 15th Street and the Battery, the company assumes the payment of the principal and interest of the bonds mentioned above of the Broadway Surface Railway Co., and also for the use of the tracks of the South Ferry Railroad Co., the payment of principal and interest of $350,000 of the mortgage bonds of that company.

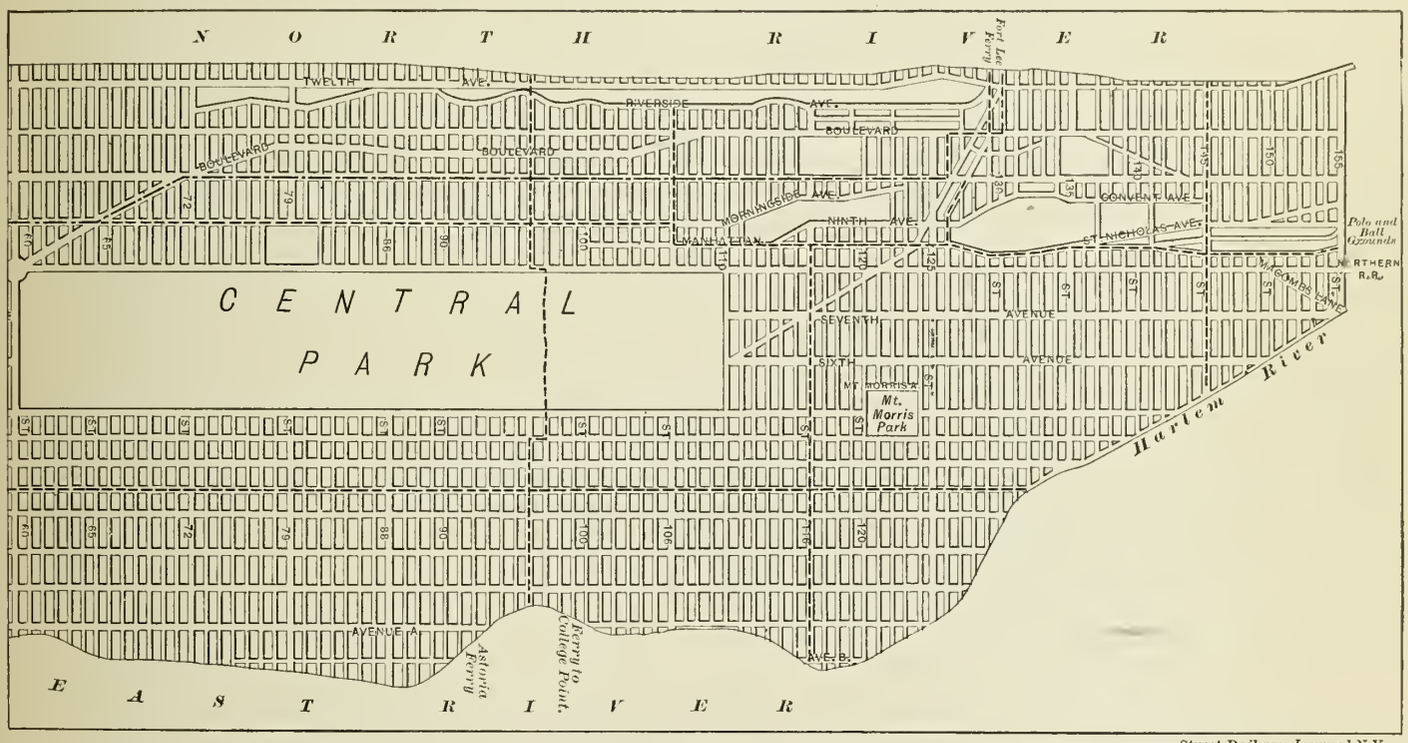
The terms of the lease with the Houston Street, West Street & Pavonia Ferry Railway include: The payment of the interest on the bonds of the company and those guaranteed by it, mentioned above, the rent to the city due under the Broadway Surface franchises, which amounted in the year ending June 30, 1891, to $85,497.96, and a 10 per cent. dividend on the stock of the Broadway & Seventh Avenue Railway Co.

with three centre lights. The interior of the car body is finished in the same style as the present Broadway cars, *i. e.* with body painted cadmium and lower concave ochre. The doors are especially large and ample and afford easy ingress and egress. The platforms are also large and are equipped with wire gates at the side. The bonnets are supported by pillars from the dash board. The car is equipped with the Stephenson superspring running gear having a nine foot wheel base, and is provided with a life guard which extends all around the sides, front and back.

The main depot of the division is at the corner of Seventh Avenue and 50th Street, and 1,900 horses are stabled here. The officers of the company are: President, Henry Thompson; secretary and treasurer, Thos. F. Ryan; superintendent Henry A. Newell.

SIXTH AVENUE DIVISION.

The Sixth Avenue Railroad Co. was the second street



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MAP OF UPPER NEW YORK CITY, SHOWING METROPOLITAN TRACTION CO.'S SYSTEM.

The average daily car mileage on this system on a week day is 12,850, divided as follows: Broadway line, 9,000; University Place line, 1,250; and Seventh Avenue, 2,600. The average number of passengers per day is divided about as follows: Broadway line, 90,000 to 100,000; University Place, 6,500 to 7,000; Seventh Avenue, 9,000.

The cars at present in use on the Broadway line were built by the John Stephenson Co., Ltd., and the Pullman Car Co., and were the first cars constructed without a letter board above the windows, the sash extending to the roof. These cars are very handsomely finished, the interior being fitted in natural wood, mahogany and maple being employed. Similar cars are also being used on the Seventh Avenue division.

The new cars adopted for the Broadway cable line are being built by the John Stephenson Co., and have a length of car body of twenty-two feet, with dimensions over all of thirty feet six inches. The width of the car body is seven feet and the aisles are thirty and three-fourths inches. As will be seen, this gives a large amount of room in the aisles and increases enormously the capacity of the cars. The free space between two cars when passing each other on a straight track is twenty-four and one-fourth inches.

The interior of these cars is finished in maple with paneled ceilings and trimmings of solid bronze. The seats and backs are covered with Wilton carpet, the windows are high and large and the car is lighted at night

railway company organized in New York City, the articles of association having been filed December 6, 1851. The company has a capital stock authorized and issued of $1,500,000, and a funded debt of $500,000, 4 per cent., first mortgage bonds. The length of the line owned by the company is five and one-eighth miles double track extending from 59th Street and Sixth Avenue to Broadway and Vesey Street, with a branch to the corner of Broadway and Canal Street. One mile and a quarter of this line at the lower end is operated in common with the Eighth Avenue Railroad Co.

The number of cars belonging to this line is 122, of which 102 are box and 20 open cars. Most of the cars were built by Stephenson, though some are from the works of the Lewis & Fowler Manufacturing Co. The cars make an average of 6,000 miles per day on week days and about 42,500 passengers are carried daily. The number of horses employed by the company is 925.

The offices and stables of the company are at 758 Sixth Avenue, and at the time of their construction were considered the finest then built for the purpose. Even at the present day they are worthy of remark, as the management has kept pace with the times by the addition of modern improvements. The officers of the company are: President, Frank Curtis; secretary and superintendent, E. H. Garrison.

The line was leased during the current year to the Houston Street, West Street & Pavonia Ferry Railway Co. for a period of 999 years.

NINTH AVENUE DIVISION.

The date of the Ninth Avenue charter is July 29, 1859. The line was built by an association and transferred to the Ninth Avenue Railroad Co. for $610,000 in stock. The total amount of stock authorized and issued by the company is $800,000. There is no funded debt.

The road extends from the corner of Broadway and Fulton Street through Ninth Avenue and the Boulevard to the corner of Tenth Avenue and 125th Street, and is eight miles long, all double track. The weight of rail is from forty-five to sixty pounds per yard. There are sixty cars, of which forty are box and twenty open. The former were built by the company themselves, and the latter are from the works of the Lewis & Fowler Manufacturing Co. The cars make an average of 5,100 miles on week days, and the number of passengers carried per day is about 23,000. The number of horses required to operate the line is 712, and the depot is at 814 Ninth Avenue.

The road was leased during the current year to the Houston Street, West Street & Pavonia Ferry Railway Co. for a period of ninety-nine years. The officers of the company are: President, Geo. Law; vice-president, Jacob Hayes; secretary and treasurer, James Affleck; superintendent, Lewis P. Foulk; being, with the exception of the superintendent, the same as with the Eighth Avenue Railway Co.

CHAMBERS STREET DIVISION.

This division is the only one of those belonging to the Houston Street, West Street & Pavonia Ferry Railway Co., on which short cars without conductors are used. The line is divided into two sections, with a common terminus at Chambers Street Ferry, and the other termini at Grand Street Ferry and James Slip.

Stephenson cars are used. The company was merged in 1891 into the Houston Street, West Street & Pavonia Ferry Co. by an exchange of stock, share for share, the amount issued by the larger company for the purposes of consolidation being $800,000. The Chambers Street line had no funded debt at the time. The daily car mileage is 1,700 and the average number of passengers carried per day is about 9,000.

METROPOLITAN CROSSTOWN DIVISION.

The date of the charter of the Metropolitan Crosstown Railway Co. is March 22, 1889, and the line extends from the foot of West 23d Street to the foot of Grand Street, East River. The cars make an average of 1,450 car miles daily, and from 7,000 to 9,000 passengers are carried each day. This line is now a part of the Houston Street, West Street & Pavonia Railway Co.

BROADWAY SURFACE RAILWAY.

Many efforts were made by different individuals to secure a street railway franchise on Broadway below 15th Street, but all failed until the one secured by the Broadway Surface Railway Co. This company was incorporated May 13, 1884, with Jacob Sharp as president, and it secured the consent of the local authorities in December of the same year for the construction of the road. There were charges that bribery had been used to secure this franchise, and Jacob Sharp, the promoter of the company, was tried on the charge and convicted, but obtained a stay, and died from pneumonia before the new trial came off.

The construction of the road was completed and cars were run thereon in June, 1885, by the Broadway & Seventh Avenue Railway Co. which had an agreement with the Broadway Surface company for the use of their tracks. On May 8, 1886, the road passed into the hands of John O'Brien who as receiver made an arrangement with the Broadway & Seventh Avenue Railway Co. by which this latter company continued the operation of the cars. In 1889 the road was sold at public auction and was purchased by the Widener-Elkins syndicate of Philadelphia, and it now forms a part of the Broadway & Seventh Avenue system.

TWENTY-THIRD STREET RAILWAY CO.

The Twenty-third Street Railroad Co. was chartered January 29, 1872, to operate under a franchise secured by S. A. Yeomans for $150,000. In 1873 the company was authorized to extend the route from 23d Street and Second Avenue to the foot of East 34th Street, and in 1876 the Bleecker Street & Fulton Ferry Railroad was leased to this company.

Its capital stock, at present authorized and issued, consists of $600,000, and its funded debt of $250,000, 7 per cent., first mortgage bonds due in 1893, and $150,000, 5 per cent., debenture bonds due in 1906. In addition to this funded debt, the company have guaranteed the principal and interest of $375,000 first mortgage bonds of the Broadway Surface Railway, for use of part of the tracks of that company. The 23d Street line is divided into four divisions, which have a common terminus at the foot of West 23d Street, and are named as follows: East 23d Street division, East 34th Street division, Union Square division and the Brooklyn Bridge & Fulton Ferry or Bleecker Street division. These lines are operated by horses, the present number owned by the company being 975. The stables are at the foot of West 23d Street. The length of track operated by the company is fourteen and three-quarters miles, laid with fifty pound, centre bearing and tram rail, except where renewals have been made, where, as stated above, the "Philadelphia girder rail" is being used. The cars belonging to this line are 101 in number, and are from the works of John Stephenson Co., Ltd., Lewis & Fowler Manufacturing Co., Jones' Sons Co., Pullman Car Co. and the J. G. Brill Co.

The average daily mileage on a week day on the 23d Street line is 4,100; of the Bleecker Street line 3,300; 14th Street and Union Square line 890, and average number of passengers on 23d Street 32,000, Bleecker Street 17,000 to 20,000 and 14th Street line 3,000 to 4,000. The officers of the company are: President, W. L. Elkins, Philadelphia; vice-president, P. A. B. Widener, Philadelphia; secretary and general manager, Thomas H. McLean; treasurer, C. E. Warren.

The Paterson Street Railway Co.

The street railway company at Paterson, N. J., like many in other cities, had much trouble, in the days when the benefits of electric traction were not so generally appreciated as at present, to secure the necessary rights to erect poles and conductors for an overhead line. The opposition, as usual, came from many sources, but the railway company finally triumphed, and their wisdom in the selection of electric power has been amply demonstrated. The electric system has been extended rapidly, so that it now covers nearly all the lines operated by the street railway company, and steps are being taken to equip with the necessary apparatus the only line now operated by horse power. It is only necessary to state that the number of passengers carried by the cars has increased 100 per cent. since the adoption of electricity, to attest the popularity of the latter system.

The electrical equipment now covers eighteen miles of track out of a total of twenty-five miles owned by the company. This track is laid with Johnson centre bearing girder rails, weighing fifty-eight and a half pounds to the yard, two miles of which are laid on chairs, the rest being spiked directly to the ties. The latter are laid two feet between centres and are of chestnut and white oak. The joints are supported by angle bars with a ten inch tie laid directly under the joints, a construction which up to the present has proved satisfactory. For a return, the rails are double bonded with galvanized iron bonds and cross connected every ninety feet. The contractors for the track construction were the Field Engineering Co. and the Thomas Murray Co.

The overhead line is supported by neat iron pipe span poles, supplied by the Pennsylvania Tube Works of Pittsburgh, and, in the outskirts of the city, by octagonal wooden poles. The feed and trolley wires were supplied by Benedict & Burnham, and the overhead material by A. &

J. M. Anderson and the Thomson-Houston Electric Co. On recent work the company solder the trolley wire to only every fifth insulator clip, supporting the wire at the other four insulators by a Rumrill "common sense" clip. By this means the work of taking up any slack in the trolley is much facilitated since only one-fifth the number of clips have to be unsoldered that would be were solder used at every hanger.

Sixteen foot cars are used throughout the line, and the rolling stock is very neat and tasteful. The cars are painted a deep wine color with gold lettering, and were supplied by the John Stephenson Co., and the Gilbert Car Manufacturing Co. Thirty-three inch wheels are used, and there is a short step between the body of the car and the platform. While this is considered a disadvantage by some, the management believe that the greater room secured under the car for the electrical apparatus more than compensates for any drawbacks. The registers are of the Railway Register and Lewis & Fowler make, and Smith headlights are used.

The motor equipment for the fifty-eight cars at present electrically equipped, consists of thirty-three motors of the Westinghouse type, twenty of the Edison type and five of the Thomson-Houston type. All of these are single reduction except three of the latter which are double reduction. Steel gears are used. The Gilbert truck is employed exclusively on all the cars.

The company rent their steam from the Edison Illuminating Co. of Paterson, and their generating apparatus is in the station of this company. Their present electrical equipment includes five compound wound Edison railway generators of 100 K. W. each, but these will be increased shortly by two more of the same type. These generators are belted directly to an equal number of Ball & Wood simple, non condensing engines, whose cylinders measure 16 × 16 ins. Cotton leather belting, manufactured by the Underwood Manufacturing Co., is employed to transmit the power. The boiler room contains three Babcock & Wilcox boilers of 300 H. P. each, which will soon be increased by the addition of two additional boilers of the same make of 400 H. P. each. A National feed water heater is located in the boiler room, and a Stratton separator is also employed.

Berlin Underground Electric Railway.

The need of additional transportation facilities in Berlin has caused the Allgemeine Elektricitäts Gesellschaft of that city to propose a plan, outlined below, for an underground electrical railway. The increase in passenger traffic is shown by the figures of a single tramway company who in 1881 carried 51,000,000 passengers, while nine years later they carried 121,000,000. According to statistics, over 50 per cent. of the inhabitants of the city have to leave their places of abode to reach their business. In the new plan the tramway and omnibus companies will still have the short distance passengers. The conditions to be held in view in carrying out the line are :

1. The street traffic is not to be interrupted by it.
2. That it shall not be influenced by changes of climate.
3. That it shall supply similar facilities to the tramways, only at a greater speed.
4. That the cost of construction maintenance should be proportional to the expected traffic receipts.

The practicability of the plan is proved by the great success of the City & Southwark Railway. The trains would be composed of an electric locomotive and three cars. accommodating 120 passengers, and running at three minute intervals, with a speed of twelve and a half miles per hour. The lines are not all to be constructed at once, but as occasion may require, and consist roughly of two concentric circles, each with double lines of rail and two cross lines at right angles to each other, crossing at the centre of the two concentric circles and connecting their circumference.

A narrow gauge of 39.37 ins. is to be used, and the sharpest curve in the "circles" is 164 ft. radius, but this only occurs once and where the speed is low ; the next smallest curve is 246 ft. radius for two short distances of 75 ft. and 79 ft. respectively. A curve, however, of less radius than 164 ft. occurs at the junction of the "circle" line with the "cross" line, but as the speed is necessarily very low it is of less importance.

The material through which the tunnel is to run is sand and gravel. The walls of the tunnel itself are composed of wrought iron plates, twenty-seven and a half inches broad, with flanges on the inside for bolting up ; the joints between the flanges being made with pine-wood strips, tow and cement. The thickness of the plates is .4 in. and of the flanges .59 in., the whole tunnel outside being covered with a layer of cement to prevent the plates from rusting. The tunnel is to be cut by a special machine designed for the purpose, which consists of a large shield with a large rotating cutting tool in advance of the shield, to which water is supplied at the top of the tunnel, and the refuse is drawn off by a large tube at the bottom of the tunnel. The whole operation is carried out under air pressure to prevent the inflow of water, and as the machine advances the sections are bolted up in their places. A shaft would be sunk and a machine set in each direction with a probable advance of sixteen and a half feet in twenty-four hours per machine.

The rails are to be supported at twenty-seven and a half inch distances by the flanges of the sections, and are to weigh forty and a half pounds per yard, the three insulators for carrying the electrical conductors are to be laid between the rails.

The trains, running at three minute intervals, will be about 1,000 yds. apart, and forty-eight trains, consisting of forty-eight locomotives and 144 carriages, will be running at once. Two power stations with two complete plants each will be erected, and under ordinary circumstances one engine and dynamo of each station will supply current to one of the cross lines and half the circle line, but the leads will be so arranged that, if necessary, the whole system can be worked from either of the stations at will. There will be a constant pressure of 500 volts, slow speed motors with varying resistances and gearing running in oil to diminish friction and noise.

The total length of the line is about thirty miles, with an estimated cost of £2,550,000 or £68,500 per mile. The charge for any distance per passenger will be 1.2d. The traffic is estimated at nearly five persons per carriage mile, or 57,000,000 passengers per annum, with 11,800,000 carriage miles or 117,000,000 passenger miles. This would bring in a total yearly receipt of £285,000 of which £144.000 would be required to defray running expenses.

New Power Stations of the West Chicago Street Railroad Co.

Construction on the two new cable power houses of the West Chicago Street Railroad Co. have been delayed quite seriously. The rains which have flooded Chicago interfered with the work, and on the site of the station at Blue Island Avenue and 12th Street an unlooked-for difficulty was encountered. An old slough was struck at two different points, and, to make a bottom, 87,000 cu. ft. of concrete was necessary. The contracts for equipping the two stations were let to the Pennsylvania Iron Works. In the Blue Island Avenue plant will be installed two Allis 40×72 in. engines of 1,700 H. P. each. Four sets of Walker's patent drums will be used, the shaft of which will be sixteen inches in diameter. The main line shaft will be eighteen inches in diameter.

In the station at the corner of Van Buren Street, two Allis 38 × 60 in. engines of 1,400 H. P. each will be installed.

The Lakeside Electric Railway at Toronto, Ont., was put in operation on July 15. The system used is the Rae, and all the machinery was built in Canada, and installed under the direct supervision of Mr. Rae, with the assistance of Mr. G. Wilson. The cars are double decked with fore and aft seats on the roof.

Meeting of the Tramways Institute of Great Britain and Ireland.

The Tramways Institute of Great Britain and Ireland met at Guild Hall, E. C., on June 27. Mr. W. Carruthers-Wain, who presided, was unanimously re-elected president for the forthcoming twelve months, on the motion of Mr. A. P. Smith, seconded by Mr. G. P. Bradford. Other formal business was then transacted, after which Mr. Elliott, the secretary, presented the annual report, in which it was stated that thirty-four companies were members of the Institute, and that there were also sixty-two delegates and 150 associates. This showed an increase of five companies since the last report, of six delegates and fifty-two associates. On the other hand, two companies had ceased to belong to the Institute (one owing to liquidation and the other to legislation), while twelve associates had ceased to be such owing to promotion, resignation and death. The Council urged most strongly upon the members of all classes the paramount interest to increase, by the addition of other companies and associates, the power and influence of the institution, as there could be no doubt that one result of the general election would be legislation which, unless carefully supervised and properly dealt with, must have injurious effects upon tramways and the shareholders.

Mr. Carruthers-Wain, in moving the adoption of the reports and accounts, congratulated the members on the satisfactory condition of the Institute, and drew attention to the recent development of electric tramways. After giving some figures concerning the slow growth of tramways in the United Kingdom, he concluded by impressing upon the members that pressure should be brought to bear upon parliamentary candidates at the forthcoming election, so that a committee should be appointed to inquire into the working of the Tramways Act of 1870.

The report of the committee on mutual assurance against accidents was then presented by Mr. A. P. Smith. The report recommended generally that a company should be formed to undertake the insurance of tramway plants. In the discussion on this matter a difference of opinion was expressed as to whether, among other points, if such a company were formed it could be made self supporting, and as to the liability of one company running steam cars and another horse cars. It was eventually proposed and carried that the meeting generally approved of the outlines of the plan, that the committee was authorized to take such further steps as might be desirable and the matter be reported upon at the next meeting.

Mr. F. Arnall, A. M. I. C. E., assistant surveyor of Birmingham, then read the following paper on

PERMANENT WAY CONSTRUCTION, ESPECIALLY AS REGARDS WEAR AND TEAR AND DEPRECIATION.

When tramways were first laid in Birmingham the question arose as to whether they should be laid and maintained by the Corporation or whether this work should be left to the company working the line. It was thought that as it was the duty of the corporation to maintain the roads it would not be altogether right to delegate that duty to a company who would use a part of the road for their private business, and whose primary object was not the care of the road, but the making of a profit in the using of a part of it. It was, therefore, decided that the tramways should be laid by the Corporation and maintained by them on terms to be agreed upon with the several companies concerned.

The first tramways were laid in Birmingham in 1872 and in 1875, the lines forming a continuous route, about four and a half miles long, from one side of the town to the other. It was nearly all double line and laid to a four foot eight and a half inch gauge. In construction the Larsen system was adopted—an iron rail laid on a continuous wooden sleeper, as shown in section in Fig. 1. It was found that although the rail was fastened to a continuous wooden sleeper, its bearing upon it was evidently very discontinuous; the wood warped and shrunk in a way that the iron rail could not follow, and however firmly it was fastened down it soon worked loose. As this system of construction in and about Birmingham is, however, now a thing of the past, it is hardly worth while now to go into detail as to the merits or defects it possessed. A part of it was taken up in 1887 for the construction of the Hockley cable tramway, and the remainder in 1889 for the construction of the Bournbrook electric line.

Steam traction was introduced into Birmingham in 1882, and has since received a very extensive development; its growth was rapid, but soon checked. Between 1882 and 1887 the three companies using steam on the Birmingham tramways acquired altogether about 120 locomotives, and I believe the various companies have always done their best to keep as many as they possibly could at work on the roads. This paper deals more particularly with the effect of this steam traffic upon the tramways rather than with the tramways themselves, and the Birmingham results are the more important because the traffic upon the lines is so exceptionally heavy. In some streets there are four lines of routes overlapping each other, and in other streets as many as five lines, each route having quite a full complement of cars running over it. The result is that we have as much wear and tear on these tramways in five years, or in four years, as the case may be, as we get on a single route in twenty years. This is, of course, apart from the effects of ordinary traffic, which I believe to be very small indeed.

Knowing, then, the actual amount of wear in five years where four routes run over the lines, we have a good guide as to the amount of wear to expect on a line over which the traffic from only one route passes will sustain in twenty years. Many things may conspire to increase the effect on the single route in the long period of twenty years, such as corrosion, the long continued effect of ordinary traffic, the natural growth of the district and consequently more frequent service, and so on; but I know of nothing that can possibly diminish the effect, except that the engines, etc., taken over the lines be reduced in weight or number, which can hardly be expected.

This point of view does not seem to me to have yet received at the hands of the Institute the attention which it deserves, especially bearing in mind its important bearing upon the question of depreciation or of prolonged maintenance, as apart from casual, every day repairs. Generally speaking, every case of repairs is a renewal of some part or another; it may be the replacing of a broken point, or only the renewal of the bedding under the adjacent paving stones, or of the grouting between them. Those engaged in the maintenance of steam tramways generally have a pretty good notion as to what every day repairs means, but the almost imperceptible wear and tear to the rails themselves, which is always going on but which generally takes a long time to make itself visible, when not overlooked altogether, is generally only provided for in an indefinite sort of a way by a depreciation fund. The traffic on some of the steam routes in Birmingham has already produced some results which may serve as data to assist in determining what this depreciation fund should be in similar circumstances, and, properly interpreted, may even be of service in circumstances which are not similar.

The first tramway laid for steam in Birmingham was the Birmingham and Aston route in 1882—a length of about one mile of double line inside the borough, laid by the Corporation, and a further length of about three miles or thereabouts in the district of the Aston Local Board, laid by the Aston Tramway Co. The gauge was three feet six inches, the rail used being that known as Barker's, a steel rail, forty-two pounds per yard, keyed to a cast iron sleeper, as shown in section in Fig. 2. The sleepers were cast in lengths of two feet eleven inches each, and laid with a gap of only one inch between them, so that they were practically continuous. They were moulded by machinery, and were as nearly true on the upper surfaces as castings not machined over can be, and though they formed a nearly continuous line, it soon became evident that they did not form a continuous bearing for the rail. In a very short time after the line was opened the rails began to work loose at the joints, which were always in centre of sleepers, and in spite of all tightening up and replacement of keys, this defect gradually spread along until the rail was loose from one end to the other; and the next result was, of course, the loosening and sinking of the paving stones alongside. A length of 200 to 300 yds. in Corporation Street was left unpaved, and here the keys could be readily got at for tightening up, etc., but it was found that the rail did not become loose because the keys were not tightly driven in, but because they were cut away by the harder rail. A trial of some steel keys was made, but it was found that they caused the edge of the hole in the rail itself to cut away, so they had to be abandoned.

It was found that the steam traffic was really subjecting the rail to a process of "cold rolling," which lengthened out the upper surface, while the lower parts of the rail remained unaltered. As a result, the rail tended to assume an arch or bow form, and when all the keys in a thirty length of rail had been knocked out, the loose rail rose in the centre six inches or nine inches. It, furthermore, was no longer straight on plan, but curved, the tread or bearing surface of the rail being on the outside of the curve. The effect was that when keyed down the rail was always in a state of strain, and the least looseness in the keys caused it to rise above its bed, and at the same time the horizontal curvature caused it to move sideways, so that when a car passed over it the lower parts of the rail did not fall directly in their proper places on top of the sleeper, and dust and grit from the road surface formed a most efficient grinding material which was constantly being renewed. Thus, the top of the sleeper wore away as fast, practically, as the top of the rail, and it, moreover, wore out of shape, and the notion that we should be able to replace the rails when worn out without having to disturb the sleepers, had to be definitely abandoned. This process went on until the flange of the wheel reached and ran on the bottom of the groove, and then destruction went on more rapidly still, until, toward the end of 1886, when the lines had been in use four years, some of the rails began to split along the groove and had to be taken out, thus terminating their career.

Four years seems a short life for a tram rail, but the conditions must be taken into consideration. The rail was in a macadam road, and the traffic over it, amounting to, perhaps, 30 000 steam cars in 1883, had rapidly increased until the fourth year, when it had to carry the traffic from five different routes, amounting to 120,000 cars in that year. The total in four years amounted to about 280,000 cars, roughly equivalent to somewhere about an average of five minute service during the period.

In lower parts of the tramway, where the road was paved all across, and where some of the traffic had been diverted down other streets, the wear and tear was not so great—nevertheless it was found necessary to take out and replace all the rails before the end of 1889, after the passage over them of about 380,000 steam cars in seven years. Outside the borough boundary the tramway company contrived to carry on for a few months longer, but took out their rails in the following year, after having been in service about seven and a half years and carrying the traffic of rather more than 400,000 cars.

Our experience thus shows that, apart from all questions of ordinary everyday repairs to paving, points, etc., the Barker rail will be worn out and done with, and must be replaced, after the passage over it of about 400,000 steam cars. If the new rails have to be put in in the night time and without disturbing the traffic, it may be taken that a mile of single line will cost about £2,000 in relaying it with girder rails, which is equivalent to about 1¼d. per car mile as a sinking fund to provide for the replacing of the rails alone.

The results I have indicated were, of course, not arrived at until after the Barker rails had been laid down for several years, but before even they were opened for traffic opportunity had been taken to examine the system and to gain lessons from its use elsewhere. The result was that when, in 1883, the Corporation were called upon to construct

tramways for what is now called the Birmingham Central Tramways Co., the conclusion had been arrived at that the system was not suitable for steam traction. Considering the extensive system of tramways that the Central company proceeded to construct, or have constructed, and the nature of the agreements already entered into between them and the Corporation, it is not too much to say that this decision of the Corporation has proved to be one of the utmost importance to the company. The system decided upon for the new tramways was the Gowan, or girder, rail, seven inches deep, to suit

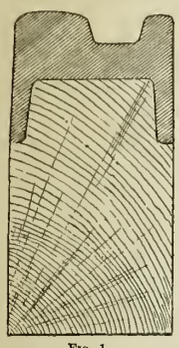


Fig. 1.

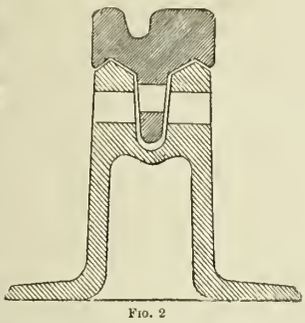


Fig. 2

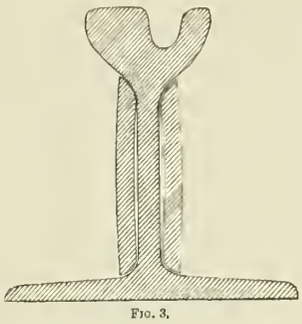


Fig. 3.

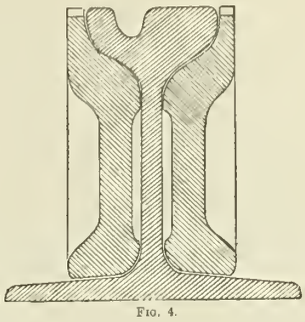


Fig. 4.

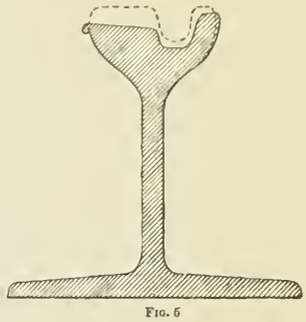


Fig. 5

six inch paving, seven inches wide on bottom, and weighing ninety-eight pounds per yard, the section being as shown in Fig. 3. The tenders of the Barrow Hæmatite Co. were accepted for the supply of rails and fishplates, and, in fact, all the rails of this section hitherto laid by the Corporation have been supplied by the Barrow company.

The joints were made of two sixteen inch fishplates, with four bolts, and were generally found to stand very well on a single route of tramway for the first two or three years, equivalent to the passage of, perhaps, 60,000 to 70,000 cars over them. After this they began to work loose, and the remedies resorted to—viz., tightening up the bolts and often replacing them, repacking the rail, etc.—are found to be only a temporary cure. For some time it was thought that the working loose was due to the nuts slacking back, or to the bolts stretching, and various varieties of locking nuts were tried, but with no beneficial results. The bolts may certainly have stretched a little, but the nuts certainly did not slack back or work loose, and it appears that the failure at the joints was due to several causes, which may produce different results under different circumstances.

It is not easy to imagine how a line of rails, properly fished together, and supported continuously on a solid bed of concrete, can work loose at the joints, but it is very certain that they do. The chief reason is to be found in what I believe to be the fact, that on a steam route the rail generally is not continuously and equally supported, and, furthermore, it never can be for long together. The rail bears more solidly in some places than it does in others, bridging over the hollow places, and there is, consequently, a minute deflection as the load passes over the places that are least firmly supported. When the joint happens to be over one of these slack places in the concrete the deflection will be greater. In the section of rail under discussion, deflection can readily take place, the head of the rail sinking between the tops of the fishplates, wedging them open. To be effective in resisting a tendency of this sort, each fishplate should act like an arch, the bolts passing through the crown, the abutments being at top and bottom of the plate. In the Birmingham section, however, though we have a fairly good abutment at the bottom, there is a very bad one at the top, and sliding can very readily take place there, and does. The narrow edge of the plate is not a good surface for withstanding an action of this sort; it is too narrow; this is very plainly seen when a loose plate is taken off, the top and bottom edges being often ground quite bright and smooth, and generally, a more or less deep ledge is worn in them by the extreme ends of the rails.

Many attempts have been made to deal with this weakness at the joints, with but imperfect success. In the last route constructed by the Corporation the length of fishplates has been increased from sixteen inches to twenty-four inches, and the number of bolts from four to six, but the traffic on this line is comparatively slight, and as yet the soundness of the joints upon it is no criterion of what we might expect on a steam route with heavy traffic. A large number of Marshall's soleplates have been used; at first the plates were sixteen inches long, with four clips on each side, but these not being in all respects satisfactory, the length was increased to twenty-two inches. These long plates were practically no better than the short ones, if so good. More close attention being paid to the movements of a loose joint under the traffic, it was seen that the defect was rather with the clips, so I suggested that the two centre clips should be brought close together, and coalesced into one, the two bolts being retained. This form of clip turned out to be a great improvement on the old form, and I believe the plate is now as good as a soleplate can be expected to be. It should be remarked that in our work these plates have been under one disadvantage, inasmuch as with the exception of one route, and that of light traffic, they have been put under joints that were already faulty, and mending a bad joint is not such easy work as delaying the failure of a good one.

To find what the effect of increasing the bearing area at top and bottom of the fish plates would be, a number of C. I. plates, sixteen inches long, and of the section shown in Fig. 4, were prepared. They fit the rail closely top and bottom, and the top is brought up to the street surface, and finished with a corrugated surface, and it will be seen that in screwing up the bolts there can be no tendency to make them ride up on their abutting surfaces. A trial length of line was selected, and a number of these plates put in in the autumn of 1890 in a street of very heavy traffic, and their behaviour is being compared with joints of other forms made at the same time in the same street, and under precisely the same conditions. They are still standing very well. Where these plates are used without soleplates the joint seems about equally good as when fishplates and soleplates are used, and where it has been combined with a soleplate the joint is better than any that has yet been tried in Birmingham. As the plates have been in a year and eight months only, it seems too soon to speak very positively of their merits; nevertheless, it is worth remarking that in tha time they have had more than 250,000 steam cars over them, or the equivalent of a ten minutes' service for about twelve years.

To refer again to the "cold rolling" process which has been already mentioned, I am persuaded that this action is one reason why we have so much trouble with the joints; its whole tendency is to lift the rail off its bed, allow dirt, etc., to get underneath in irregular patches and thereby destroy the continuity of the bearing. The dipping at the joints, which is such a marked feature in a well worn steam tramway,

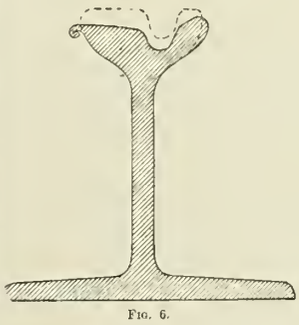


Fig. 6.

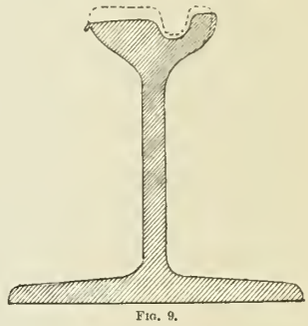


Fig. 9.

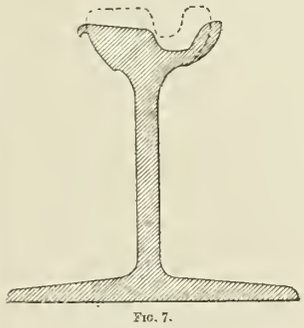


Fig. 7.

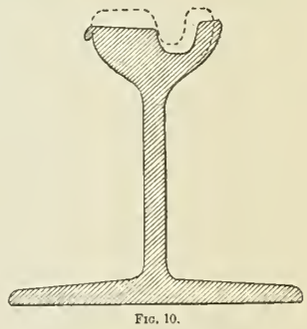


Fig. 10.

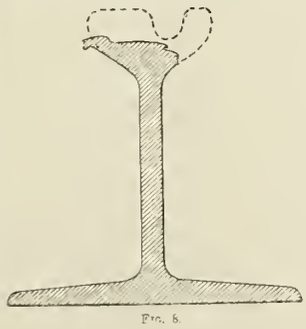


Fig. 8.

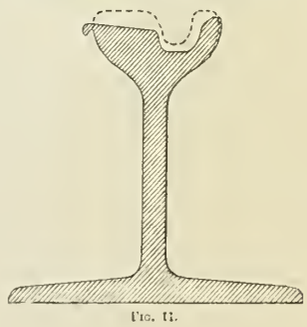


Fig. 11.

is not so much a lowering at the joints as a lifting of the intermediate parts of the rail, and it is found that whenever a rail gets this hog-backed appearance, the trouble with the paving, which at first was only experienced at the joints, is now found pretty general all along the rail. It is furthermore to be remarked that the curving up in the centre is very much more with the same amount of traffic on a six inch rail than it is on a seven inch rail, and so much is this so that I venture to advance the opinion that nothing less than a seven inch rail is fit for use on a steam tramway of a moderately heavy traffic.

I have here, Figs. 5 to 11, actual sections of some rails that have been taken out of the Birmingham tramways, showing the effects of wear upon them.

No. 5, Straight line; effect of 555,000 cars
No. 6, Flat curve " " 570,000 "
Ny. 7, Sharp curve " " 570,000 "
No. 8, Straight line " " 560,000 "

This example shows effect of expansion in wood paving, when allowed to become excessive.

Nos. 9, 10, 11, straight line; effect of 670,000 cars.

All these sections show more or less the effect of tilting over of the rail, which is always to be found on a steam tramway, has upon the wear and tear of the rails; the tread is not worn evenly down, but more rapidly towards the groove, leaving the flange standing up as a more dangerous obstacle to the ordinary traffic. From them some idea may be obtained of the great advantage which a rail with a central groove would have over one of the ordinary section.

These sections show that on a straight road a girder rail will be worn out and require replacing after the passage over it of less than three-quarters of a million of steam cars. Many things may cause the number to be less, but nothing, except reduction in weight, can cause the number to be greater. Taking the cost of relaying at £2,000 a mile, it works out that over and above the cost of every day repairs and maintenance of paving, etc., a damage to the extent of certainly over .5 of a penny per mile is accumulating on the rails, and may some day want paying off all at once. How this liability is to be provided for is for the company to determine, but it seems to form a very definite factor in any depreciation fund that may require to be set aside to provide for future requirements.

DISCUSSION.

Mr. Cox, in the discussion, said the difficulty was at the joints. He had tried Marshall's soleplates, and was now trying Whytehead's joint chair and fishplate. In the course of his experience he had found that single lines on tramways worked by steam wore as long as the double lines. Steam engines and cars passing all in one direction tended to break down the joints very much indeed; but on a single line that was counterbalanced by the traffic going in each direction. On the lines he was connected with, the fishplates wore in the same manner as Mr Arnall had explained. They were sixteen inches long and half an inch thick at first, but better results had been obtained with longer plates three-quarters of an inch in thickness.

Mr. Wroughton was of opinion that the Barker rail gave "more trouble than enough." In 1886 his company had laid a short length of line with transverse sleepers where the road surface was very hard, and when General Hutchinson made an inspection recently, he was surprised to learn that not a single joint had been touched or anything spent on the paving. Cross sleepers were, no doubt, the best system.

Mr. A. Dickenson, of Darlington, congratulated the author of the paper, and suggested that one of the methods by which the difficulty of joints might be overcome would be by reducing the number of the joints, and for that purpose electric welding, or some other process, could be used.

Wr. J. Waugh, of Bradford, believed in the use of the Barker rails, which he had found to stand exceedingly well.

Mr. Bradford was strongly of opinion that transverse sleepers were the best. There was less oscillation when the foundation was firmer, and it was the oscillation which caused the joints to break; he was thoroughly convinced that cross sleepers were the best, and they ought to be used.

In the course of his reply Mr. Arnall stated that he did not think that the Whytehead joint chair and fishplate would remedy the evil of the joints. People had made a diligent search for something to cure the evil of the joint, but up to the present they had not found it. The trouble did not so much arise from the inherent weakness of the joints, but from that process of "cold rolling" on the top of the rail. He agreed with what Mr. Cox had said regarding the cost or wear of the single and double lines. He had tried to discover the difference between the two, but could not do so. With reference to electric welding, he did not agree with Mr. Dickenson on that point, as such a process would increase the trouble through "cold rolling," to which he attached great importance. The cross sleepers would diminish noise, but, in reply to the question put by the president, he was unable to state what was the best system of laying tramways.

Mr. Sharp next read a paper on "The Further Development of the Connelly Motor in England and America."

A paper, of which the following is an abstract, was then presented by Mr. G. Annesley Grindle, C. E., on

ELECTRIC TRACTION: THE CITY & SOUTH LONDON ELECTRIC RAILWAY.

In the year 1884 an application was made by certain individuals to Parliament for power to construct an underground line from the city to the Elephant and Castle, and granted. The want of such an undertaking had been long felt, and various schemes had been suggested to afford communication between the City of London and the densely populated districts on the south side of the river, and relieve the congested traffic over London Bridge, which, in 1886, when the railway was commenced, was estimated at 7,000,000 vehicles and 56,000,000 foot passengers per annum. The course taken for the line was from a terminal station adjoining the Monument, under the Thames, a few yards above London Bridge, and beneath the Borough, Blackman Street and Newington Causeway to the Elephant and Castle, following, as nearly as possible, the line of roadway, and so avoiding the cost of land purchase and compensation. The work of construction was commenced in 1886, and so gratifying were the results of the operations on this first section, involving as it did the difficulties of tunneling under the Thames, that the directors applied to Parliament in 1887 for further powers authorizing them to extend the line to Stockwell—making in all a distance of some three and a quarter miles. The route for this extension was from the Elephant and Castle along the Kennington and Clapham Roads, with stations at Kennington, Kennington-Oval and Stockwell. The work of the extension proceeded concurrently with the completion of the original section, and for obvious reasons the opening of the first portion was delayed until the completion of the scheme in its entirety from the city to Stockwell. Since the opening of the line to Stockwell, further powers have been sought and obtained for an extension to Clapham Common. This extension, however, has not yet been carried out, but will doubtless shortly be commenced, and cannot but prove a valuable addition to the undertaking, Stockwell being at present, at any rate, a poor centre for a terminal station. The system of tunneling is somewhat novel, and introduced into this country by Mr. J. H. Greathead, M. I. C. E., to whom the designs of the line is due, and under whose able superintendence the construction works were so successfully carried out. Entirely separate tunnels are employed for the up and down lines, so avoiding all possibility of collision between trains approaching each other in opposite directions. The material used in the construction of the tunnels is cast iron, built up in consecutive rings, each ring being composed of several segments, with a key piece. The tunnels are driven by a shield, which in form may be described as like a tube of some ten or twelve feet long, with a bulkhead, the internal diameter of the tube being slightly larger than the internal diameter of the iron tunnel. A short length of soil is excavated in front of the shield, which is then driven ahead by means of hydraulic power, and the segmental ring is built up within the shield tube in the resultant gap caused by the forward movement between the bulkhead and the last built ring of the tunnel. The diameter of each tunnel is about ten feet. The stations are of brick and usual construction of arch and invert, and have a diameter of twenty-two feet. The tunnels run, as a rule, side by side, excepting under the Thames, where one line is directly above the other. The depth of the tunnels below the surface of the roadway varies from fifty to seventy feet, and is consequently below all sewers, gas pipes, water pipes and subways, and causing no disturbance to the surface of the roadway. At such a depth the question of ventilation would appear to be a serious one, but as a matter of fact the tunnels are self ventilating, and no special arrangement or machinery whatever is employed to effect what is generally acknowledged to be a very satisfactory state of air in the tunnel. This is due chiefly to the employment of separate tunnels for up and down traffic; the trains fit the tunnels almost like pistons, with the result that every train is continually changing the air, pushing, so as to speak, a column of air to the station ahead, whence it escapes by means of the lift shafts, and sucking air from the shaft of the station last passed. Of course, at such a depth steam locomotion would be out of the question, and originally it was proposed to work the line by means of cable haulage, and, in fact, contracts for such means of running were actually entered into. In the interval, however, that elapsed between the first conception of the undertaking and the time when its accomplishment was in the near future the application of electricity to traction purposes had been advancing by leaps and bounds, and with the success attained on the Newry and Bessbrook line (on which the loads dealt with, as mentioned before, were but little, if any, less than those it was proposed to run on to South London line). Messrs. Mather and Platt were induced to approach the directors of the line with a view to obtaining their consideration as to the advisability of employing electricity as their motive power in lieu of cable, and to submit a complete scheme for the purpose, together with proposals for the working. The matter was the subject of long and careful deliberation by the board of the company, and was warmly taken up by the chairman, Mr. Charles Grey Mott, to whose untiring energy and deep interest in the matter a great part of the success of the undertaking is due. The submitted scheme was eventually accepted in its entirety, and a contract entered into in the early part of 1889 for the equipment of the line in accordance with the same. It addition to the actual equipment of the line an offer was also made to work the line for a period of twelve months, or at the option of the company to guarantee the cost of haulage according to a sliding scale, dependent upon the train mileage run per annum, commencing at 3.5d. per train mile for the full possible mileage of 384,800 miles per half year. The trains under the guarantee to consist of: Locomotive, ten tons; three coaches of 4.25 tons each, and 100 passengers. During the summer of 1889 various experiments were carried out on a short length of line then completed, by a temporary plant at Great Dover Street station, and two experimental locomotives. The experience gained in these trials was at the same time both unique and valuable, affording an amount of information which had never before been attained, and which proved invaluable in working out many subsequent details. In the meantime the construction of the plant proceeded rapidly. In close proximity to the Stockwell terminus of the line, on a large plot of land which serves as a general depot, a spacious engine house, in which the entire current employed in working the line is generated, was erected.

The plant supplied consisted of three generating dynamos of the Edison-Hopkinson type, each having an output of 450 amperes at 500 volts. The machines are compound wound, with bar armatures, and are about the largest machines of the class that have ever been constructed, the total weight of each machine being over seventeen tons. The driving is effected by means of link leather belts twenty-eight inches wide, and to increase the grip, the belt is led under a jockey pulley. Each dynamo is independently driven by a vertical compound engine, designed and constructed for Messrs. Mather and Platt by Messrs. John Fowler & Co., of Leeds. The high and low pressure cylinders are seventeen inches and twenty-seven inches internal diameter respectively, and are both steam jacketed. The stroke is two feet three inches, normal running speed 100 revolutions per minute, giving a piston speed of 450 ft. per minute. The engines are fitted with automatic expansion gear on both high and low pressure cylinders, con-

trolled by a high speed governor driven by ropes directly from pulley on crankshaft. The steam pressure employed is 140 lbs. per square inch. The flywheels are very massive—fourteen feet in diameter, twenty-eight inches wide on face, and weigh fourteen tons. Each engine will indicate 375 H. P., and in practice two engines and dynamos are employed, and are sufficient to work the entire line, the third engine being kept in reserve. The engines are supplied with steam from six steel boilers of the Lancashire type, twenty-eight feet long, seven feet diameter, and are fed with fuel by means of Vicar's mechanical stoker. The water supply is effected by means of two Worthington pumps, and before entering boiler is forced through two feed water heaters, heated by the exhaust steam from engines.

Since the opening of the line, and in view of the extension to Clapham Common, a fourth engine and dynamo similar to the original three have been erected, also two additional boilers. The boiler house is below the general ground level, which greatly facilitates the stoking, the fuel being simply tipped straight into the hoppers, and so avoiding all cost for elevating, etc. Adjoining the engine house is a fitting shop where minor repairs can be carried out. From the dynamos the current generated is conveyed by means of lead covered cables to a massive, but simple, switchboard, and is there distributed to the feeding mains. These mains or cables, of which there are four, are of the well known Fowler-Waring manufacture, and consist of a $\frac{0}{14}$ B. W. G. copper core, insulated with patent insulating material and lead-sheathed. The cables are carried on brackets along the sides of the tunnel, and lead into the various signal boxes. In the signal boxes are fixed small slate distributing boards, fitted with plugs and fuses, and from these the current is conveyed to the working conductor by means of feeder cables. The working conductor is of steel, of channel section, specially rolled for the purpose, and of such composition as to ensure its having a low specific resistance. It is carried by glass insulators, which are cleated with creosoted blocks to the sleepers and laid between the two main rails at a distance of about one foot, from one rail—this position being rendered necessary on account of the low position of the central buffer coupling. The lengths of conductor are fished with two small fishplates and four bolts, as a mechanical coupling, while the electrical connection is ensured by means of a laminated copper strip secured by four copper rivets. The steel conductor is not continuous, but broken at every station, the intervening gap, a length of some two feet, being made up with a piece of well seasoned oak, by which means it is possible to isolate any one section of the line, without interfering with the remaining sections, or, in case of any accidental failure occurring on any section, it automatically disconnects itself from the system. At the points and crossings, which are in every respect similar to ordinary railway practice, the shoes or collectors have to be lifted over the crossing rail, the level of the conductor being one inch below that of the main rails. This is accomplished in a simple and effective method by means of inclined wooden planes, up which the shoes run. The insulation throughout the line is exceptionally high. The daily test of the entire system—which includes generators, switchboards, cables, feeders, working conductor, points and crossings, locomotives and lightning circuits with the full pressure of 500 volts—does not give a leakage current of one ampere, or considerably less than one H. P., and is often as low as a quarter of an ampere. The conditions of the line naturally are highly favorable in this matter, no difficulty with weather having to be contended with. The return circuit is made by means of the main rails, which are connected, in addition, to the ordinary fishplates with copper connecting strips fixed in the same manner as in the working conductor.

The electric locomotives, of which fourteen were supplied for working the line, were each designed to be capable of exerting a tractive force of 3,000 lbs., and running at a speed of twenty-five miles per hour. In general appearance the locomotives closely resemble steam tram motors. The weight of each locomotive is ten tons, and it is carried on two axles with a wheel base of six feet. In the construction of these motors a striking and novel departure from anything that had previously been attempted was made with regard to the armature. Instead of being, as in previous engines, connected with the driving axles by means of gearing, belts or chains, the armatures were actually built up on the axles themselves, thus entirely obviating all the necessary incumbent complications that had hitherto been in vogue. The magnets are supported partly by the axles and partly suspended from the car itself, an arrangement which allows of a certain amount of freedom of angular motion round the axle, yet always remaining concentric with the armature. A separate and independent motor is fitted on each axle. The motors are series wound, and the armature revolution per minute, of course, varies with the speed of the train; at twenty miles per hour, the revolutions are approximately 250 per minute. The current is taken from the working conductor by means of three sliding shoes fixed by hinged supports to the frame. The shoes are of cast iron, and it is found in practice that they will run about 10,000 miles before requiring renewal. From the shoes the current is carried by an insulated cable to the main resistance switch which controls both motors. The resistances are placed in series with the motors, and gradually cut out as the switch is put over. A second switch controls the reversing movement, which is effected by changing the direction in which the current passes through the armature. The locomotives are fitted with hand and air brakes, the latter being of the well known Westinghouse type, and continuous throughout the train. To work the air brake, a supply of compressed air is carried in two steel reservoirs on the locomotive, and replenished at Stockwell on every round journey. Connection between the locomotive and carriages is effected by means of a central buffer coupling. The trains are made up of two coaches, each constructed to carry thirty-four passengers, open from end to end, with two longitudinal seats like those in an ordinary tram car. Entrance into the cars is gained by means of end doors, and between the carriages intermediate platforms are fixed, fitted with collapsible side gates. The carriages, which are twenty-nine feet over all, are carried on two four wheel trucks, and, exclusive of passengers, weigh over seven tons each. The lighting is effected by means of incandescent lamps, supplied with current from the working conductor.

The gauge of the line is standard, four feet eight and a half inches, and the rails, sixty pounds weight per yard, are of Ebbow Vale steel. The track is not ballasted, the cross sleepers merely resting on the sides of the iron tunnel. The road has many severe curves and gradients, the sharpest curve having a radius of one and a half chains, and the heaviest gradients one in fourteen with, and one in twenty-five against, the load.

A complete telegraphic and block signaling system is carried throughout the line.

Such is a brief description of the line and its equipment, the entire electrical portion of the latter being constructed by Messrs. Mather and Platt, of Manchester, from the designs, and under the superintendence, of Dr. Edward Hopkinson, a partner in the firm.

A few words on the working and results may, perhaps, be of interest. On November 4, 1890, the line was formally inaugurated by His Royal Highness, the Prince of Wales, who, accompanied by His Royal Highness, the late Duke of Clarence, made the journey from the City to Stockwell, and visited and inspected the plant and works. Shortly after this the line was passed by the inspectors of the Board of Trade, and eventually opened for public traffic on December, 18, 1890.

Upwards of eighteen months have therefore elapsed since the public opening, during which time the line has been in daily operation. For the first few months a train service of some twelve trains per hour each way was maintained, but with the growing traffic this has been increased, until at the present time, during the busy hours of the morning and evening, as many as sixteen and seventeen trains per hour are run. The public appreciation of the line is shown by the increasing numbers of passengers carried. For the half year ending June 30, 1891, the number of train miles run was 141,108, and passengers carried 2,412,343. For the second half year, ending December 31, 1891, the train mileage run was 188,666 miles, and passengers carried 2,749,055, exclusive of season ticket holders, the revenue from which on the average fare would represent 37,300 additional passengers, or a total of 2,786,355. The revenue receipts and expenditure have been—for the first half year, receipts £19,637, expenditure £15,520, or a balance to the good of £4,117; for the second half year, receipts £20,243, expenditure £15,516, balance to the good £4,727. These figures are significant when compared with the train mileage and passengers carried, 47,258 train miles more having been run, and 374,000 more passengers carried during the second half year, while the total expenditure has been £4 less, which reflects much credit on both the general manager and engineer, Messrs. T. C. Jenkin and Basil Mott, for the manner in which the working of the line has been conducted. It is to be regretted that this meeting was not a few weeks later, when the results of the present half year would have been available for comparison, but to date, since the opening of the line, the total mileage run is over 500,000 miles, and the number of passengers carried upwards of 7,000,000. The percentage of expenditure to receipts may appear high, but careful study and analysis of the figures show that this is not abnormally due to the traction expenses—the cost of locomotive and generating power, including salaries, office expenses, general superintendence, running expenses (including wages connected with the working of locomotive and generating engines, coal and coke, gas, water, oil, tallow and other stores), repairs and renewals, including wages and materials, only amounting to 40 per cent. of the total expenditure, or 30 per cent. of the gross receipts, which I venture to submit will compare favorably with any other mode of traction. From these figures it will be seen that the cost per train mile for the last half year was just under 8d., while under the sliding scale before mentioned the cost per train mile on the mileage run would have been 7.152d. But in the actual cost of 8d., drivers' wages and other items are included, which were excluded in the sliding scale and if deducted, bring the actual cost down to 5¼d. per train mile. This, I think, will be generally admitted as highly satisfactory, especially when the serious increase of the train load (no less than 40 per cent. above that originally stipulated for) caused by the increased weight of carriages is taken into consideration, the total train load for the 5¼d. per mile being forty-two tons. The working of the plant and line has been both regular and satisfactory.

On no single occasion during the whole period that the line has been in operation has there been any accident or stoppage of the generating dynamos, showing conclusively the security and certainty with which electrical plant can be worked. Slight delays have occurred from time to time with the locomotives, but these have in almost every instance been distinctly due and traceable to the unexpected load and strain put upon them, and in spite of which the record of work done by these locomotives will compare favorably with that accomplished by steam locomotives. The average mileage of the locomotives in regular use during the past year has been no less than 27,000 miles, while on a well equipped steam road the average is 20,000 to 23,000 miles per locomotive. The success of the line is further shown by the numerous similar projects which have followed. Last year a bill was passed through Parliament authorizing the construction of the Central London Railway, a line seven miles in length extending from the City to Bayswater, to be constructed in the same manner, and to be worked electrically on similar principles, but on a much larger scale. During the present session no less than six bills have been presented applying for powers to authorize the construction of similar undertakings. Of these six bills, four of which are applications for new lines, and two for extension of existing powers (including the extension of the City & South London line to the Angel,

Islington) three have passed through both Houses. The Great Northern & City line, running from Drayton Park to Finsbury Pavement, is of exceptional interest, being intended to relieve the Great Northern traffic, and over which it is proposed to run the ordinary rolling stock of the Great Northern Railway. The above bills in the first instance were referred to the Joint Committee of both Houses appointed to consider the whole question as to the best method of dealing with the electric and cable railway schemes, and to report their opinion as to whether underground railways worked by electricity or cable traction are calculated to afford sufficient accommodation for the present and probable future traffic. The Joint Committee, after having met on several occasions, and having had submitted to them a large amount of evidence, reported strongly in favour of the various schemes, and with regard to electric traction, as follows :

"The committee report that the evidence submitted to them was conclusively in favour of the sufficiency and special adaptability of electricity as a motive power to the proposed underground tubular railways."

It may therefore be assumed that before very long this system of transport will become fairly general in London, affording, as it does, a cheap, rapid and safe mode of conveyance.

DISCUSSION.

Mr. Scott Russell asked why a separate motor had been adopted. He thought otherwise a great deal would have been saved and greater adhesion obtained. He considered that all concerned in the City & South London line deserved the greatest credit for the success achieved.

Mr. A. J. Jarman said that when the armatures were wound on the axles, the latter were turned into part of the magnet with the wheels, thus forming the pole, and clinging to the rail ; hence, no sand was required to assist in starting. Another point was why the motors were wound in series. Supposing one of the main wires became cut or broken, that motor would stop. If, however, the motors were wound in parallel, there would always be one leg of the field magnet to work, but worked in series with series winding that motor would be cut out. Winding in parallel had many advantages over winding in series in working the machine on gradients. He was alluding to tramcar traction, and he considered it would be more advantageous to wind the motors in parallel than in series.

Mr. Reckenzaun stated that great credit was due to all concerned in constructing the City line, which was the pioneer line in that direction. With regard to operating expenses, he thought Mr. Grindle would have given details ; how much was paid for coal and wages, etc. Taking 5½d. per train mile, the working expenses seemed very low indeed. He agreed with Mr. Jarman that if two motors on a locomotive or tramcar were placed in series, there was a possibility of their not working in union ; if in parallel they worked together, and in case of accident one automatically cut itself out of circuit.

Mr. Holroyd Smith supported the remarks of Mr. Jarman and Mr. Reckenzaun on the matter of parallel working. From his own experience he had found a decided benefit by coupling up in parallel. It would be interesting to know the cost of producing one Board of Trade unit on the line. He would like to know whether any measurements had been taken to ascertain the relation between the electrical power put in the line and the mechanical efficiency obtained from it. Mr. Scott Russell had referred to the motors not being placed under the cars themselves. He (the speaker) said that if Mr. Russell had had the details of the line to thrash out he would have found that it was impossible to do so in that case. When the matter was fully taken into consideration, Messrs. Mather and Platt had decided upon the only safe way, considering the structure of the line, tunnel, cars, etc.

Dr. E. Hopkinson, in reference to the separate motor or otherwise, said that in the case of the City line there was the difficulty of putting the motor on the bogie due to the restricted space, but that was a mechanical difficulty which could have been overcome with sufficient application. The total weight of the locomotive was ten tons, and of the train fifty tons. Of the ten tons the motors weighed six tons, and the saving by not having a separate locomotive would be four tons out of the whole fifty tons. If, however, the motors were placed on the framework, the bogie would have to be strengthened and made heavier, and the total saving would be only about two tons. Under those circumstances it was not worth while to do so, and that was ample justification of the plan which had been adopted on the South London line. Mr. Grindle, who came to his firm in Manchester seven years ago, suggested that that railway was the place for electrical work. That gentleman urged them to turn their attention to it, and the result was the working out of the details. With regard to having the motor in series or in parallel, from an electrical point of view there was nothing to choose between the two. It was a great mistake to suppose that having the motors in series would reduce the risk of a breakdown.

Mr. Jarman stated that what he meant was that each pole of the field magnet should be wound so that they might be coupled in parallel and joined in series afterwards. That might be something new in motor work, but he had found it of great benefit in tramway work.

Other papers were also read by Mr. L. Epstein on "Electric Traction for Tramcars," and by Mr. A. J. Jarman on "Electric Tramcar Traction."

We are indebted to the London *Electrical Engineer* for a report of this meeting.

THE Chicago & Urban Transit Co. have increased their capital stock from $1,000,000 to $2,000,000, most of which has been subscribed. It is the intention of the company to begin to let contracts within five or six weeks.

Coming Development of Electric Railways.*

BY FRANK J. SPRAGUE.

(*Continued from the July issue.*)

No one will question the capacity of an electric motor to do the necessary work required, or to make a speed superior to that of the steam locomotive, provided sufficient energy be delivered to its terminals, but we must deal with existing or probable methods of supply. It is true that the speed at which a train is propelled by steam has only increased about 50 per cent. in sixty years, for in 1832 the "Matthew Baldwin" often made a speed of a mile a minute, but we must not confound speed with power, for while the maximum speed has not been so materially increased, the endurance, the perfection of the mechanism and the economy of performance have made great strides, and the increased speed, which is by no means the maximum possible of a locomotive *per se*, has been attained at much higher powers, and the schedule time has been shortened principally by cutting down grades, straightening curves, filling up ravines, abolishing trestle works, replacing wooden bridges by permanent ones of iron or stone, by the use of heavier and stiffer rails, better switches, improved methods of automatic signaling, the interlocking switch and signal system and the abolition of grade crossings ; in short, by improvements in details and management which permit of higher speeds on more extended sections of road, because of greater safety, lower traction co-efficients and a greater degree of confidence possessed by the engineer.

All these things are necessary for high speed electric railways, and any general improvements that will be of benefit to the latter must necessarily be of service to the former.

Now, any predictions which are made concerning the future of electric propulsion, either in ignorance or disregard of the possibilities of steam duty and the limitations necessarily existing in all systems of transportation, deserve and will receive little consideration.

Almost every one is familiar with the remarkable run recently made by a Schenectady locomotive hauling a special train on the New York Central Railroad, when the distance of 439½ miles from New York to Buffalo was made at an average speed of nearly sixty miles per hour, and which was the precursor of the Empire State express, which makes the regular run at an average speed of over fifty-two miles per hour. More recently we have accounts of an interesting record made by a well known writer on two runs between New York and Albany, on which a large number of indicator cards were taken. The weight of the train was about 270 tons. The steam pressure varied from 160 to 170 lbs. From an inspection of about a dozen cards, the indicated horse power varied from 551 H. P. at 44 miles to 1,120 H. P. at 78.9 miles. At 60 miles per hour the resistance is stated to have been 15 lbs. per ton, and at 70 miles, 17.10 lbs, per ton. About seven pounds of water were evaporated per ton of coal.

A remarkable statement concerning this performance was made by Mr. Sinclair, which, while almost incredible, will, if borne out by an analysis of facts, prove to be something of a surprise to those who make their prophesies of the electric economies by comparative statements. In the description of these tests it is stated that the whole trip shows an indicated horse power per hour for an average expenditure of only about three and one-eighth pounds of coal per hour. This is far better than many stationary engines.

On the New Jersey Central road one schedule time is eighty-six and one-fourth miles in eighty minutes, which is made where there are a number of necessary slackings. On May 13, the time was taken of the speed of a Baldwin compound locomotive for a considerable period of time on one of the regular runs. Ten continuous miles were made in 452½ seconds and five were made in 222 seconds. The fastest time taken was forty-four seconds and the slowest noted was forty-seven.

In making these very high speed runs there is not much attempt at maximum economy or coal consumption, the necessity being to generate steam as fast as required by the cylinder, but on taking an average of five trips I find that there was evaporated 7.19 lbs. of water per pound of coal used and 9.41 lbs. of water evaporated per pound of coal consumed. The total weight of train varied from 213 to 241 tons.

I recently inspected a number of engine sheets. On one, which gave the duty of twenty-five engines, the average total cost per engine mile was 10.85 cents, of which 2.66 was for fuel. The total cost varied from 6.8 to 19.24 cents, and the fuel (wood) from 1.96 to 4.77 cents. On another sheet giving the performance of twenty-two engines, the total cost per engine mile was 14.70 cents, of which the fuel cost 4.61 cents. The total cost varied from 8.82 to 27.98 cents, and the fuel cost from 2.04 to 7.48. In still another, that of the performance of eighteen engines, the total cost per engine mile was 14.73 cents, of which the fuel (coal) cost 6.62 cents. The total cost varied from 10.04 to 22.52 cents, and the fuel cost from 3.82 to 13.84 cents.

In discussing the electric system there is often a confusion of statements with reference to economy. Despite the undoubted fact that the electric motor can probably be run at variable high speeds with less variation of economy than can the steam locomotive, we must not forget that in the latter we are considering the economy of the unit as a whole, not merely of the steam cylinders but also of the boiler and the furnace. In electric propulsion a similar comparison of economies must take into account the variable duty of the central station and the losses on the line as well as those in the motor, and where single units are used the variation in economy of the whole system would be much greater than in the steam locomotive. There will be only a reasonable fixed efficiency of the central station and the line when the number of units is large enough to make the load on the central station nearly constant.

*Abstract of address delivered at the meeting of the American Institute of Electrical Engineers, Chicago, June 6, 1892.

Some time ago I made a very careful analysis of the work done on the elevated roads in New York City with a view of determining the coal consumption and the duty performed by the locomotives. At the time this investigation was made, now nearly seven years ago, there were in use on the Third Avenue division sixty-three trains at one time, running at very close intervals. The weight of the trains was from eighty to ninety tons, the speed was often as high as twenty to twenty-five miles an hour; stops were made every third of a mile; in short, the duty demanded of the engines was exceedingly severe. The maximum indicated horse power of the locomotives was found to average about 163 H. P., although on occasions these locomotives have been worked up to 185 H. P. Work was divided approximately as follows: Acceleration in starting, 59 per cent.; lifting, 24.3 per cent., and traction, 16.7 per cent. The average horse power exerted was 70.3 H. P., considerably less than one-half of the maximum.

The work on the line was so distributed that there was an almost constant total duty of about 4,500 H. P. The locomotives were on duty twenty hours, but used steam only six hours, and including all losses when standing still and the amount of steam used in braking, there was a horse power developed for about 6.2 lbs. of coal.

An analysis of the coal expenditure showed that, with an efficiency of 60 per cent. and without any of the energy of the train being returned to the line, the relative coal expenditures between steam and electricity would be about in a ratio of two to one, but if the energy of the train was returned to the line to the extent which I believe it possible, then the relative expenditure of fuel would be in the proportion of seventy-two. Since the coal charge on the four divisions was at that time about $550,000, it can easily be seen that, independent of any question of saving in the care of the structure and any reduction of depreciation of the motor equipment, the fuel saving would be sufficient to pay a good interest on the cost of electrical equipment, and a large interest on the cost of electric equipment minus this value of the present engines.

In discussing high speed possibilities and limitations, the testimony of Dr. Dudley, as given in a discussion of a paper before this Institute, February 24, 1891, is interesting.*

Such a shape can be given to the front of an electric locomotive as will make the air resistance not over one-half that presented by a plain surface of equal cross section and perpendicular to the line of motion, but even this fact does not alter the other, that the resistance per ton must be higher for small trains than for large ones.

Speed, capacity and coal economy are, however, not the only questions to be considered in railroad operation, and in discussing the general subject it will be found that the signaling and braking questions at high speeds are serious ones. Undoubtedly, an electric train with distributed motors, making the weight of the train available for traction, could, by using the motors as dynamos to return the energy of the train to the line from the highest to mean speeds and then on a local circuit, be more quickly and more effectually slowed down and stopped than where shoe brakes are used, and both methods, of course, would be available.

When riding at sixty or seventy miles an hour it is a very quick stop to bring a train at rest in less than 2,000 ft. This is often as far as any signal can be made out, especially when the weather is at all thick. Hence we may expect to find on electric railroads, if high speeds are to be attained, and quite possibly also on steam railroads, an extension of automatic signaling so that trains indicate on more than two sets of signals.

In discussing the use of electricity instead of steam, a well known steam engineer recently stated that, in his judgment, it must be conceded that electromotive force for the propulsion of cars will not be economical except for suburban traffic, and upon certain sections of important trunk lines, like the New York Central between New York and Albany, the Pennsylvania system between New York and Philadelphia, the other lines of like character where it is necessary to disband a large number of comparatively light trains every day, and at short intervals. The principal field for a power of this kind would be in suburban service long enough to make the ordinary street electric cars unpopular because of the time required, and in such cases as these mentioned above; also for moving freight trains in cities, that is, for the performance of transfer service. This is precisely in line with the arguments which I have advanced from time to time, and which I illustrated in a paper before the National Electric Light Association at its convention in Kansas City, where I outlined the possible service between New York and Philadelphia, and to which I will again refer.

I must repeat that it narrows itself down to the one question as to the number of trains operated between two terminal points. Make that number of trains sufficiently large and the electric motor is the best means of propulsion, whether for high or low speed, whether for large or for small cars. Decrease this number and we must rely on steam propulsion; or to put it in another way, the answer to the query, Will electricity take the place of steam for railroad purposes? is: Only in part, and then only when the number of units operated between the terminal points are so large that the fuel economy would pay a reasonable interest and depreciation of the necessary cost of the central station and the system of conductors.

Of course I do not in this general reply consider those special cases where advantages are to be gained for which there is a return for capital in another direction. Such a case is that of the Baltimore tunnel, where the investment and cost of operation will be greater than that for steam propulsion; in fact, there will practically be no economy in power, because the steam locomotives are not done away with, but simply unused for a period of a little over a mile. There is in this specific case, however, the incidental advantage of doing away with the necessity of a ventilating plant and yet getting rid of the annoyances incidental to tunnel service.

Every system has its limitation. The electric is not exempt from this law, and hence it will set forth what are well known limiting laws concerning the transmission of energy. They have been stated time and time again, but somehow or another people often lose sight of them in discussing the question of investments in large electric railways, so that I think it would be well, perhaps, to restate and emphasize them.

The weight of copper necessary to transmit a given amount of power with a fixed loss, will vary inversely as the square of the electromotive force used.

The distance to which it can be transmitted with a given weight of conductor will vary directly as the pressure.

The distance to which it can be transmitted over a conductor with a given cross section will vary directly as the pressure.

The weight of copper necessary where the supply station is in the centre of the system, is only one-quarter that required if the station is at one end.

The weight of copper will vary inversely as the square of the number of supplying stations properly placed.

The electromotive force required will vary inversely as the number of stations.

Lack of knowledge of these simple and unalterable laws has led to much misconception of electrical possibilities, and these have not been confined to the electrical engineers.

In many of the suggestions which have been made even by practical steam engineers, there has been an unnecessary confusion of the practicable and unpracticable, and the specific object which should have been borne in mind has been lost sight of.

Committees have drawn impossible specifications for trunk line service, and demanded of electric motors a capacity and performance superior to that of the best compound steam locomotives. I unhesitatingly pronounce any attempt to build some such machines for the present, certainly unnecessary and impracticable. The service thus suggested, if at all needed, will for many years be better performed by the steam locomotive than the electric.

Leaving out of present consideration trunk line work, there are three problems requiring solution in the application of electricity to propulsion on a large scale under conditions existing, for example, in Chicago or in any other place where there is a movement of a large number of trains on more or less complicated tracks, as will be found at almost all terminal stations. They are:

First. The development of an electric locomotive of ample power which shall be as readily controlled as the steam locomotive and shall be reliable in operation and shall show a high economy. Of course such a machine must have all the adjuncts which are necessary for train movement.

Second. A system of conductors and method of supporting the same, which can be relied upon for ample supply of current and absolute certainty of continuous contact at all speeds on curves, switches, cross-overs and the multitudinous combinations which exist on yard tracks.

Third. A system of automatic block signaling which, while effective for steam traffic, will not be thrown out of operation by the use of tracks as conductors of electricity for a general supply. This is a more serious question than is at first considered, for this use will materially interfere with, if not absolutely destroy, the utility of what is known as the rail circuit system.

This third problem is one which must necessarily follow the development of the other two, as the automatic signaling systems now existing have followed the development of steam practice.

It will probably be found necessary to erect a variety of kinds of conductors. From the most careful consideration which I have been able to give to the subject, I believe there is one way, and only one way, in which the current can be supplied in any complicated system, and that is from the overhead conductor, practically rigid in character, following very nearly the centre line of all tracks and switches with no movable overhead parts, and with return through the rail. The locomotive would then practically be moving between two electric planes, the lower being the guiding one. I know there has been a great deal about other possible systems of supply, We have heard much of the charged rail using low potential currents supplied at frequent intervals by motor generators driven from a central station.

Since we have discovered no conductors devoid of resistance, and the art of welding is not particularly applicable for railway service where moving contacts are a necessity, little credence need be given to any scheme of this character.

Intimately connected with the question of conductors, and one of the most serious ones which has to be met by the electrician, is that of potential. The personal danger limit of continuous or ordinary period alternate currents is pretty well determined, and it seems generally admitted by constructors that the danger limit for the continuous current machine, with its commutator, is about the same as the personal danger limit.

Hence we meet with two dilemmas. If using continuous current motors, we are limited to a difference of potential per machine of 1,000 to 1,200 volts, and we can, so far as safety of the machines is concerned, only probably go above this limit by putting the motors in series precisely as has been proposed for long distance stationary transmissions.

If this is not done, then we have the introduction between the transmitting dynamo and the receiving motor of a motor generator system, another pet theory which is often suggested but which I unhesitatingly pronounce as so uneconomical as to be impracticable.

If using an alternate current system, then converters must be used,

*For a full report of this discussion see the STREET RAILWAY JOURNAL for April, 1891.

either distributed along the line and supplying the working circuit or placed upon the locomotive to safeguard the motors.

While the use of a converter under these conditions is not as objectionable as the use of a motor generator, it cannot commend itself as a very practicable scheme, and certainly in view of the fact that no single phase alternate motor promises up to the present serious success.

For the present, and. I think, for a long time to come, we must confine ourselves to the consideration of railroad problems where continuous currents are used, and where the traffic is sufficiently large to justify the investment in central stations and conductors which would be required for the operation of such assistant.

There are two methods of propelling trains electrically, one by following steam practice, that is by building a motor and hooking it to the head of a train, the weight of the motor being such as is required for the necessary power and traction when grades and slippery tracks are encountered. From all that has been developed up to the present, to get the control that is necessary and to build the machines safely, the electric locomotive will weigh nearly as much per horse power as the steam locomotive. This weight can be better distributed, but I do not think if steam practice is followed on trunk line service, that there could be any very material reduction of weight of train.

The other plan is to have each car propelled by one or more motors This would be the ideal system so far as propulsion goes, provided the electric motor was unlike all other mechanical apparatus, in that it never failed, and if a number of machines could be as well taken care of, cost no more and show as little depreciation as fewer machines of larger capacity operated as a unit.

Should we arrive, as we hope, to possession of a single circuit, alternate current motor , then in view of the simplicity of its control, we may fairly hope for the distributed motor system. But here also the capacity and, likewise, the weight of the motor being determined by the total duty done, the weight of train limit would not be decreased, but rather increased.

Among the roads that are ripe for the electrical engineer, and on which in the near future I hope he will demonstrate he has a most legitimate claim, are the New York elevated and the Chicago elevated, the handling of the trains on the New York Central and Harlem roads below the Harlem river, the long talked of rapid transit road of New York, the Metropolitan underground road of London the proposed tunnel roads in London, Paris and Berlin, and, coming more immediately home, suburban service such as that of the Illinois Central Railroad, a most ideal track for the electrical engineer, and last, and, as it will prove, one of the most important, the operation of the terminal and warehouse systems for the interchange of freight on the lines entering a city situated as is Chicago.

There will probably be in operation in the United States within twelve months not less than five locomotives varying from 700 to 1,200 H. P. and from forty-five to eighty tons in weight. The character of the work done will vary. In that work in which I am most concerned from a personal standpoint, a 700 H. P. electric locomotive will be built for experimental work, and to attempt to solve as far as may be the various problems involved in railroad practice in Chicago. If my judgment is followed, there will be an experimental section of track in the form of a loop about thirteen miles long with eighteen miles of rail, and with every variety of single and double track construction, and simple and compound crossings and switches.

On this I hope to see erected such varieties of overhead construction as may be found best to meet the various kinds of service, and where the railroad problems on track jointly operated by steam and electricty can be developed in the most satisfactory manner. On this track there will be not only this locomotive, but also one of equal rated capacity supplied by one of the larger manufacturing companies. The duty demanded of these machines will be severe. They will be required to haul a train of not less than 450 tons, at thirty miles an hour, up a grade of twenty-six feet to a mile. They will probably be required to develop their full rate of capacity at all speeds between thirty and sixty miles per hour, and if there is sufficient track room they will be driven at a speed of at least seventy-five and perhaps 100 miles per hour for short distances. The potentials used will be nearly double that at present obtaining in street railway practice.

A still larger problem, so far as power goes, although not in the variety of conditions which will have to be met, will be that recently taken for the operation of the belt line tunnel now being constructed in Baltimore to avoid the necessity of boat transfer at Locust Point. The duty of the motor will be to propel the train with engines coupled on, but not in operation, through a tunnel about 6,000 ft. long.

The conditions require the motors, which will weigh about eighty tons and have a capacity of about 1,200, to propel a 1,200 ton freight train up a grade of forty-two feet to the mile at a speed of fifteen miles. Passenger trains of 450 tons' weight must be regularly started from rest twice in the tunnel on this grade, and in an emergency must start the freight train. The draw bar pull under regular duty, and when not starting, may be as high as 32,000 lbs.

Perhaps the traffic from New York to Philadelphia affords as good an example as any of what may be done on regular passenger service, provided the track is clear enough.

For this I, some three years ago, and again in the *Forum* of September, 1891, outlined an electric express service, with a method of supply through a rod carried above the car and a return circuit through the rails and earth.

Such is the work before us, a work well meriting your best efforts; yet it is well to temper your enthusiasm with prudence.

Limit your attempts to the solution of those problems which will prove of practical benefit.

Do not chase rainbows. They are beautiful and poetic, but they have small place in the world's economies.

Remember that neither sentiment nor ignorance are winning cards, but lessened costs of operation for equivalent duty and increased returns on invested capital.

All this is said in no spirit of discouragement. for I yield to no man in my confidence in the future of electric traction. No new field is so rich, none more pregnant with great possibilities, but the growth of the work will be more expeditious and healthy if we separate the visionary from the real, the impracticable from the practicable.

Compound vs. Simple Engines for Cable Roads.

In our July issue (P. 488) we quoted from *Power* a communication and editorial with above title, which has proved of considerable interest. We take pleasure in presenting the following on the same subject, from galley proofs kindly furnished by *Power*.

In continuation of the discussion instigated by our editorial remark concerning the use of simple non-condensing engines for the Broadway and Third Avenue cable roads in New York City, the following communications have been received. Two of these are from men in actual charge of cable plants, one of whom is putting into practice his evident belief in the adaptability of the compound non-condensing engine for cable service, while the other would look for favorable results from such an engine only under particularly favorable circumstances. The third letter is from a constructing engineer of wide experience in cable road work who requests that his name shall not appear, but who evidently believes in the possibilities of the compound engine in this direction.

Mr. A. N. Connett, chief engineer of the Baltimore City Passenger Railway, writes :

I am now installing three plants for our company, and in all I am using compound engines to run non-condensing. I consider that the constant load will be large enough to keep the low pressure cylinder ever from expanding below atmosphere. They have proved moderately successful on electric railway plants, and the service there is a more variable one than on cable plants. The Seventh Street road in Washington (cable) is showing an admirably economical result in the use of compound condensing engines. Of course it can be readily said that there is no danger of back pressure with such engines. But I think you state the case fairly when you say that the automatic proportioning of the loads between the cylinders will always give the low pressure cylinder sufficient initial pressure to make its introduction an object. The Brooklyn Bridge example is a poor one. Their variation of loads is largely in excess of most street railway plants. The Broadway and Third Avenue lines, I think, should have remarkably steady loads. The conditions of loading and alignment there cannot but make it so. The same will prove true in a somewhat less degree with the plants being installed by our company. The results obtained here will, no doubt, be very interesting, and I have the greatest confidence in being able to show five ponuds of water saved per hourly horse power by compounding over similar plants using simple engines.

On the other hand, we have from Mr. Fred. W. Wood, manager of Temple Street Cable Railway Co., Los Angeles, Cal., the following :

EDITORS POWER :—Apropos of the recent discussion regarding the adoption of simple non-condensing engines by the New York cable roads, permit me to say that the considerations which should govern in the design of the power plant for any given road depend so largely upon the local conditions that any general rule is impossible. That the use of compound engines is economical under certain conditions all engineers will admit. That compound engines do as a fact operate satisfactorily in some cable power houses is also not to be disputed. That the conditions of cable railway practice are unfavorable for the best operation of compound engines is equally true.

The percentage which the cost of power bears to the whole cost of operating seems to me to be a necessary factor in deciding upon the character of power plant to be used. This percentage is variable, and my judgment is that it may range from 25 to as low as 6. It is manifest that in dealing with an item that amounts to 20 or 25 per cent. of the whole cost of operation, much more money may be invested and complications introduced than would be warrantable if the item ranged lower than 10 per cent.

In those cities where the price of coal is $10 per ton, the cost of power is a large item, and complications in the engine room and expense for condensing apparatus and water may well be incurred, and the added risk of accidents and consequent delay from all these may be borne. But if fuel costs from $2 to $3 per ton, and if the traffic of the proposed road is of very large amount, the possible economy of cost of power may become an insignificant matter when compared with other considerations. Assume that the cost of power will be 6 per cent of the whole operating charge, and that under the rather unfavorable conditions 20 per cent. is the saving that compound engines would accomplish, the real saving would then be 1.2 per cent. of the whole operating charge. Now, if this saving of 1 and 2 per cent. is accomplished at some additional expense of plant and cost of repairs and liability to accident, it becomes a question as to whether it is wise to make the economy at the cost. It seems to me to be a question to be decided more from the standpoint of the manager than from that of the engineer.

While I fully appreciate the value of compound engines in the use of steam and in the distribution of working strains, my experience has also taught me that the economy which is purchased at the expense of added mechanism may prove to be dearly bought ; and I should be very conservative in criticising the use of simple engines when coal is $3 per ton and the traffic of the road of great volume.

I know of one power house provided with well designed compound engines (and these engines with complicated attachments on the valve gear for increasing the range of the cut-off) in which the low pressure cylinder is and always has been idle, and from the valve gear of which all the attachments that so much was expected of have been removed, until the whole has been reduced to a simple and fairly economical Corliss engine. In other instances the original complicated engines have been removed, and replaced by smaller simple engines, to the great economy of the operation.

The keeping up of a steam plant in its daily operation to some approximation of the conditions usual while it is being experted and tested—the application of as high a degree of scientific knowledge and study in its daily operation as is put into its design and while in the hands of the mechanical engineer is, I think, of greater economic importance than the design of its engines.

With reference to the particular question: Would compound engines have been preferable in the New York power houses to simple ones? I think it is safe to assume that the designers have considered the whole matter, and that the small percentage of the total expense which the power item will probably be, and that the great importance of avoiding possible delay in the very large traffic to be handled, and the fact that the variations of load incident to cable railway work would place the compound engines under unfavorable conditions, have led them very wisely to adopt the simplest possible means of producing their power, and that their action is not in any sense to be regarded as evincing a lack of appreciation of our faith in the principle of compounding a steam engine *per se*.

If anything goes wrong in one power unit in an electric road, the design is usually such that this particular unit may be out for repair without delay to the system. This is impracticable in the cabel railway practice; hence the prime importance of avoiding possible accidents, especially under the conditions which obtain in very large cities.

Again, the percentage which the cost of power bears to the whole operating cost decreases as a cable road is worked to its maximum capacity; and the nearer this maximum capacity is approached the greater will be the proportion of the variable load and, consequently, the conditions for the good working of compound engines are still further departed from. These are, I take it, exactly the conditions that will probably arise in a cable road in New York City. And the engineer, who under other conditions would install triple expansion engines, might well use simple engines here.

We regret that we are not at liberty to announce the author of the following. His name stands for years of successful experience with cable railway work and heavy transmission machinery, and would give addional weight and interest to the opinions expressed:

What would apply to operating cable railways should in general apply to any other ordinary plant of machinery driven by steam power. In the first place, the conditions and location of power houses may materially interfere with the character and kind of engines to be used. In a general way, under ordinary circumstances, in our crowded cities, and especially where coal is dear, it is important that the most economical in the use of steam should be adopted, regardless of the cost of the plant, as the first cost is a small matter when compared to a plant that is costly to operate. There is not the least doubt but that the majority of cable railways to-day, in this country, are driven by high pressure engines, of the Corliss or automatic type. It is very questionable whether a well designed and proper size Corliss engine (for the work to be done), working at the most economical point of cut-off for the average duty, can be compared with the compound non-condensing engine, even when the wear and tear of the extra parts, and the loss by radiation in two cylinders are taken into account. The difference in cost between the single and compound engines would be very small.

I have never heard of a case where a change has been made from a high pressure automatic Corliss engine to that of a compound non-condensing. The compound engine of to-day will undoubtedly do the same work at less cost than a high pressure engine, as the compound engine simply carries the expansion of steam to its greatest limit. If proper data was taken before and after such a change, it certainly would be very interesting. Where it is possible to condense, in connection with the compound engine, there need not be the slightest question as to economy or hesitancy in using this class of engine in driving cable railways, as well as any other plant or class of machinery. The varying power required on a cable railway is unquestionably considerable, but no more so than in rolling mills, or in the triple expansion engines as used on our large transatlantic steamers. Take, for illustration, the engines of the "City of Paris," or the "City of New York," of 20,000 H. P. Consider that these vessels in a storm have their propellers whirling in the air at one moment, and the next plunged into the water. In this case we have triple expansion engines, with condensing included, so that if such engines answer under the conditions stated, there is no real reason why they should not answer in cable railways, or other work.

Possibly the finest examples of compound condensing engines in use to-day in the United States, on cable railway work, are to be found at the Seventh street power house of the Washington & Georgetown Cable Railway Co., Georgetown, D. C., the power house being adjacent to the Potomac River. The economy need not be questioned by any visitor, as a walk into the boiler house will satisfy him at once that about as little fuel is being used as is possible, for the work performed. The boiler house and appurtenances are about as perfect as practice and experience can make them. I have recently heard of a cable plant to be erected in San Francisco, in which vertical triple expansion condensing engines will be used, which I think is a step in the right direction. The engines will be placed directly on the centre driving shaft, and make 115 revolutions per minute, using a much smaller pinion than has been customary in cable railway construction, thus getting a higher piston speed, higher velocity on the main shaft, and reducing its diameter to the minimum. The high initial velocity will no doubt help to keep the cable steadier.

The subject is still susceptible of discussion, and we shall be pleased to hear from others regarding it.

Legal Intelligence.

Cable Railway Companies—Additional Servitude—Injunction Proceeding—Statutory Construction.

1. *Held*, In an action to enjoin a traction company from operating a railway track on a certain street is not multifarious, when the rights under which all the plaintiffs claim are the same, and the acts complained of affect them all alike.

2. Where Act 1887, authorizes traction companies to construct and operate, upon any street on which a passenger railway "now is or may hereafter be constructed," with the consent of such passenger company, appliances necessary for the traction of the cars of such passenger company; and, where the act further provides that traction companies may lease the property and franchises of passenger railway companies and operate such railway companies, *Held*, that a traction company, which has obtained a lease from a passenger company, may construct its appliances, not only upon streets already occupied by the passenger company, but also upon streets which the railway company has a right to occupy.

3, *Held*, that the use of a street by a cable railway company is not an additional servitude, entitling abutters to compensation, though vehicles cannot stand between the curbing and tracks without interfering with cars, and though the pipes under the surface of the street, by being lowered to make room for the cable conduit, may be slightly more difficult of access.

4. Where the use of a street by a railway company is not an additional servitude, entitling abutters to compensation, the latter cannot maintain a bill to enjoin the operation of the railway on the ground that the company has transcended its authorized powers, since it is amenable for an excessive exercise of power only to the state. *Rafferty et al.* v. *Central Traction Co. et al.* Pa. S. C., March 21, 1892.

Injury to Passenger—Defective Brake—Negligence of Driver.

In an action by a passenger against a street railway company for injuries caused by a collision, resulting from the fracture of the brake chain, and the consequent inability of the driver to stop the car on the grade, where there is no evidence that the driver was wanting in care or skill, it is error to submit the question to the jury.

2. Where the runaway car made great noise, the failure of the driver to shout to the employes of the car ahead to start their car will not be adjudged negligence, in the absence of evidence that shouting would have prevented the accident.

4. When the inspector testified that on the morning of the accident he looked the chain over, and tested its strength by winding it up several times, but did not examine each link, and a chain manufacturer of large experience testified that a flaw could not exist at the centre of the iron without being visible at the surface, the sufficiency of the inspection was a question for the jury. Judgment for plaintiff reversed. *Wynn* v. *Central Park N. & E. R. R. Co.* N. Y. C. of App. April 26, 1892.

Injury to Person on Track—Deafness—Contributory Negligence—In an action to recover damages for personal injuries resulting to plaintiff's wife, the court on appeal

Held, 1. That a person who is afflicted with deafness, and who wears a protruding apparel, obstructive of the sense of sight, and who ventures, without looking right or left, to cross a street railway track acts rashly, and is guilty of such contributory negligence as will prevent a recovery in damages in case of injury sustained by a collision with a coming mule and car.

2. *Held*, that the driver had a right to presume the

person sound of hearing, and that she would exercise her senses, so as to avoid an accident, by stopping in time to let the mule and car pass freely. Hence, a verdict in favor of the company, under such circumstances, will not be interfered with. *Schulte* v. *New Orleans etc. St. Ry. Co.*, La. S. C., Mar. 21,1892.

Injury to Passengers—Negligence—Declivity—High Speed—Damages—Verdict. On appeal,

Held, that the evidence justified a finding of negligence in respect to the condition or operation of a train of passenger cars (cable line) which, while carrying passengers, ran down a steep declivity, composing a part of the line, at very great and dangerous speed, and apparently beyond the control of those operating the train.

2. *Held*, that the evidence justified a finding that injuries received by the plaintiff, manifested immediately by temporary unconsciousness, by headache, nervousness, sleeplessness and some impairment of mental faculties, was also the cause of his paralysis, although that did not supervene until seven months after the injury.

3. If an injury is the direct cause of a diseased condition which results in paralysis, the latter may be ascribed to the jury as a proximate cause.

4. That the application for a new trial on alleged newly discovered evidence *held* properly denied, and verdict sustained as to amount.

Bishop v. *St. Paul City Ry. Co.*, Minn. S. C., January 14, 1892.

Use of Another's Track—Compensation—Expropriation—Procedure.

1. A street railway company which is authorized by the City of New Orleans to enter upon the tracks of another must, before doing so, make compensation to the company.

2. The material in place is the private property of the company occupying the street; and in the absence of any agreement, it must be expropriated to public uses like any other private property.

3. Where a city ordinance provides the mode of compensation, and the two corporations are within the limits of the same franchise, the ordinance will control the mode to be pursued in reference to fixing the compensation, as the corporations accept their franchises with reference to said ordinances. But the city ordinance cannot arbitrarily fix the amount of compensation.

4. There is no limitation in the ordinances of the City of New Orleans, which prevents the street railway companies from contracting with reference to the amount due from the use of tracks.

Canal etc. St. Ry. Co. v. *Orleans etc. St. Ry. Co.*, La., S. C., January 4, 1892.

Street Railways—Powers—Erection of Poles in Street—Ordinance—Test.

1. *Held*, that the provisions of the act empowering street railways, with the consent of municipal authorities, to use electric or chemical motors or grip cables as the propelling power of their cars instead of horses, do not legalize the erection of poles and the stretching of wires in a public street as a part of a system of electrical railroading.

2. *Held*, that an ordinance which purports to grant permission to erect such poles and stretch such wires is illegal.

3. *Held*, that an abutter, owning to the middle of a street, can use the writ of *certiorari* to test the validity of an ordinance which purports to confer the power to place such posts upon his land lying in the street.

State v. *Inhabitants of Trenton et al.*, N. J. S. C., January 8, 1892.

Use of Streets by Railroads—Ordinances—Resolutions.

Held, That a resolution of common council giving consent to a street railway to place posts and stretch wires on a street, and prescribing the size and location of the poles, and limiting the speed of the railroad when operated by electricity, is a street regulation, and such regulation of streets shall be by ordinance or by-laws, and not by resolution, as provided by charter of the City of Newark. Resolution is set aside.

State v. *Mayor etc., of City of Newark et al.*, N. J., S. C., January 8, 1892.

Street Railway Track—Projection of Rail Above Grade Crossing. A street railway company allowed one of its rails to project three inches above the surface of the street crossing or crosswalk, against which projection plaintiff stumbled, fell and was injured.

Held, that such condition of the track was negligence in the company, for which it was liable in damages. Judgment of the trial court affirmed.

Schild v. *Central Park N. & E. R. R. Co*, N. Y. S. C., December 14, 1892.

Note: A street railway builds its track in accordance with the chartered rights. Limitations usually govern the laying of tracks. Conditions must be complied with. A street railway company is bound to lay its rails properly and to keep them in proper condition. *Woster* v. *Ry. Co.*, 50 N. Y. 203. Where rails were left projecting four and a half inches above the surface without planking between them, and an accident was occasioned to one who crossed the track thus maintained, a verdict was upheld; see *Wasmer* v. *Ry. Co.*, 80 N. Y. 212. A traveler has the right to assume the safe condition of the crosswalk.

Horse Railroad—Injury to Child on Track—Negligence of Driver. Plaintiff (by guardian), a child of three years of age, slipped into the street unseen by a half grown sister who was in their house at work, and while there was badly hurt by defendant's horse car, which was being slowly pulled up hill by the regular horses and an extra tow horse. A witness testified that he saw a child on the down track crossing over to the other track while the car was yet ten feet away, and heard people shouting to the driver. He then turned his back, but, at renewed shouting, turned again, and saw the child knocked down by one of the horses. The driver and tow boy both testified that they were looking straight ahead but did not see the child, and knew nothing of the accident until the conductor blew his whistle to stop, which was after the car had passed the child.

1. *Held*, that a verdict for plaintiff would not be set aside as unsupported by evidence.

2. *Held*, under the circumstance of the incident as above set out, that an instruction that the highest degree of care is required of a driver who sees a person lying helpless on the track in front of his car was not sufficient ground for a reversal, as it could not have injured defendant. Judgment affirmed.

Giraldo (Guardian) v. *Coney Island & B. R. Co.*, N. Y. S. C., December 14, 1891.

Regulation of Street Cars--City Ordinances—Nuisance—Police Power. In an action by the complainant street railway company against the city authorities, on appeal it is

Held 1. That under the provisions of a city charter giving the council power to pass all ordinances necessary for the due administration of justice and the better government of a city, and to "cause the removal or abatement of any nuisance," the passage of an ordinance requiring a street car company to put "a driver and a conductor" on each car is a proper exercise of the city police power, and not an impairment of the company's rights, not being unreasonable or oppressive.

2. Also, that a provision in such ordinance, requiring the police to cause every car not provided with a "driver and conductor," to be returned to the stable, is not an enforcement without trial, but merely a means of preventing a nuisance by blockading travel. Judgment a reasonable time. A party wishing to alight must uot hesitate or loiter. On street railways the conductor only in favor of the city affirmed. *South Covington St. Ry. Co.* v. *Mayor etc.* Ky. C. of App., May 12, 1892.

The Lynn (Mass.) Belt Line.

If one wants to get the worth of his money, he has but to board one of the fine cars on the lines of the Lynn Belt Line Street Railway Co. at any point, and he will be carried entirely around the city, in fact, well out into the suburbs and returned to the same point, a distance of seven miles, for one fare. This ride on a pleasant evening is a very enjoyable one, and the citizens show their appreciation of the service by a very liberal patronage. The company operate twenty-five cars, six being long cars equipped with the Robinson radial trucks, and the others four wheel cars. The former are by far the most popular with the patrons. The capacity of this equipment is severely taxed on Sundays and holidays; in fact, there are times when they cannot begin to accommodate the traffic. The power house and car house are on Spring Street, some distance from the city. The buildings are plain wooden structures, but are conveniently arranged. The power equipment consists of two batteries of Root water tube boilers, and two Greene engines, one of 500 H. P. and the other of 150 H. P. These are coupled by means of belting and countershaft to five eighty horse power Thomson-Houston generators of the D 62 type. The Ireson belt is employed, and the shaft is provided with Barker clutches. Ordinarily only fourteen or fifteen cars are run, and the daily fuel consumption is four and a half tons of Cumberland soft coal, but when the traffic is heavy six or more tons are required.

It is the purpose of the company to put in condensers in the near future, and to take the water for this purpose from a neighboring pond. A current of about 525 volts is carried, and the circuit is connected with that of the Lynn & Boston lines which it crosses in numerous places.

The city of Lynn is growing rapidly, and since the great fire, two years ago, has made rapid strides. It is a city of comfortable homes, and these spread over a wide extent. Numerous shoe factories are found in every part of the city, and these, except in the heart of the city near the burned district, are mostly plain wooden structures of one or two stories. The future of its street railway interests would seem to be very bright, and the Belt Line, under the able management of T. W. Adams, superintendent, will doubtless receive its share of the patronage.

Montreal to Have Electric Power.

The street railway problem in Montreal was settled July 20, by the Board of Aldermen, who voted twenty-two to fourteen to allow the street railway company to install electric power. According to the proposition of the street railway company to the city, the latter will receive the following percentages on the gross annual receipts of the railway company: On all sums up to $1,000,000, 4 per cent.; from $1,000,000 to $1,500,000, 6 per cent.; from $1,500,000 to $2,000,000, 8 per cent.; from $2,000,000 to $2,500,000, 10 per cent.; from $2,500,000 to $3,000,000, 12 per cent.; all over $3,000,000, 15 per cent.

The railway company also offer to introduce immediately the sale of eight tickets for twenty-five cents, available on all working days between six and seven in the morning and five and seven in the evening, and to give transfers to every part of the city. Mr. H. A. Everett, managing director of the company, states that if the bill receives the necessary approval of the mayor the work on the electric equipment will be commenced immediately. The general feeling is one of satisfaction and relief that the question which has so long been agitated has finally been settled.

The Philadelphia Traction Co. have secured the services of the Field Engineering Co. as their engineers in charge of all electrical construction work in Philadelphia and vicinity. There will be about forty-five miles of track in West Philadelphia and about 150 miles in Philadelphia proper. There has been considerable delay and discussion in regard to the Philadelphia part of the work, but it is expected that construction will soon be actively begun. The material is all on hand.

Notes from Paris.

Paris is at last to have an underground railway. The Municipal Council arrived at this decision July 4, after hearing the evidence of the third commission on the project and listening to various reports relative to the cost of the line, necessary work and so on, and have settled upon the length of line, period of lease (seventy years), minimum wages to employes (fifteen cents per hour), fares (four cents), guarantee to be given ($100,000) and other points. The route and general plan of the railway is the same as given in our May issue, and electricity will be used as a motive power. Trains will be of one, two or three cars, having each a carrying capacity of fifty-two passengers. The speed is to be twelve miles per hour. The principal station will be at the Place de la Bastille, and the road will be connected by a branch to the Paris, Lyons & Mediterranean Railroad.

One condition of its construction is that the line shall not interfere with either the waterways, gas mains or sewers, nor are the streets to be opened above the tunnel, but the work is to be accomplished by small openings here and there at the sides, as is being done with the Sceaux-Limours railway now being built. Only at the location of the stations will there be any opening to the surface. On this head the permit to construct is very strict.

Another very important condition imposed by the Municipal Council is that there shall be a considerable participation of profits with those employees whose wages amount to less than $800 per year. This has been done it is said, to avoid the possible chance of the Council of State rejecting, as contrary to law, any terms fixing minimum salaries.

By the completion of this railway, Paris will be provided with a means of transit that will mean hardly less to it than did the elevated railway to New York, and it will probably hasten the adoption of some system of more rapid transit with the present surface roads. It has taken five years to bring this project to the point which it has now reached. It was first submitted to the administration in September, 1887, and passed through three commissions. In 1888 further consideration was postponed pending the completion of details with regard to the question of electric traction. This last point was finally settled in July, 1891, thanks to the progress of electric traction in the United States and to what the delegation to London gathered from the operation of electric motors there, and the necessary plans recommended for consideration in the report of a Mr. Sauton.

A Rhode Island Clambake.

The fourteenth annual Rhode Island clambake, tendered the electrical fraternity by the American Electrical Works of Providence, R. I., occurred at Haute Rieve, on July 23. Lunch was served at 11.30 A. M. at the Union Club's country house, and the bake was opened at two o'clock with appropriate ceremonies.

All who have ever participated in the generous hospitalities afforded by this well known wire company need not be told that the clams were of the best and that they disappeared rapidly. Mr. Eugene F. Phillips, the genial president of the company, was, as usual, the recipient of many encomiums, and when the party finally separated in good spirits it was with the best of feelings to their host and every wish for his future welfare as well as that of the company which he represents.

The Connelly tramway motor was recently put in operation in London on one of the lines of the London, Deptford & Greenwich Tramways Co., and at the test a large company of members of the Tramway Institute were present. The motor was of the same type as those used on the North system in Chicago. It was claimed that it was capable of drawing a heavily loaded car up a grade of one in twenty, and that its speed was sixteen miles per hour. The total expense for operating the car was stated to be $3.87 per day, this amount including labor, fuel oil, lubricating oil and wear and tear.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
Street Railway Publishing Co.,
World Building, New York.

The New York Street Railway Association will hold its tenth annual meeting this fall at the United States Hotel, Saratoga Springs, N. Y., September 20, at 10 A. M. Two papers will be presented to the Association for consideration, entitled "Recent Improvements in Cable Traction" by Geo. W. McNulty, engineer, Broadway & Seventh Avenue Railway Co., New York, and "Recent Improvements in Electric Traction" by L. H. McIntire, engineer, Harlem Bridge, Morrisania & Fordham Railway Co., New York. With these gentlemen to report on the improvements made recently in the two most approved motive powers used in street railway service, an able review of the advances made by each is assured, and an interesting session may be expected. The place of meeting always possesses an attraction of itself, and it is to be hoped that every member of the Association who can attend will make a special effort to do so, and that this meeting will be marked by a larger attendance and a larger accession to its membership than any heretofore.

Valuable Lessons both as to mechanical details, inventive energy, financial ability and *esprit de corps* on the part of employes may be derived from reading the account of a visit to the extensive works of the Thomson-Houston Electric Co., at Lynn, Mass., the first installment of which will be found in another part of this paper. While we found many things to admire during our visit to the works, we were more profoundly impressed with the character of the employes as evinced by their skill and devotion to their work, but more particularly by their gentlemanly behavior on the streets when going and coming from work and in public after business hours, than by any other feature. It is an inspiring sight to stand at the close of the noon hour and watch the nearly 4,000 operatives and students as they approached the works from every possible direction and note the entire absence of disorder and boisterous conduct, showing that a proper system of discipline influences the individual not only while he is within the walls of a factory, but on the street and in his home. Where these things are found, excellent mechanical skill is not wanting and the products will necessarily bear the same stamp of excellence.

"Street Railways," our new handbook for street railway men, is now ready for delivery, and orders are being rapidly filled. A prospectus and price list will be found in our advertising columns. This work has been prepared solely in the interests of the street railway industry, and every person who has the development and improvement of this business at heart will secure this work and take an interest in its circulation. As is stated in the preface, the work will doubtless elevate the business and those engaged in it in public estimation, by showing the importance of the industry, the talent and varied accomplishments one must possess to become a successful manager in any department of the business. Many will be disappointed in the work, in that it gives much more than its title indicates. It is not alone designed for the leading officers of a street railway company, but should be in the hands of all the men at the head of the different departments as well. Even then its use should by no means be confined to men actually engaged in the street railway business; it will prove of great service to engineers and inventors, to all students in engineering and other technical schools, and to the student of economic subjects. We do not dwell upon the merits of the work in order to sell it, but because we believe that it will prove helpful to all who will use it. It must be remembered that this is the first and only work that covers the entire field of the street railway business and treats of all the leading methods of traction. This fact alone renders the work valuable.

Improvement in the General Construction for Electric Railways has been very noticeable within the last year and a half. The work on the first railways was very crude, it may be admitted, not much better or more substantial than would now be deemed necessary for a temporary installation; but at the present time the tendency is all in the direction of thoroughness, and the best possible construction that money can procure. Articles that have appeared in these columns from month to month give evidence of the fact that track laying is conducted by a great many companies in a style scarcely inferior to that required by the standard established by the best steam railroads. At the same time companies generally are seeing to it that overhead work is done in a manner that indicates a realizing sense of the fact that cheap construction is by no means economical. There was a reason and an excuse for the wretched construction of the early days of electric railroading. What was required was not definitely understood in the first place, and every piece of work was to a great extent experimental. Time soon demonstrated, however, that electric railways had come to stay, and experience, sometimes bitter, perhaps, indicated in a general way what was essential to successful and economical operation. With the best managers at the present time the belief is thoroughly established that construction cannot be too good. While these comments are to a certain extent trite, we are in-

clined to express in this way our confident belief in the value of good construction in view of the great amount of building to be done within the next few months.

The Meeting of the American Street Railway Association this fall at Cleveland, promises to be one of the most interesting in the history of the Association. Cleveland, besides its natural attractions which render it one of the pleasantest cities in the country, is especially interesting from a street railway standpoint. The transit facilities of the city are well developed, the three principal systems of street car traction, electricity, cable and horse, being all represented. In addition, the city is interesting because the early success of electric traction there did much to prove the desirability of the system as a motive power. The complete list of papers to be read at the meeting, announced in our last issue, shows that the advance made during the last year in street railway engineering and methods will be ably presented, and the papers will undoubtedly call forth the usual discussion, which in some respects is often more valuable than the papers themselves. Owing to a wise provision decided upon at the last convention, the papers to be presented will be set in type some time before the meeting, and copies will be distributed to any members desiring them, so that any who wish to present their own experiences on the subject under discussion, or bring up questions, may be able to prepare such subject matter in advance, with a knowledge of the way in which the subject will be treated by the speaker. This practice has been widely followed in many scientific bodies, but will be tried for the first time by the Association this year. We have often stated our belief that no street railway company in the country could afford not to be a member of the Association, and we trust that among those companies who have not joined, there will be many who will decide to send a representative this year. The annual fees are trifling, while the benefits to be derived from such a connection are large.

World's Fair Transportation has been a much discussed topic during the last few weeks in Chicago, and it has been repeatedly asked if the facilities were at all adequate to the enormous demands to be made upon them. In recent considerations of this question, it has generally been stated that facilities for handling, at a maximum, 150,000 persons per hour should be provided for. Four means of reaching the Exposition grounds at Jackson Park from the centre of the city will be available: The street railways, the elevated railroad, the steam surface roads and the steamboats. A cursory examination of the situation as thus outlined, is interesting. No one who is acquainted with the facilities of the South Side cable road to cope with great crowds will question the ability of the managers to do their share in solving the problem; but assuming that on two lines three-car trains are run every two minutes, the number of passengers that can be carried seems small in comparison with a total of 150,000 desiring transportation. Without going into detailed figures, we may state that the street railways, the elevated railway and the steamboats are relied upon to carry at the busiest periods during the day 50,000 passengers an hour. This leaves 100,000 persons dependent on the steam railroads, and it is estimated that 1,500 cars and 150 locomotives at least will be necessary to handle the traffic. Such an equipment the companies do not possess for their World's Fair service. This result having been reached in several independent estimates, even local papers have indulged in rather gloomy forebodings, and have unsparingly criticized the World's Fair management for failing to make proper provision. We are rather inclined to the belief that the prospect is not quite so dismal as it has been considered by many, and we hold this opinion primarily because we regard 150,000 passengers an hour as too high a figure to be assumed as the maximum demand upon the transportation facilities. The movements of crowds to and from Jackson Park will, we believe, be more gradual than those who have made the estimates are inclined to predict. Great crowds there will be at the best, but so many, who are able to control their own time, will go late or return early, that it will have the effect of appreciably diminishing the transportation at the busy hours. Then, too, a multitude will live near the grounds and will require no means of transit, if a fraction of the hotel projects materialize. In dealing with a question of this sort an opinion is naturally little more than a speculation, but we venture to assert that the estimate of the necessary facilities is decidedly too high, and that if proper terminal facilities are provided at the grounds the crowds can be carried as rapidly as under the circumstances a reasonable man has the right to expect. But at the same time we as confidently believe that the managers of the fair cannot afford to let the problem solve itself, as it is a matter of most vital importance.

The Homestead Strike, with all its dire consequences, is familiar to our readers, and we have no disposition to write a homily on the subject, for if we should, it might never be read by the strikers nor by the managers of the Carnegie works. From all appearances the law and justice seem to be on the side of the steel company, since the men admit that the wages offered are better than those usually paid for similar service, but what chiefly interests our readers is how to prevent a similar state of affairs in connection with the street railway industry. Those who attended the Pittsburgh convention and participated in the river excursion to Homestead, will recall with pleasure the visit to the steel mills, and will go over in memory all the interesting details of rail making. Little did we think at that time that the employes of the mills who seemed so industrious, and were, apparently, so devoted to their work, were cherishing bitter and hostile feelings towards their employers which would so soon culminate in an unlawful seizure of the great property, the frenzied attack upon the 300 watchmen sent by the steel company to take possession and guard the works, and an atrocious attempt upon the life of the manager. What has happened will happen, and although labor organizations will receive a general set back in the present struggle, the pent up fires in ignorant, selfish breasts will continue to break out spasmodically until the kingdom of perfect love is established in the earth. Nearly all labor troubles arise from ignorance and selfishness. The judgment of the masses is (right or wrong) that those who possess or manage great wealth never justly and rightly obtained so much more than their fellows, even though laws and social customs may endorse as honest the methods used for its accumulation. To correct this judgment and bring the fortunate classes into closer sympathy with their less fortunate fellows, is the work in hand. Street railway companies have an important mis-

sion in this respect, and there are none, no matter what their present state of fancied security may be, that sooner or later will not be called upon to face hostile action on the part of organized labor; hence, there is an individual responsibility in the matter, and it is not safe to delay until there can be some concerted action, or until our social system is reformed on some of the many plans proposed by popular writers on these subjects. Everyone in self defence should begin "to build over against his own door," and if our advice were asked, we should suggest that the first step in this direction would properly be to ascertain the present attitude of the employes in relation to the company, and the character of teachings they were receiving from their leaders and from the literature with which they were being supplied. Then an earnest effort should be made to counteract the false teachings by providing that a wholesome literature, either in the form of periodicals, specially prepared circulars, or a series of articles in local papers, should find its way to the homes of all the men, supplemented by an occasional popular lecture that would lead them to look on both sides of public questions, and tend to bring them into harmony with those who are working for the common good, or, in other words, create a public sentiment in favor of that particular enterprise. There is also great advantage to be gained in publishing periodically a full and accurate report of the business, showing clearly the net income and risks, and where the income is exceptionally large, dividing all above a liberal per cent. on the investment with the employes, thus recognizing them to a certain extent as business partners in the industry which their labors have helped to create. From a financial standpoint this course will be found to be more economical than it will to ignore the matter, and finally meet the issue which, as stated above, is bound to come.

The Value of Rapid Transit, to people generally, is daily becoming more thoroughly understood and appreciated, and throughout the country the number of obstacles put in the way of those endeavoring to satisfy the public demand for better transportation facilities is, happily, considerably less than a few years ago. The value of a good street railway system is so obvious that the education of the people in this respect has at times seemed almost marvelously and vexatiously slow. Taking a general survey of the field, it is a satisfaction to note that at the present time prejudice is much less pronounced, and that intelligent self interest causes the property owner to look with increasing favor upon the propositions of the street railway man. The public has not learned the lesson, or to express the idea a little more clearly, perhaps, has not changed its point of view, without suffering some decidedly unpleasant experiences which were the logical result of its erroneous views. It is with a rather grim sort of a satisfaction that we learn of an instance in point in a Western city. In this case a certain group of merchants learned a lesson regarding the significance of rapid transit that they will never forget. When the local street railway company proposed to lay tracks for an electric railway in front of these tradesmen's stores there arose a storm of bitter protest and opposition. If we are not mistaken, the merchants failing to secure injunctions took the law into their own hands and proceeded to stop the work by deluging the laborers with water from a two inch hose. The road was built of course—roads always are built under such circumstances—and cars were regularly run. The street railway company immediately began to heap coals of fire on the heads of the protesting merchants, not intentionally, perhaps, for the trade of the latter straightway increased quite materially, it is said. They refused to recognize the fact, and continued to protest against the disfigurement of the street and the dangers to their customers from rapidly moving cars. Recently, it happened that the company found it necessary to abandon, temporarily, on account of repairs, a part of one of their routes in which was included the track located in front of the premises of the protesting merchants. No longer were latters' eyes offended by the rapidly moving cars or their ears assailed by the clang of the gong. They ought to have been happy, but, no; they found that the patronage of their stores commenced to decrease in the most alarming fashion; trade seemed to follow the new line of the cars; even the traffic teams deserted the street for reasons that it would be hard to determine. The street soon began to lose its busy and prosperous appearance, and the merchants dismayed by the radical change in affairs, came to the conclusion, finally, that it was far better to modify their views, confess that they were wrong, to do anything, in fact, than to have things remain as they were. Regardless, then, of the humiliations attending an admission of error, and throwing ceremony to the winds, they humbly besought the railway company in their wisdom to restore the service at the earliest possible moment. Poetic justice, perhaps, would have then dictated the final abandonment of the road; but sentiment of that sort did not have any weight with the street railway company, as, to tell the exact truth, the street was a very essential part of the line. So the petition of the merchants was granted, and if the street railway managers felt a malicious satisfaction who shall blame them? We fancy that these tradesmen are now thoroughly alive to the advantages and importance of rapid transit. And, as we have said before, the public generally is gradually reaching the same conclusion. An electric pole is no longer such an objectionable sight as it was two years ago. The owner of the abutting property has begun to realize that the offensive pole is an integral factor in the electric road which has brought his office ten or fifteen minutes nearer his home and has caused his property in the suburbs to rise in value very materially. The pole is daily looked upon with more favor as its necessity is better realized, and all the electrical companies using overhead wires, electric light, telegraph, telephone, owe an immense debt of gratitude to it. Had it not been for the essential trolley line their overhead construction in many a city and town would have been laid low long ere this.

Reduced Passenger Rates to the Cleveland Convention.

The secretary of the American Street Railway Association informs us that he has concluded arrangements with the Trunk Line and Central Traffic Associations for securing the usual reduced rates for members to attend the Cleveland Convention in October. Mr. Richardson has recently been to Cleveland in consultation with Mr. H. J. Davis, the secretary of the local committee, and reports that the arrangements for the meeting are progressing satisfactorily. The hall that has been selected as the place of meeting is a very desirable one indeed, and the outlook is encouraging for a large and interesting meeting.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

The $350,000 Cable Road and the $46,000 Electric Road.

II

Taking up again Census Bulletin No. 55, entitled "*The Relative Economy of Cable, Electric and Animal Motive Power for Street Railways*," I would like to ask what is meant by "Total Cost of Road and Equipment?"

Looking over the details of the cost of certain cable railways as that thing turns up in auditors' books, I find: Real Estate, Buildings, Street-work, Power Plant, Gas and Water Changes, Bridges and Viaducts, and similar charges, about the propriety of the including of which in such statements as those of the Bulletin there can be no question; and then come such items as: "Repaving Streets as Required by Charter," "Discount and Commission on Bonds," "Legal Expenses," "Cost of Extension of Franchise," "Old Horse Railroad Property," etc. In a list of which these are extremes, opinions will differ as to where the line should be drawn and the footing made to answer a call for "Cost of Road and Equipment," and the conclusion will depend on the purpose of the investigation.

For comparison of the ten cable with the nine electric roads, suppose we put on the right side, under "COST OF ROAD AND EQUIPMENT," every dollar spent in and about the construction and equipment of the new road, every outlay for materials and labor, every incidental expense of administration or otherwise; in short, "*everything that*," in the sweeping language of Brown's old Grammar, "*can be known or mentioned, as apple, truth*," &c.; and on the other side, under "FRANCHISES, ETC.," the old horse railroad, the extraordinary legal expenses, the expenses of transfer and reorganization, the discount and commission on bonds, the things of the nature of a price paid for the franchise (like repaving streets, giving the municipality a new drawbridge over the open sewer, installing a new town clock, etc.), and so on. This will be the left side, and in the comparison of roads I propose to leave it out. This seems fair because the item "*Franchises, etc.*," may be a large one in a large city, and sometimes it bears a closer relation to the place where, than to the system under which, the new road is to be operated. It is probably included in making up the cost of some of the horse railroads in a table given in my last letter; in the cases, say, of all of those costing from $185,000 to $516,000 per mile of line.

But we are immediately concerned about the disposition made of it in our two Census tables.

The *Financial Statement* of Electric No. 1, June 30, 1890, reads, on one side,

"CONTRA,

Franchises, etc.	$800,000.00
Construction	664,190.45
Equipment	408,163.83
Real Estate	84,000.00
Trustee Investments	5,020.00
Acounts receivable, etc., etc."	

The "Total Cost of Road and Equipment" for this road in the Bulletin is $1,156,354.28, an amount made up of the three items I have connected by a brace. The item "Franchises, etc., $800,000," is, very properly, left out. And I believe there is little, if any, of it on the whole electric side of the census tables.

But being out of the electric side it should, for the comparison, be out of the cable side.

It isn't by a long shot.

In the ten cable roads I find it, on information still far from perfect, however, *there* to the amount of about $10,000,000 (and probably more) or about $133,000 per mile of line, on an average. Without this item the $350,000 cable road of the Bulletin reduces to $217,000 (or less) per mile, including bridges and viaducts costing large sums.

I may be able to speak more precisely and more positively on this matter later, but it is enough for the present that nearly, or quite, the last dollar of this item has disappeared on the electric side, and some $10.000,000 of it stands charged on the cable side in this treatise on "*The Relative Economy of Cable, Electric and Animal Motive Power for Street Railways.*"

Returning to "Operating Expenses." In my last letter I showed how an electric whose operating expenses, properly speaking, were 17.55 cents in six selected months of 1890, and 19.79 cents for the year 1891, turns up in the Bulletin with 13.53. Taking now No. 7, which operated for 8.34 cents per car mile for twelve months—in the Bulletin—we find the details as follows:

Fuel	$2,190.00
Wages of engineers and firemen	2,007.50
" " dynamo engineers and mechanics	912.50
Various supplies for power house	510.00
Repairs of cars	120.00
Repairs and renewals on motors (except gearing)	60.00
Repairs of gearing and trolleys	300 00
Wages of motormen and conductors	7,220.00
Wages of trackmen and others employed on line	730.00
Salaries of general officers and clerks	1,500.00
Total operating expenses for twelve months	$15,550 00

And in all of that twelve months this company did not apparently spend a dollar under these heads of the Census office form: "Repairs of Roadbed and Track," "Repairs of Buildings," "Repairs and Renewals on Engines," "Repairs and Renewals on Dynamos," "Repairs and Renawels on Other Machinery," "Miscellaneous Items under Current Expenses for Power," "Repairs and Renewels on Electric Street System," "Miscellaneous Items under the head of Maintenance of Rolling Stock," "Removal of Snow and Ice," "Damages to Persons and Property," "Miscellaneous Expenses under Transportation," "Miscellaneous Expenses of General Office," "Advertising and Printing," "Legal Expenses," "Insurance," and "Miscellaneous Items under the head of General Expenses."

The reports of some others have this appearance of being defective in a less degree.

No. 10, as said before, is operated by storage battery, and the figures exhibited for it are not used in making any of the averages of the Bulletin. Of the nine others three show figures for a fraction of a year (one of them though it had been in operation about sixteen months on January 1, 1891), and six, only, show results ostensibly based on twelve months' experience.

Now, among the 300 electric roads of 1890, was it not possible to collect reports of ten operated by the trolley, without filling out the list with a storage battery road, whose figures are not used? Was it not possible to get a whole year's experience on more than six? Was it necessary to use reports so obviously defective as some of those of the Bulletin? Would any man with an interest of his own at stake—wanting the *truth* for his own information—work on such material as this?

On the cable side, No. 2 is credited with 1,653,303 car miles; it made about that many *train miles*, say, 3,306,606 car miles. No. 10 is credited with 1,307,613 car miles; and made that many *train miles*, or 2,615,226 car miles.

The car miles given for Nos. 8 and 9 are correct in number, but the car was in each case an eight-wheeler and equal, for all business purposes, to two of the cars on the electric side. No. 3 made nearly all of its miles with eight wheel cars. No. 1 about 42 per cent. of its miles with eight wheel cars. No. 4 about 55 per cent. of its miles with eight wheel cars. No. 7 is credited with 1,244,750 car miles. About 90 per cent. of this mileage was made with eight wheel cars and the rest was train miles. Nos. 5 and 6 made miles about as reported, and all with four wheel cars.

Thus on two roads we find about 2,960,916 car miles entirely omitted; on three we find that all the "car miles" which were not made by eight wheel cars were really "*train miles*;" on three more, a large part of the work was done by eight-wheelers and on two out of ten

roads, the mileage is fairly reported for purposes of comparison.

Now, as I have said above, the eight wheel cable car, which by a singular fatality is so extensively pitted against the four wheel electric car in the Bulletin, is equal for all business purposes to two four wheel cars. I, therefore, rewrite "Table A 2" in part.

Turning once more to the nine electric roads, if we assume that 70 per cent. of their *reported* expenses is wages and that wages on the ten cable roads are 40 per cent. higher (both reasonable assumptions), the 13.21 cents per car mile becomes:

13.21+40% of (70% of 13.21)=16.91 cts.

If we could add the undoubted omissions of their

A.—CABLE RAILWAYS.
2.—STATISTICS OF OPERATION. } (Revised by the Writer.)

No.	How the "Car-Miles" of the Bulletin were Made in Each Case.	Total Operating Expenses, as per Bulletin.	"Car-Miles" Made, as per Bulletin.	Equivalent Number of "Standard" Car-Miles Actually Made.	Cost per Car-Mile in Bulletin. (Cents).	*Corrected Cost* per Standard Car-Mile.
1	42% by 8 wheel, 58% by 4 wheel cars	$1,063,834.59	6,290,172	8,932,044	16.91	11.91
2	"Car-Miles" of the Bulletin should be *Train Miles.*	355,415.13	1,653,303	3,306,606	21.50	10.75
3	95% by 8 wheel, 5% 4 wheel cars	200,093.65	1,413,280	2,755,896	14.16	7.26
4	55% by 8 wheel, 45% 4 wheel cars	145,299.39	1,404,000	2,176,200	10.35	6.68
5	All by 4 wheel cars	441.151.59	4,698,120	4,698,120	9.39	9.39
6	All by 4 wheel cars	344,22?.99	3.355,435	3,355,435	10.26	10.26
7	90% by 8 wheel cars; the rest should be *Train Miles.*	272,721.43	1,244,750	2,489,500	21.91	10.96
8	All by 8 wheel cars	225,069.39	1,595,650	3,191,300	14.11	7.06
9	All by 8 wheel cars	57,697.94	310,331	620,662	18.59	9.30
10	"Car-Miles" of the Bulletin should be *Train Miles.*	180,948.54	1,307,613	2,615,226	13.84	6.92
		$3,286,461.64	23,272,654	34,140,989	14.12	9.63

There are minor inaccuracies, of which I take no account, to reduce the complications. Thus, No. 7 included in its operating expenses some additions to its equipment, and other things more properly chargeable to cost of road, and No. 2 (which operates only 5.07 miles by cable instead of 5.75) worked into its report horse car figures which brought the cost per train mile (given as cost per car mile in Bulletin) up to 21.50 instead of 20.18, or 10.09 cents per car mile, and the cost per passenger up to 3.54 instead of 3.33 cents.

To explain some of the larger errors of the Bulletin, it should be said that some of the cable roads are in a state where street railway men call a *train mile* a *car mile*, and a grip car and a trailer hauled 100 miles are said to have made 100 car miles instead of 200, as in the East. (What they would do with the three and four car trains of Washington, St. Louis, Chicago, and the occasional morning and evening five car trains of another city, remains to be seen).

Thus we see that the 14.12 cents which has so long been "standard" reduces to 9.63 cents per "standard car" mile, for the ten cable roads of the Bulletin. The average is still high for the average cable road of this country. This is to *some* extent due to the circumstance that four out of the ten roads selected burned coal costing from $8.50 to $10.50 per ton and paid Pacific Coast wages and prices for everything. Cable railway men know that the cable road whose operating expenses (exclusive of interest on bonds only) are as high as 10.00 cents per car mile for four wheel cars is "paying high" for something. Recent figures are as low in some instances as 6.60 and 6.40, and the average, now, is probably well under eight cents per standard car mile.

I said in my last letter: "I have little doubt that, reduced to equivalent numbers of 'standard cars' and miles, we shall find the cable figures at least twenty-one cars and 1,000 car miles per mile of line, or a car each way every two and one-quarter minutes." A result of the revision of Table A 2 is that we get:

	Equiv. No. of Standard Cars per Mile of Line.	"Standard" Car-Miles per Mile of Line per Day.	Average Headway.
The $350,000 Cable Road (which cost less than $217,000)	24.00	1,242	1.85 min.
The $46,000 Electric Road.	2.93	177	13.00 "

reports and give them coal at the high average price paid by the ten cable roads, these nine suburban electric roads would show, where they stand, operating expenses exceeding those of the ten cable roads, by *at least ten cents per car mile.*

If we could move them into the cities served by these cable roads, their operating expenses would be swelled by repairs of pavements, by the wear and tear of track, due to city traffic, by a large increase in the accident account, by blockades on crowded streets and at steam railroad crossings, by increased taxes, by exactions of many sorts, and by twenty things incident to doing business in large cities.

And when we get the operating expenses of this particular nine electric roads, not for a few selected months, but for their second, third and fourth years, when the wear and tear have fairly begun, and the renewals for which no adequate allowance is made on their books, we shall the better understand why, with everything in its favor—on paper—the electric road realizes so little in dividends. Experience teaches that with the electric road the first year is the best, and "operating expenses" per car mile advance from year to year: while with the cable road progress is as plainly marked in the other direction.

I have speculated at some length on the relative showing we should have for this particular ten cable and nine electric roads, if we had them both hauling four wheel cars, paying the same wages, buying the same coal, and generally near enough together for a reasonable comparison. My main object has been to show that the figures of the Census tables are, as they stand, decidedly misleading, and to suggest why.

Some further inaccuracies of the Bulletin may be noticed.

Cables Nos. 3 and 7 are credited with grades of 70 per cent. and 80 per cent., and the text says of grades: "The steepest of all rises for a distance of 413 ft. at an angle of over thirty-five degrees with the horizontal." Now, I should suppose that anybody *digesting* these Census figures would pause here long enough to verify the data, and that having found them correct he would, in simple fairness, transfer these roads to the department "Inclined Planes and Passenger Elevators." But, anyhow, the facts are that No. 7 has a rise of eighty feet in 413, or a grade of about 20 per cent. (which is not uncommon on cable railways, being slightly exceeded for about 1,300 ft. at Portland, Ore., for instance), and No. 3 has probably no grade exceeding 7 per cent. On

the other hand, No. 8, which is credited with a maximum grade of 4 per cent., has about 1,500 ft. of 10 per cent. grade, up and down which, month after month, eight wheel cars run with the smoothness of machinery at a speed of 12.86 miles per hour.

I have alluded to the "carelessness with which returns are made on blanks sent out for such information as is embalmed in these tables." Most of the things I have pointed out are to be ascribed directly to this cause. The Census Office should be well aware of this uncertainty of things, and it should have contented itself with publishing the returns, marked plainly "FOR WHAT THEY ARE WORTH." But instead, it sits down with this mass of impossible figures, with millions of car miles left out on one side and millions of dollars on the other, with four wheel cars on one side, pitted against eight wheel cars or trains of two cars on eight out of ten lines on the other, with footings in which train miles are added to car miles, as if they were units of the same denomination—and grinds out some pages of ready made inferences *which are exactly characterized by the epithet preposterous.* Every arithmetical result is precise and as infallibly accurate as if worked out by a machine, sublimely unconscious whether the figures in the hopper stand for allspice or degrees Fahrenheit; and the strongest marks of a guiding intelligence in the business are found in such sentences as these: "It seems that the cable railways under consideration were built at a cost per mile of street occupied of over seven times as much as were the electric railways," and "a comparison between the economy of the cable and electric roads represented can not fairly be made without taking into consideration the fixed expenditure due to the greater first cost of the cable roads;" followed by little tables which look like this:

Electric	46 697.50	13.21	4.35	17.55	1.75	1.23
Cable	350,324.60	14.12	6.79	20.91	2.15	1.91

the small ends of *these* horns being the best ones to come out at.

The Bulletin itself could not long pass current among street railway men, cable or electric, but its machine-made inferences, made, to be sure, chiefly of rags, straw and coloring matter, but stamped with the government imprint, have been as good as an annuity in Treasury notes for the electric interest, and it will be long before the $350,000 cable and the $46,000 electric shall cease to circulate in the back counties, unless the beneficiaries alluded to shake public confidence by trying to make eight bills out of seven, after the manner of a writer in the *Engineering Magazine* of May 1892, who says:

"A comparison of the average cost of building and equipping cable, electric and horse railways per mile of track, taken from the recent Census reports is given below:

Cable roads	$350,000
Electric roads	30,000
Horse roads	41,000"

It is dangerous to tamper even with an eighty cent *silver* dollar; you may make it uncurrent in spite of traces of the stamp of the government left on its face.

My July letter said of Cable No. 1, which "cost" $684,000 per mile, in the Bulletin, "the last lesson of this case may be that it is a healthy sort of a system that can stand up under such a load."

Here is part of the lesson: In the first place, the $684,000 is not the "Cost of Road and Equipment," as that expression is commonly understood by gentlemen making electric exhibits under this title. In 1886, the "North Chi. St. R. R. Co." obtained possession of the lines and franchises of an older corporation, the "North Chi. City Railway Co.," under a lease for 999 years. The North Chi. St. R. R. Co. guarantees the interest on the outstanding bonds of the older company, and pays a fixed annual dividend of *30 per cent.* on its stock. The North Chi. St. R. R. Co. made a bargain with the City of Chicago by which the company got a tunnel under the Chicago River, at its own cost, and the city a new bridge, etc., and thereupon proceeded to cable about seventeen miles of (single) track, which now (since May 26, 1888) it operates, with also some sixty-six miles of horse railroad line.

The company pays the highest wages going, allows sick employes one-third wages when off duty, gives the public (since the first wrestle with the combined grade and curve at the north end of the La Salle Street tunnel) a service alongside of which that of the old horse cars was a shadow, and generally works along on broad gauge principles, with results about like this:

						Par Value	Market Price
$ 500,000	worth of	6	per cent.	bonds of the	old Co.		112
1,500,000	"	4½	"	" "	old Co.		95¾
2,350,000	"	5	"	" "	new Co.		100⅜
500,000	"			stock "	old Co.	$100	$500
5,000,000	"			" "	new Co.	$100	$194

Net profit on the $5,000,000 of stock in 1890, 10.3 per cent.
" " " same in 1891, 12.25 "

Doubtless some electric man will (again) credit the horse car part of this large system with the earnings suggested by these figures, as the writer in *Engineering Magazine* for May, 1892, substantially does. In that case, perhaps, I can finish his education.

Now your electric road cannot stand up under that sort of thing and live, any more than we can balance successfully such a feather as 177 car miles per mile of line per day.

It may be well to admit here that the figures given in these letters may be tainted with error. They are as good as I have been able to get with much painstaking, and I think none of them are seriously misleading.

CABLE RAILWAYS.

(*To be Continued.*)

Montreal Notes.

The fever of electric traction has at last reached Montreal, and nothing else of interest is at present mentioned in street railway circles. The Montreal street railway is operating an excellent horse car system, although the passengers do help the employes in their work by being required to deposit their silver five cent pieces in a tin fare box held by the conductor. The cars run on sufficient headway to accommodate the traffic, and are far enough apart to necessitate a single track only, with turn-outs on each route. On Craig Street, however, where several lines converge, the track is doubled.

The cars are very neat indeed, and were made principally by Stephenson, Jones and N. & A. C. Clariviere, local builders. The Clariviere cars are close copies of the Stephenson and Jones cars, and attest the fact that the Canadians are better imitators of American street cars than their cousins across the Atlantic. The closed cars have sixteen foot bodies, and the open cars have seven and eight benches. The cars used in summer are stored away when snow appears, and other cars mounted on sleigh runners take their place. The number of cars operated in summer is much larger then in winter, and, in consequence, a number of men is discharged each year as winter approaches. Conductors and drivers receive as wages from $6 to $7 per week. The track construction is of the old horse car type, with the ordinary tram rail and stringer construction. No cast iron or built steel crossings are used, but the car wheel jumps over the rail crossing its path, or has a clear passage, according to the circumstances. The ordinary tongue switch is used. Instead of hitching the hill horse beside the car team, as in the United States, a novel device is substituted. Poles are used on all the cars, to the front hook of which a chariot with two horses is hitched, and the car is thus assisted up the grade. The chariot fits exactly in the rails.

But electricity is to do away with all the horse cars in Montreal, notwithstanding the arguments from the opposition in regard to the difficulties of operation in winter, and as a result the city will receive a boom in all quarters, which is sorely needed. Affairs are in the following shape at the present writing: The franchise of the Montreal Street Railway Co., the company at present operating the horse cars, has eighteen more years to run. But the company wish to substitute electricity for horses as soon as possible. In this privilege they have competitors, and not a monopoly, as in the case of the horse cars,

for three electric companies are in the field to obtain the right from the city authorities to operate the present horse lines electrically. They are the Westinghouse company, represented in montreal by A. H. Morin, the Thomson-Houston company, represented by S. R. Williams, and the Royal Electric Co., of Montreal, of which Wm. Hagar is general manager, and Wm. Thomson, brother of Prof. Elihu Thomson, electrician. The Montreal Street Railway Co. appear to favor the Edison system, and from present indications they will be granted the privileges. The mayor of Montreal is bitterly opposed to electricity, but his opposition is of no avail as everybody else is in favor of the innovation.

The Royal Electric Co., a few days ago, received from the Brownell Car Co., St. Louis, an "Accelerator" car. It is a beautiful specimen of the car builder's art, and is shown herewith. The illustration depicts the end of the triumphal march through the city. The people flocked after the car as it passed through the principal thoroughfares, and nothing but praise as to its grace and beauty was heard on all sides. The car is equipped with Brownell's new truck, and all the advantageous features of the "Accelerator" type of car. S. L.

St. Louis Notes.

The annual meeting of the National Brotherhood of Carworkers took place in this city on June 21, and was well attended.

The franchise of the Forest Park & Clayton Electric Railway has been passed by the City Council. The eastern terminus of the road is at Delmar and DeBaliviere Avenues. It extends westward on the former street to Adelaide Avenue, thence to Kingsbury Boulevard, and northwesterly to Clayton. The company wanted to use the Forest Park loop of the St. Louis & Suburban Railway, but the latter company would not think of it, notwithstanding the fact that at the terminus decided upon, the Lindell Railway offered transfer privileges.

The Meramec Street line of the Union Depot Railway is to be extended from the present terminus at Springtown Road to Carondelet. The route was mapped out by the citizens of Carondelet and submitted to Mr. Scullin, president of the railway company, who decided to accept it.

An electric belt line is to be built around Forest Park. The City Council has decided to sell the franchise to the highest bidder. Some lively bidding is expected, as the line will some day be useful for other than park purposes The proceeds of the sale are to be used for beautifying the park.

The owners of the Chattanooga (Tenn.) street railways were in St. Louis recently, endeavoring to sell their property. All inquiries at brokers' offices were met with no reply. It is known, however, that the St. Louis Trust Co. have taken up the offer of the representatives, and that the sale will shortly be accomplished. The visiting party consisted of Messrs. Charles A. Tyler, D. S. Watkins, J. C. Devine, all of Chattanooga.

The City Central Electric Railway Co., of which mention has previously been made, intends to connect the various points of interest in the city by rapid transit, on a direct route and for a single fare. It is to give to North and South St. Louis a thorough crosstown system of transportation, so that one section can communicate with the other in the briefest possible time and for a single fare. Transfer tickets will be issued to all parts of the line. Excursion cars will be run from the Fair Grounds to Tower Grove Park. This system will give to North and South St. Louis a direct connection with the new Union Station, and what has long been needed, convenient access to the beautiful cemeteries of the city. The road will be built and in operation six months after the franchise has been obtained, and a bond of forfeiture will be given for the construction of the road.

The projectors of the Chicago & St. Louis Electric Railway claim that the road has now assumed definite shape, that the bonds have been floated in New York, and the stock partially subscribed in New York and St. Louis. The capital stock is $6,500,000.

The Grand Avenue Railway Co. have applied to the City Council for a franchise. The route of this company's line runs along Grand Avenue from Carondelet on the south to the cemeteries on the north. There is no competition whatever, as the nearest parallel crosstown lines are some distance away. The proposed road will be about ten miles long, double track. For this distance a five cent fare will be charged at all times. It will use the tracks of four other companies whose cars run only two or three squares in the case of each line, and will thus prove a valuable feeder. The new company have met with no objection so far, and it is safe to say that the franchise will be obtained with little or no trouble. Messrs. Butler, Slattery, Conrades and others, all residents along the proposed line, are the prime movers in the scheme.

The Missouri Railroad Co. have filed suit against the Southern Railway to restrain the latter company from using their track on a portion of Market and Sixth Streets. There is a city ordinance allowing one company to use the tracks of another in so far as the traffic of the company does not injure that of the owners of the franchise. The Missouri company claim that their franchise is of a date previous to the above ordinance, and that there is no clause in their franchise which will allow the cars of another company to run on their tracks. The Southern company refuse to accept the damages assessed by the commissioners appointed by the mayor in the case of the Union, Union Depot and Broadway lines, because they are allowed to run only horse cars, while they have been operating electrically for some years past. The amount of the damages is $250,000.

The Lindell Co. are replacing all their galvanized iron guard wiring with copper, on account of the latter being non-corrosive. S. L.

Statistics of Horse Car and Omnibus Traffic in Paris.

The Annual Report of the Compagnie Général des Omnibus de Paris for the year 1891 shows the following interesting statistics.

Horse Car Traffic.— Total number of street cars in service during the year 1891 was 270, the same as during the preceding year. Each car covered on an average per day 59.8 miles. The total number of horses employed by the company for the operation of cars averaged 3,471 per day. The number of horses owned per car operated, was 13.55. The cars carried during their regular trips 72,988,111 passengers. Of these 41,578,473 rode inside the car and 31,409,638 on top. 13,150,388 passengers used transfer tickets. The average receipts per passenger were 3.552 cents. The average receipts per car mile were 46.6 cents.

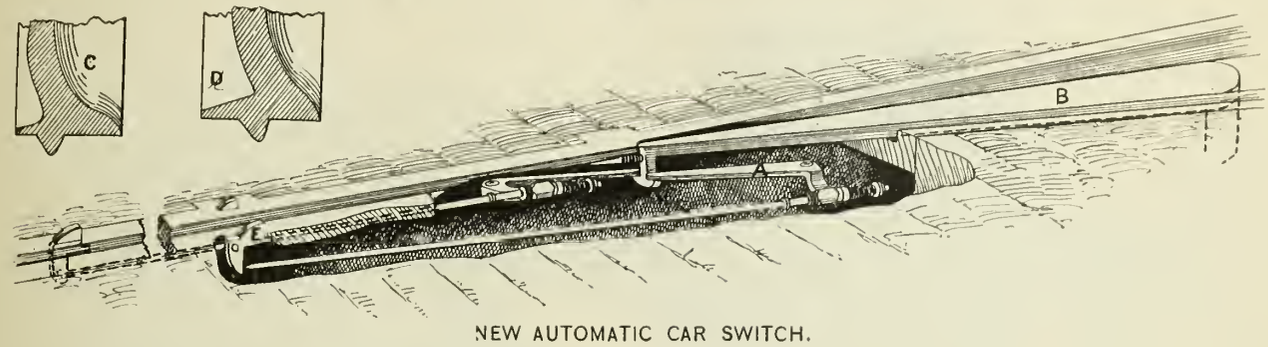
Omnibus Traffic.—The maximum number of omnibuses in service in 1891 was 650, an increase of 34 over the preceding year. Each omnibus covered on an average 56 miles per day. To operate these required on an average a stock of 9,122 horses, an increase of 126 over the preceding year. Each horse covered an average of 10 miles per day. The average number of horses allowed per omnibus was 15.33. The number of regular passengers carried during the year was 118,102,968; of these 68, 692,738 were carried in the interior of the bus and 29,401, 230 on top. The receipts per passenger averaged 3.772 cents. The receipts per omnibus mile were 13.76 cents.

The cost of forage per horse per day during the years 1890 and 1891, is shown in the following table :

	1890	1891
Oats	$0.1305	$0.1486
Bran	0.0008	0.0006
Corn	0.0962	0.0846
Beans	0.0386	0.0379
Hay	0.06	0.0485
Straw	0.0485	0.0452
Peat	0.0026	0.003
Total	0.3772	0.3684

Automatic Track Switch.

The accompanying illustration shows a street railway switch designed for use with cars propelled by animal or mechanical power, and operated entirely by the car wheels, independently of any other mechanism attached to the car, or of any attention on the part of the driver. As will be seen from the illustration, the proper switching of the car is insured independently of the direction of the preceding car, or of any change of the switch by accident or otherwise, some of the cars having wheels with specially designed treads or flanges to secure that result.



NEW AUTOMATIC CAR SWITCH.

The operating mechanism consists of switch keys or levers, E, pivoted within openings in the rail, and so placed as to project slightly above the rail, and in position to the right or left of the track groove to engage with the tread or flange of an ordinary, or specially designed wheel, C and D, by which they are depressed, and which in turn operate the switch tongue, B, through the medium of connecting rods and bell cranks, A. Spiral springs are also provided for the adjustment of the levers and to prevent shock, and one is placed at the end of the tongue, which assists in throwing the tongue into position after passing the centre line, and holding it there. The mechanism is housed in a chamber beneath the rail, or in a specially constructed rail, having a removable side by which access can be had for the adjustment or repair of the parts.

It will be seen that the device admits of any number of key combinations. For instance, the first key, which is operated alike by all cars, may be arranged to throw the switch in one direction, and provide for leading off such cars as are equipped with ordinary wheels, and two other keys located betwen the first key and the switch tongue in position to be operated respectively by treads or flanges of greater width than required to operate the first key, and designed to throw the tongue in the opposite direction; the keys and tongue being so located relative to each other and to the car wheels that the car may set the switch by the first key and reset it for itself by one of the last keys. The diameters of the outside treads are made somewhat smaller than the regular wheel tread so that it will ride above the guard rail on curves. The keys are so coupled together that the operation of the second key sets the first one in position for the first car. The device was originated by C. E. Garey, master mechanic of the Dry Dock, East Broadway & Battery Railroad Co. of New York.

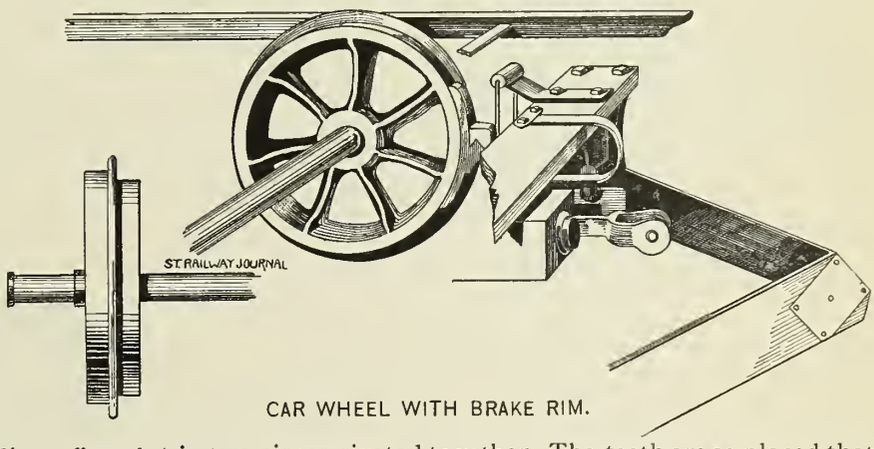
Car Wheel with Independent Brake Rim.

It is well known that the wear of the brake shoe upon the tread of a car wheel, materially shortens the life of the wheel. In order to prevent this wear and at the same time provide an always clean surface to which the brake shoes may be applied, the design illustrated herewith has been devised by Mr. W. E. Haycox. It consists of an independent brake rim cast on the inside face of the wheel, having a diameter somewhat less then that of the wheel proper, which provides for passing the guard rail on curves.

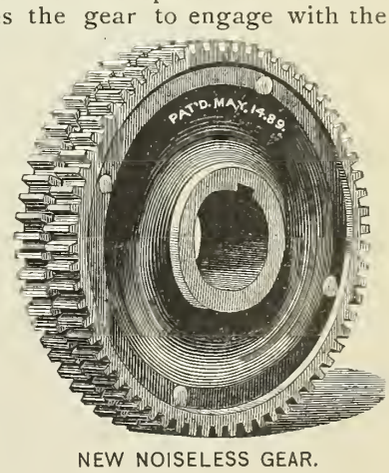
The independent rim adds but a few extra pounds to the weight of the wheel, and very little to its cost, but is claimed to add from 60 to 70 per cent. to the life of the wheel. A very efficient brake mechanism is employed with the design, and all the details of operationhave been carefully worked out. The Fulton Foundry Co., of Cleveland, O., are the manufacturers, and the tests made with the device have given good results.

A Noiseless Gear.

The gear shown below is manufactured for electric motors by the Climax Mfg. Co., of Buffalo, and is claimed to be noiseless as well as durable. The gear is of steel, and in two pieces, riveted together. The teeth are so placed that those of one part register with the spaces of the other. This arrangement enables the gear to engage with the pinion, which is of a similar type, closely and accurately, and, it is claimed, without any vibration or back lash. By the addition of a chamber in the web of the gear filled with non-resonant material, the wheels when at work are practically noiseless. A space is left between the two sets of teeth, so that there will be no injurious contact between the gear and pinion should a slight lateral displacement occur.



CAR WHEEL WITH BRAKE RIM.



NEW NOISELESS GEAR.

The street railway cars of the Binghamton Street Railway Co. carried on the Fourth of July 25,000 passengers, without the slightest accident or delay. The number of cars in service was fifteen, of which twelve were electric and three horse. This is a good record, and reflects much credit on the management of the company.

New Dynamo of Detroit Electrical Works.

A new design of twopole dynamo, in which the frame and bedplate consist of one solid casting, has been adopted by the Detroit Electrical Works for all sizes built by them, up to and including 30 K. W., and is shown in the accompanying engravings. Above the 30 K. W., the type will be similar to that illustrated, except that the machine will be multipolar. The journal boxes are provided with self centering and self oiling sleeves, which insure perfect alignment and lubrication. Each bearing is provided with a gauge glass which shows the height of oil in the oil chamber, and with a cock by means of which the oil can be drawn off whenever desired. The lubrication of the bearings is accomplished by the use of two rings which revolve in each and carry oil to the top of the shaft, from which it is distributed by means of grooves in the self centering sleeve. Directly over each of these rings, in the outer shell of the bearing, is a brass plug which can be lifted out when it is desired to ascertain whether the rings are working properly, or to put in new oil. The rocker arm, which supports the brush holders, is mounted directly on the self centering sleeve, insuring the centering of the brush holders on the commutator.

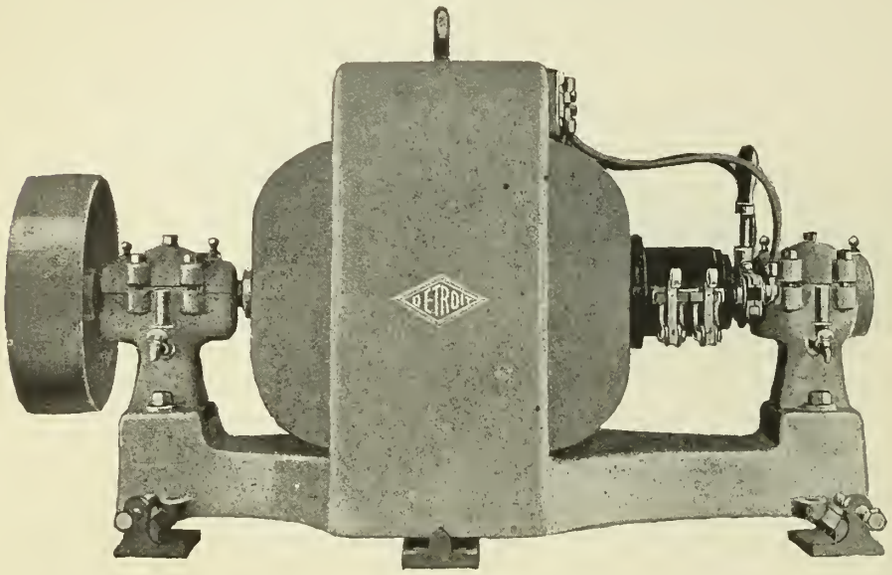


FIG. 1.—END VIEW OF DETROIT DYNAMO.

Carbon brushes are used on all sizes of machines both for motors and generators. The brush holders are of a new type and provide the requisite tension, and no more, to make good contact of brushes with commutator. This tension is obtained by the use of a spring coiled in the form of an involute, the outer end of which is continued straight from the side of the coil up to and a little above the outer ends of the carbon brushes. In this way the tension due to the coil when the straight end is in a perpendicular position is just sufficient to insure the proper contact. The coil of the spring is mounted upon an adjustable axis, so that as the commutator brushes wear the spring can be moved inward, maintaining the straight end in a perpendicular position, and insuring the same tension of the brush upon the commutator without changing the adjustment of the spring itself. The adjustment can be made at any time very easily by a single movement. As the carbon brushes feed radially they necessarily wear squarely across their entire thickness and never require trimming. Proofs of the desirability of this arrangement have been shown in practice by machines built by the Detroit Electrical Works. In one machine of an early type, but fitted with the Detroit improved brush holders and carbon commutator brushes, the original set of brushes, after sixteen months' continuous use, were still employed and not one-third worn out, while the commutator itself, although glazed by long use, showed no actual signs of wear when a straight-edge was applied.

The armatures of all machines, up to and including the 30 K. W. size are of the drum type, but have a special winding, covered by patents, which not only economizes space and firmly holds the wires at ends in position, but also has the important advantage of having no two wires of great difference of potential adjacent to each other, thus reducing largely the danger of burnouts. The armature is also well ventilated, and the insulation of the armature cores and wires is of the very best.

The commutators are of a new design, and are claimed to be the finest ever manufactured. Mica is the sole insulating material used in their construction. The field coils are wound on metal spools and are then slipped into place on the pole pieces, where they are almost entirely covered and protected by the iron frame of the machine. To replace any coil with a new one is, however, a matter of only a few minutes. The general design of the machine is such that the armature is protected on all sides by the frame of the machine and the metal flanges of the field spools, while its compactness necessarily requires smaller floor space and less head room than any other machine of equal capacity. All generators are compound wound to give any desired increase in voltage up to 15 per cent. at full load.

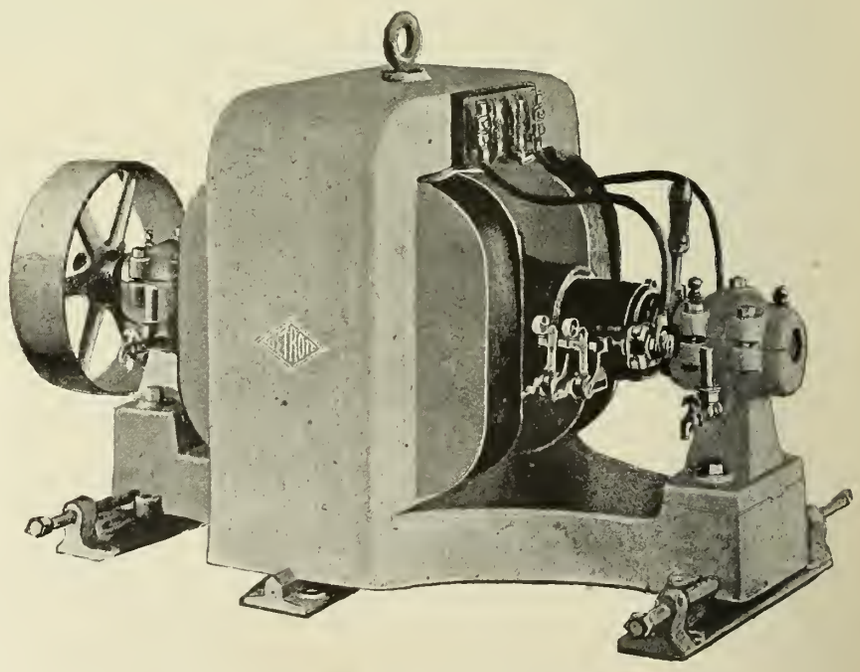


FIG. 2.—PERSPECTIVE VIEW OF DETROIT DYNAMO.

Each machine can be mounted on slides for taking up

slack in belt, or, if desired, it can be bolted to the foundations by lugs which are cast on the sides of the bedplate. The headboard of the generator is provided, in addition to the connections shown, with a double pole, quick breaking, headboard switch, so that when desired, and entirely independent of the switchboard appliances, the machine can be entirely disconnected from the mains. These dynamos have a fixed point of commutation, which renders

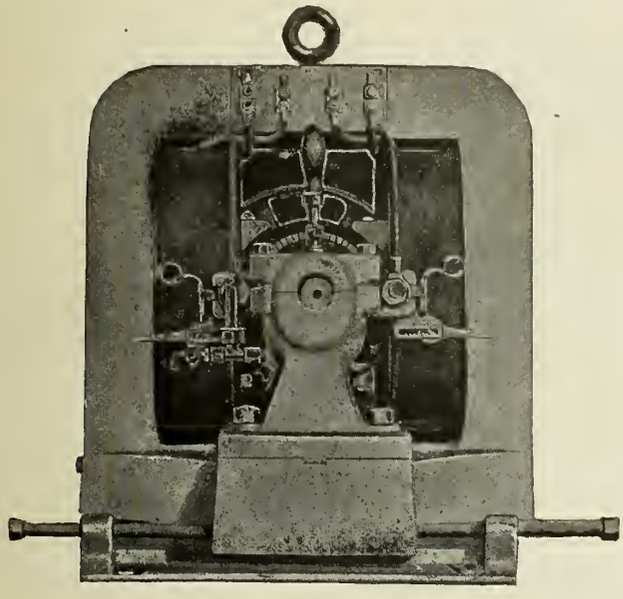


FIG. 3.—SIDE VIEW OF DETROIT DYNAMO.

possible the reversing of the machine and changing of load from no load to full load without noticeable sparking at the commutator. In designing this machine, the advantages of slow speed have been kept in view as well as efficiency.

The standard sizes of the machines now being made are as follows, ratings being made in kilowatts: ⅛, ¾, 1½, 3, 5, 7½, 9, 15, 20, 30, 40, 60 and 100. Larger machines of the multipolar type will soon be brought out.

Two New Devices.

A wire cutter is always a convenient tool for an electric railway man to have near at hand, and the one shown in Fig. 1, known as the Billings' wire cutter, and

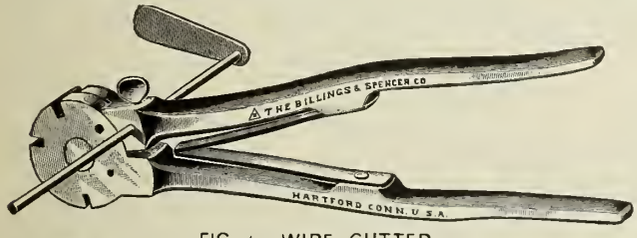


FIG. 1.—WIRE CUTTER

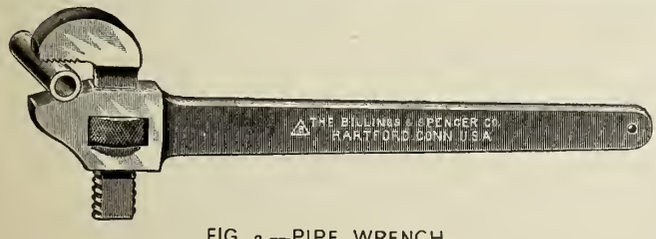


FIG. 2.—PIPE WRENCH.

manufactured by the Billings & Spencer Co., of Hartford, Conn., will be appreciated by any one who has frequent need of such a tool. It is drop forged from the best tool steel, and provided with four cutting edges on the rim and two which are enclosed. It also has an adjustable gauge so that wire can be cut accurately to any length. The workmanship is of the same high quality which characterizes all the appliances made by the Billings & Spencer Co. The total length of the tool is ten inches. Fig. 2 represents the Billings' pipe wrench. The jaws of this wrench are drop forged of the best tool steel, and the handles are of the best grade of machinery steel. This wrench offers many advantages over similar tools. It is simple in design, has few parts, and is characterized by the best workmanship and finish. A special feature of superiority is found in the fact that no matter how large or small the size of pipe for which it is adjusted, the angle of the jaws remains the same. The total length is fourteen inches, and is made to take pipe from one-quarter to one and a half inches.

Pole Top and Pull Over Bracket.

The pole top shown in Fig 1 has been recently brought out by the Railway Equipment Co., of Chicago, and is designed specially for large roads, although it is made adjustable and can carry from two to seven feeders. It is fitted with a wooden plug, which is inserted in the top of iron or steel poles, insulating them from the tops. It can also be used on wooden poles, and is fitted with ratchet or eye bolt whenever required. By using this top, electric roads can increase their feeder capacity as their traffic grows heavier or their system becomes more extensive, without a change in detail of their construction and the simple addition of the necessary light, yet strong, attachment.

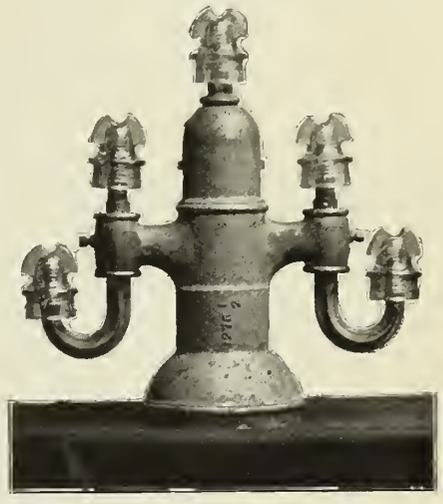


FIG. 1.—NEW POLE TOP.

Fig 2 shows the standard pull-over bracket made by the same company. An improvement has been made and

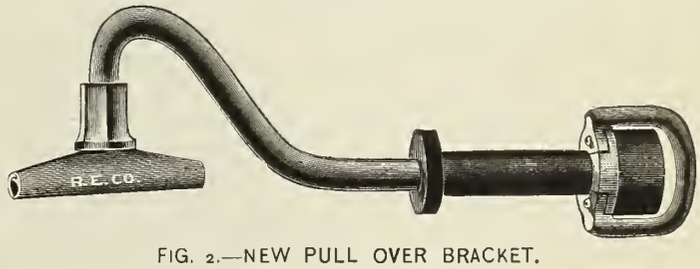


FIG. 2.—NEW PULL OVER BRACKET.

patented by which this pull-over bracket is made absolutely reliable for the purpose intended. The hook and wire attachment have unusual strength, the insulation is excellent and the bracket is fitted with the Chicago clamp, the merits of which are well understood.

The Second Avenue Railway Co., of New York, have decided to install storage battery cars on their line, and have received the necessary permission therefor from the municipal authorities. About ten cars will be put in operation at first, and they will probably run from the depot of the company on 96th Street and Second Avenue to the Harlem River, a distance of about a mile and three-quarters. The Waddell-Entz battery will be used.

The *Street Railway Journal* for July, is specially notable for its illustrated articles, each of which must prove of interest and value to those directly or indirectly engaged in the constantly growing street railway industry. The editorials are bright, crisp and strong, and there is an abundance of readable miscellany.—*Exchange.*

New Wheel Press.

To provide for those styles of electric street railway motors, which have the armature upon the axle of the truck, and which, by reason of the small distance from hub of wheel to the end of the armature, do not admit of the use of the ordinary styles of wheel presses when taking off the wheels, Watson & Stillman, of New York, have designed two styles of presses shown in the accompanying illustrations. Fig. 2. shows a belt power press, which, except in shape of moving abutment, is similar to their standard style. The moving beam rolls upon the lower tension bar, and also has one side roll upon the upper beam to avoid friction caused by the overhanging at the back. Two independent, adjustable, shaft carrying hooks are furnished, to avoid the kicking up of the shaft when placing it in the press, as in the other styles. The chuck and abutment beam block act as distance gauges when putting on wheels. The chuck, which is attached to ram by a centre pin and supported by a rolling carrier, is replaced by a small block when taking off the wheels. A safety valve is provided and the suction and pressure valves are easy of access by removing separate bonnets. The pump pistons are easily packed by a compressive packing and screw glands. Return weights, water tank and pressure gauges, with safety couplings, are furnished with all presses. The weight for the thirty-six inch wheel press is 6,000 lbs., and for the thirty inch press 3,500 lbs. The movement in both cases is fifteen inches, and the distance between bars forty inches and thirty-four inches respectively. Fig. 1 shows a hand press similar in general arrangement to the belt power press described above. The lever works perpendicularly and at right angles to line of press and convenient for operator to easily watch the work. The distances between bars are the same as with the belt power press, and the movement is twelve inches for both thirty-six inch and thirty inch wheels.

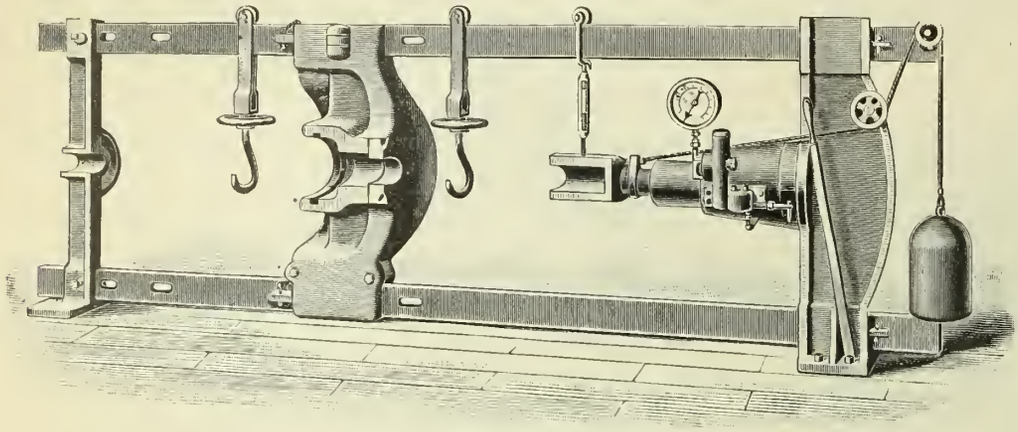


FIG. 1.—HAND WHEEL PRESS.

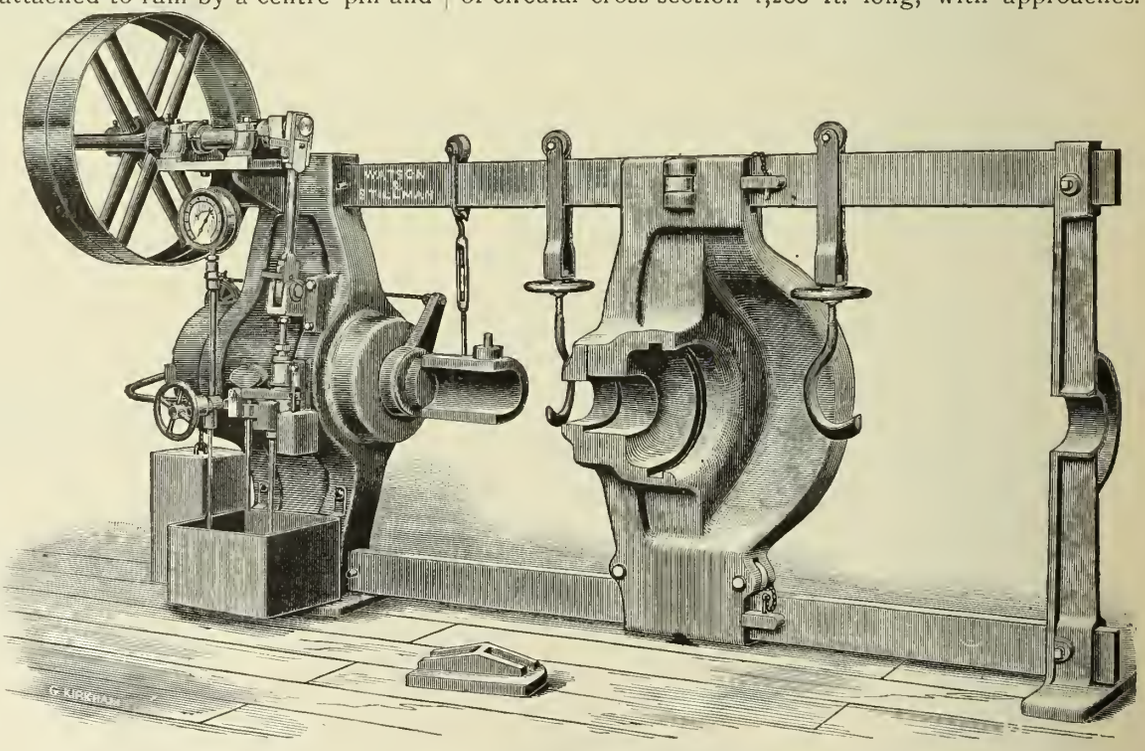


FIG. 2.—POWER WHEEL PRESS.

THE Interstate electric railway was put in operation July 19, at North Attleboro, Mass.

Tunnel Lining Badly Cracked.

The cast iron lining of the Hudson River tunnel is said to be cracked badly in several places, but that portion of the tunnel which is lined with a two foot ring of brick masonry is standing intact without cracks. That portion of the tunnel which was constructed before 1882, when the work was stopped for lack of funds was lined with brick, but when work was resumed in 1889, the Greathead system of tunneling was adopted, which employs an iron ring lining. These rings are nineteen feet six inches in diameter, and one and one-quarter inches thick, with ribs eight inches thick and two and three-quarters inches wide at intervals of twenty inches.

The cause of the failure of the rings is said to be due to the fact that the tunnel is built through a soft silt, so soft that it will flow like a viscous liquid, rendering the tunnel buoyant and producing a tendency to rise in proportion as its weight is less than the weight of the excavated material, but the material being solid enough to prevent the tunnel from rising, the vertical pressure exceeds the horizontal, tending to change the lining, from a circular to an elliptical form, the longer axis being horizontal, and the distorting force being strong enough to break the plates at the side just above the middle.

Work was suspended on the tunnel about a year ago, the funds having again become exhausted. The original plan of the work contemplated two tunnels side by side, of circular cross section 1,200 ft. long, with approaches. There still remains to be completed 1,600 ft. on the north tunnel, and nearly the whole of the south tunnel, or about 5,000 ft. in all, besides the approaches for both tunnels, that on the New Jersey end being 4,000 ft., and on the New York, 4,500 ft. The amount already expended on the work is about $2,550,000.

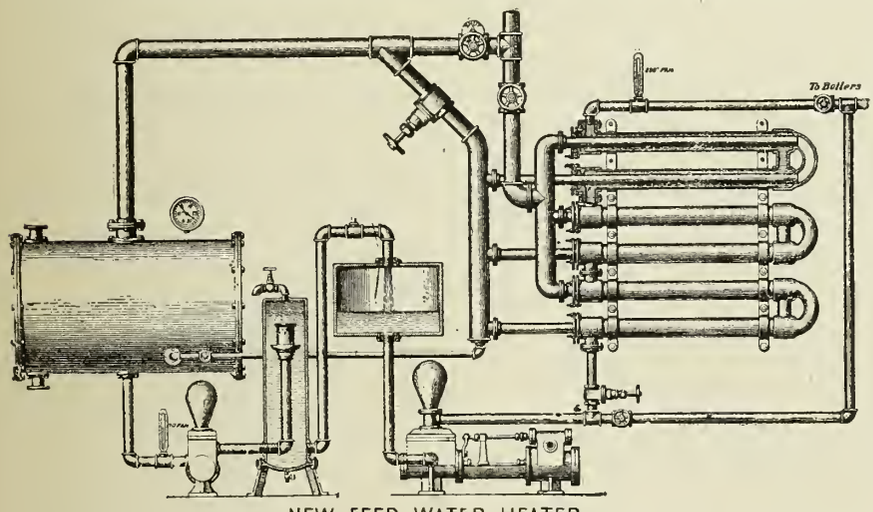
The method of construction thus far followed, both with the brick and iron ring lining, has been contrary to the advice of certain consulting engineers who, in the early history of the enterprise, suggested the buoyant tendency of the tunnel in such a formation, and recom-

mended a lining of wrought iron for the reason that neither brick nor cast iron has sufficient lateral strength, a feature which will be required when heavy trains enter the tunnel, adding to its weight and tending to sink it unequally in the soft material.

A New Feed Water Heater.

Mr. Elihu Nelson of 11 Wall Street has been engaged for some time in making a series of improvements in feed water heaters, condensers and oil separators. His latest invention is a combination of the three kinds of apparatus in one; and it would appear that he has succeeded in producing remarkable results. With an apparatus which is now on exhibition in the basement, No. 11 Wall Street, Mr. Nelson is able to carry the feed water into the boiler at a temperature almost as high as that of the steam which passes through the heater, while the waters of condensation after passing through the condenser are at such a temperature (not above 70 deg. F.) that they do not interfere with securing a high vacuum, and thus relieving the demand on the coal pile.

In the case of the apparatus which is now on exhibition, there is no load, and consequently, the amount of steam required is very small. The result is that while the absolute temperature attained is not exceedingly high, yet the relative approximation of the temperature of the feed water to that of the steam is remarkable. At a time when the steam was utilized for heating the building, we observed a much higher absolute temperature of the feed water. This was in an apparatus differing somewhat from that now shown at No. 11 Wall Street, but chiefly in the fact that it was especially adapted for stationary work, while the present apparatus is more especially suited to marine work, although requiring only slight modification to fit it for stationary service. So far as we know, the present invention of Mr. Nelson is the only feed water heater that can be successfully combined with the present ship condensers. It occupies very little space and can be set close beside the condensers already in use.



NEW FEED WATER HEATER.

This brings us to the point of saying that the significant features of the invention reside mainly in the feed water heater, which can be combined with a condenser and an oil separator of any preferred type. At the same time, Mr. Nelson has invented a condenser and an oil separator of his own which in an entirely new outfit he would probably prefer to use. But where a condenser is already set up, say, on board a steamboat or elsewhere, he can add the feed water heater and secure greatly improved results.

The cut illustrates the general arrangement of the apparatus, the vertical pipe broken off at the top representing the main exhaust pipe from the steam engine. A branch from this pipe passes to the condenser at the left, while another branch is connected through a header with the three centre pipes of a sectional feed water heater, the opposite ends of the centre pipe being joined to a return pipe connected with the branch that runs to the condenser, as already mentioned. The combined area of the three centre pipes is made somewhat greater than the area of the main exhaust pipe to allow for the greater friction, and the steam is admitted to the centre pipes by way of the header above mentioned in order to secure as fully as possible the equal distribution of the steam in the various pipes. By a suitable arrangement of valves, just the desired proportion of steam can be let into the centre pipes, the rest going through the branch exhaust pipe. The feed water is pumped into the outer pipe of the lowermost section and travels in a direction opposite to that taken by the steam from the engine exhaust pipe. In this way it is brought about that the steam is admitted to the feed water heater by multiple paths, and that it is practically fresh steam when it is met by the feed water, first comparatively cool, then of a higher temperature, and then still further heated. The result is that the feed water is raised to a temperature approximating very closely to that of the heating steam.

It is one of the advantages of passing the feed water and the steam in opposite directions that the water of condensation passes through comparatively cool, while the feed water is heated to the highest possible degree.

To sum up the whole description of the heater in a few words, it may be said that the different sections or groups of sections are connected up in such a way as to be in multiple arc between what may be called the main exhaust pipe from the engine and a branch exhaust pipe. The steam which is used for heating the feed water is thus applied to small portions of it successively while the steam is at a great heat, thereby securing the greatest possible efficiency. There is no clogging or backing in the apparatus. As a matter of fact, a vacuum is created, which greatly facilitates the action.

Beyond the condenser, the waters of condensation are pumped through an oil separator or purifier, and into a receiver shown at the centre of the cut. The water is cool enough so that the oil will rise to the top in the oil separator, where it can be drawn off through a suitable stopcock.

As to the coolness of the water after passing through the condenser, it may be stated that it reaches a degree which entirely admits of securing a high vacuum, as shown by an ordinary gauge. When there is no leakage, the vacuum runs from twenty-six to twenty-eight inches.

Street Railway News.

General.

Albany, Ore.—The Albany Street Railway Co. are experimenting with a "Prouty" noiseless steam motor, which is to take the place of the horses now in use on their lines. If it proves satisfactory, another will be ordered soon.

Americus, Ga.—The electric railway has again been suspended, the lessee having thrown up his contract.

Anderson, Ind.—The road of the Anderson Electric Street Railway Co., which is 2.8 miles in length, is now in operation. The company have two St. Louis Car Co.'s cars equipped with Edison motors.

Baltimore, Md.—The contract for machinery for the Blue Line of the City Passenger Railroad Co. has been awarded to the Robert Poole & Sons Co., and that for cabling it, to Edward Saxton. Contractor Saxton expects to begin work soon, and to have it done by the first of January. Work on the other lines is also progressing with all possible rapidity. E. D. Smith & Son have the contract for both roads.

Beverly, Mass.—The Naumkeag Street Railway have purchased the Beverly & Danvers Street Railway. The road was started to be operated by the storage battery system, but the system failed to work satisfactorily, and for the past six months the road has not been operated.

Belleville, Ill.—The city is trying to get rid of the present mule railway. It has revoked the franchise and ordered the tracks taken up; against which the company's representative has appealed. A franchise has already been granted the Edward Thomas Electric Co. to build a double track in Belleville.

Brooklyn, N. Y.—The Brooklyn City Railroad Co. have acquired the stock of the South Brooklyn Street Railroad Co. and absorbed it.

Braddock, Pa.—Wm. Yost, president of the Braddock & Turtle Creek Street Railway Co., has parted with his control of the stock of that road, and has resigned in favor of Jas. B. Callery, president of the Second Avenue Passenger Railway of Pittsburgh, who represents the purchasers. The other officers of the company are: Secretary, Jno. C. Reilly; treasurer, Jno. W. Taylor.

Brantford, Ont.—The street car drivers struck one day lately, but their places were so rapidly filled by new men that there was practically no interruption in traffic. The rails for the new electric service have been distributed along the route.

Canandaigua, N. Y.—The Canandaigua Street Railway line, with all appurtenances, was sold on mortgage foreclosures last month for the sum of $32,000. Charles C. Sackett, as representative for the majority of the stockholders, was the purchaser.

Chicago, Ill.—The North Chicago Street Railroad Co., are now using crude oil for fuel in all their power stations. The La Salle Street station was recently equipped with oil burning apparatus. The fuel gives great satisfaction, as it is economical and does not add to the smoke cloud for which Chicago is famous.

Receiver John A. Bell, of the Russell Carette Co., recently sold at auction, under an order of Court, all the property of the company for $10,500. The property consisted of 184 horses, the stables at 144 So. Green Street, the carettes and everything else connected with the line.

Street Superintendent Burke, has sent to the street railway companies a notice containing a list of streets on which the pavements are out of repair. The companies are held responsible and unless the repairs are made immediately, Mr. Burke asserts that his department will do the work and institude an action to recover the cost.

JUDGE ADAMS has dismissed the suit of Warren Springer against the West Chicago Street Railway Tunnel Co., Charles T. Yerkes and contractors Fitz-Simons and Connell, after a hard fight by plaintiff's attorneys to continue the case. Springer demanded $100,000 damages for injury to his leasehold interest in premises at 213 to 219 Canal Street and 208 to 216 Clinton Street. In 1891 the tunnel company took forcible possession of the place for the purpose of removing the building to excavate for a tunnel under the Chicago River. Before the work of destruction was completed Springer secured an injunction from Judge Tuley restraining any further damage to the premises. An appeal has been taken.

THE South Side Elevated Railway have leased the property to the east of their present stub terminal on Congress Street for $10,000 per year. This established a valuation of $100 a square foot, but the property is not supposed to be worth that figure. It was necessary for the company to pay the sum mentioned in order to secure room to accommodate the crowds at the terminus.

Easton, Pa.—An application has been made to have the name of the Easton, South Easton & West End Railway Co. changed to the Easton Transit Co.

Findlay, O.—Philadelphia capitalists have purchased the Blanchard Avenue car line.

Hamilton, Ont.—The new electric street railroad is now opened.

Haverhill, Mass.—A deed was recorded July 15, of the transfer of the Black Rocks & Salisbury Beach Railway to the Haverhill & Amesbury Street Railway Co., the consideration named being $1.

Lincoln, Neb.—It is thought that the Lincoln Electric Street Railway Co. now in the hands of a receiver, will be reorganized.

Los Angeles, Cal.—A deal is on foot for the consolidation of the cable and electric roads, which will harmonize the interests of the two and enable them to be operated more profitably.

New Haven, Conn.—The State Street and Whitney Avenue street railways have passed into the hands of a syndicate.

THE horse barn of the West Haven Horse Railroad Co. was destroyed by fire July 3. Loss, $25,000.

Norristown, Pa.—The Morristown Passenger Railway Co. have decided not to introduce electric cars, on account of the expense which the business would not justify.

Ottawa, Ont.—The first electrical car trucks ever made in Canada are now being constructed by Mr. P. Latour of this city. He is making them for the local electric car company.

Philadelphia, Pa.—The Philadelphia Traction Co. have leased the Ridge Avenue line.

Plattsmouth, Neb.—The Plattsmouth electric street railway was bought at sheriff's sale for $4,097. The sale may not be confirmed for the reason that it did not reach two-thirds of the appraisement.

Quincy, Mass.—The Quincy & Boston Street Railway did an enormous business on July 4, the total number of passengers carried being 14,427. There was not an accident or mishap of any kind. The number of cars used was nine, two of which were small cars. It is said that the number of passengers carried beats the record for one day's work of any street railway in the United States.

St. Louis, Mo.—The formal transfer of the Northern Central and the Union lines to the Cass Avenue Street Railway Co. took place June 31. An act of the Municipal Assembly of April 11, granted the transfer of the privileges and purchases of these two lines to the Cass Avenue company. They were not bought outright, but leased until 1925.

Sioux City, Ia.—Eight miles of electric railway and the 700 acre park adjoining the Big Sioux River on the west side of the city, have been sold to Chicago parties for $600,000. It is believed by some of the former owners of the property that the Chicago & Northwestern road is the real purchaser.

Tacoma, Wash.—The consolidation of the Thomson-Houston Steilacoom line and the Tacoma Railway & Motor Co. has been effected.

Toledo, O.—The Consolidated Street Railroad Co. have filed suit against the Toledo Electric Railroad Co. asking damages in the sum of $145,000. The petition is lengthy, but the object in brief is to secure compensation for the appropriation and use of the Consolidated tracks by defendant company. The suit covers the tracks which have been put in litigation by recent injunction and other suits, and is brought about by the insistence of the electric company in occupying and using the tracks constructed and owned by the Consolidated.

Toronto, Ont.—Probably the electric cars required for the Toronto service will be manufactured at Ottawa. The directors of the company have procured contract prices from Mr. Wylie, who has already turned out some fine open cars for the Ottawa company.

THE Dominion Wire Manufacturing Co., has shipped the first lot of their contract of twenty-seven miles of pure copper trolley wire for the Toronto Street Railway. This is the first lot of trolley wire in mile lengths over made in that country.

Wakefield, Mass.—The construction of the new electric road between Wakefield and Stoneham is well under way.

Extensions and Improvements.

Albany, N. Y.—The Albany Railway Co. will build about two miles of extension and will add twenty cars.

Altoona, Pa.—The City Passenger Railway Co. expect to increase their rolling stock soon.

Ann Arbor, Mich.—The Ann Arbor & Ypsilanti Street Railway Co. expect to build two miles of track for steam power.

Ashland, Ky.—The Ashland & Catlettsburg Street Railway Co. are changing from animal to electric power, and are extending their line.

Ashland, Wis.—The City Council has granted a franchise to the Ashland Lighting & Street Railway Co., a new corporation composed of members of old lighting and street car companies. The new company propose to change the present horse car service to an electric line, and extend it fully a mile at each end.

Ashtabula, O.—The Rapid Transit Co. will extend their line one mile and add two cars soon.

Atchison, Kan.—The Atchison Street Railway Co. will build one mile of road.

Atlanta, Ga.—The Consolidated Street Railway Co. are going to build a central depot.

Atlantic City, N. J.—The Atlantic City Railroad Co. expect to add four cars.

Baltimore, Md.—The Baltimore Traction Co. have just completed plans by which they will operate an electric railway from Pikesville and West Arlington to Curtis Bay and Fort McHenry. The entire route has been surveyed, and part of it is now running in good shape.

Battle Creek, Mich.—The Electric Railway Co. will increase their rolling stock by the addition of two cars.

Bay Ridge, Md.—The Bay Ridge & Arundel Railway Co. will add two dummy cars.

Belleville, Ont.—An application is about being made for power to construct and operate an electric street railway in this city.

Berea, O.—The Cleveland & Berea Street Railway Co. contemplate an extension.

Binghamton, N. Y.—The Binghamton Street Railroad Co. will construct at once a power station on State Street. The building will be of brick 129 × 65 ft.

Birmingham, Conn.—The Derby Street Railway Co. will increase their equipment by the addition of two cars.

Bloomington, Ill.—An extension will be built by the Bloomington Street Railway Co.

Boston, Mass.—Six miles of electric road will probably be built by the East Middlesex Street Railway Co.

Brantford, Ont.—The new street railway company have decided on the electric equipment of their present line.

Brooklyn, N. Y.—The Brooklyn City Railroad Co. will erect a building at Second Avenue and Fifty-ninth Street as a trolley storage and repair shop. The building will be 700 ft. long by 200 wide and three stories in height.

THE Brooklyn Heights Railway Co. will probably add five open cable cars to their line before long.

THE Van Brunt Street & Erie Basin Railway Co. will replace five old cars with new ones.

THE Broadway Railway Co. are in the market for a number of horses.

A CONTRACT has been drawn up between the Brooklyn Elevated Railroad Co. and the Union Construction Co. of New Jersey, for the building of two extensions of the system. One is from the present terminus on Fulton Avenue along Fulton Street to Crescent, and down Crescent to Cypress Hills Cemetery. The other is the one from the present terminus at Fifth Avenue and Thirty-sixth Street, through Fifth Avenue, Thirty-eighth Street and Third Avenue to Fort Hamilton.

Buffalo, N. Y.—The Buffalo Railway Co. have received from the State Board of Railroad Commissioners permission to change their power to electricity on Exchange Street from Main to Louisiana Streets, and on Michigan Streets between Exchange and Carlton Streets.

Cedar Rapids, Ia.—The electric railway company will add a new engine and a new generator to their plant.

Champaign, Ill.—The Rapid Transit Co, contemplate an extension.

Charlottesville, Va.—The street railway company are adding a number of cars to supply the place of those lost by a recent fire.

Chelmsford, Mass.—The Lowell & Suburban Street Railway Co. have asked for permission to lay double tracks on the Chelmsford road down Stony Brook Bridge.

Chicago, Ill.—The Calumet Electric Street Railway Co. will build a new power house and car barn at Burnside, near Ninety-fourth Street. They will also extend their line to Seventy-fifth Street.

THE Chicago & North Shore Railway Co. have asked for the right to extend their electric line south from Graceland Avenue to Dewey Court, the cable terminus.

THE World's Fair cable loop for the Chicago City Railway Co. at Jackson Park has been changed by the City Council, so that it will not interfere with the elevation of the Illinois Central tracks.

Cleveland, O.—An ordinance has been introduced in the Council to grant to the Cleveland City Cable Railway Co. the right to operate certain portions of their road with electricity.

Cottage City, Mass.—The Selectmen have granted the petition of the Cottage City Street Railway Co. to locate their tracks from the present terminus on Sea View Avenue along Waban Park to Lagoon Heights.

Cumberland, Md.—The residents of the city living on the west side of Wills Creek have presented a petition to the City Council to have the street railway company extend their road over the creek.

Deadwood, S. Dak.—The Deadwood Street Railway Co. are contemplating a change from horse to electric power.

Defiance, O.—The Defiance Light & Power Co. are preparing to make considerable extensions of their lines.

Denver, Colo.—The people of Valverde are agitating the extension of one of the city lines into their suburb. The plan is to build a line to connect with the South Eleventh Street line of the Denver City Cable Railway Co. and transfer for a five cent fare.

THE Aldermen have granted a franchise to the Tramway Co. to operate a car line on Fortieth Street and Josephine Avenue.

Detroit, Mich.—Application has been made by the Detroit Citizens' Street Railway Co. for permission to occupy several more portions of the streets in order to establish loop lines, etc.

Easton, Pa.—The Easton, South Easton & West End Horse Street Railway and the Easton, Pa., Phillipsburg, N. J., Horse Street Railway have been purchased by a syndicate of local capitalists headed by J. S. Rodenbaugh, president of the Lehigh Valley company, who will rebuild and extend the lines and operate them by electricity.

Elmira, N. Y.—The Elmira & Horseheads Railway Co. are considering the purchase of a number of cars.

Fond du Lac, Wis.—It is reported that Geo. W. Hathaway, of Cleveland, O., has in view the purchasing of the street railway line in this city and placing an electric system in its stead.

Fort Scott, Kan.—The Fort Scott Rapid Transit Co. have decided to extend their system and add two miles, with a loop at the southern terminus of the city. They will also build an extension of half a mile to the Fair Grounds.

Galesburg, Ill.—The College City Street Railway Co. have sold out to the Galesburg Electric Motor & Equipment Co., who will rebuild the entire system and equip with electricity.

Gallipolis, O.—The street railroad is to be extended to Point Pleasant.

Glens Falls, N. Y.—A short extension is contemplated by the Glens Falls, Sandy Hill & Fort Edward Railway Co.

Great Falls, Mont.—The street railway extension to Highland Park is to be built this season.

Greenville, S. C.—The Street Railway Co. of Greenville have been granted a thirty-seven year franchise to build an electric road. The franchise is void unless work is commenced on the line in six months, and unless four miles of it is completed and in operation in fifteen months. The company is exempted from taxation for ten years.

Harrisburg, Pa.—The Harrisburg electric line is to be extended to Rutherford Station.

Hartford, Conn.—Citizens of the outlying new districts have petitioned the horse railroad company to give them better car facilities. They are unanimously in favor of the electric system.

Haverhill, Mass.—The Haverhill & Groveland Street Railway Co. on July 11, voted to accept the terms of the charter granted by the Board of Aldermen some time ago for the use of electricity on the streets. It has been generally understood that the matter of using electricity had been given up.

Hoboken, N. J.—The North Hudson County Railway Co. have received another franchise for a surface road from the city. The Council has granted permission to lay tracks on Fourteenth Street, west of Willow Avenue, to the hill, conditional upon the company grading the street and paving between the tracks. The franchise is good for three years.

Hull, Ont.—Mayor Champagne has interviewed Mr. Soper, of Ottawa, regarding the possibility of extending the Electric Street Railway through Hull and to Gratineau Point.

Huntington, W. Va.—The Belt Line Street Railway Co. and the Huntington Electric Railway Co. have consolidated. The consolidated lines own seven miles of street railway, three being electric and four horse power. The entire line will be made electric at once.

Indianapolis, Ind.—The Citizens' Street Railway Co. expect to extend their line seven miles, and will add about ten cars.

Ironton, O.—The Ironton & Pittsburg Street Railway Co. will equip with electric power this year.

Jackson, Mich.—The Jackson Street Railway Co. will extend their line one half mile.

Kansas City, Mo.—The reorganization of the Interstate Consolidated Rapid Transit Road has been effected, under the name of the Kansas City Elevated Railroad. The work of reconstructing the line and equipping it with electricity will be pushed forward as rapidly as possible.

THE Stockyards & Northwestern and the E. L. Martin companies have applied to the City Council for new franchises, over the same route.

La Crosse, Wis.—The La Crosse Street Railway Co. have recently received permission to operate with electric power, but have not decided whether or not to make the change this year.

Laredo, Tex.—The City Council of Laredo have granted to the electric railway company the privilege of extending their track over several streets, and the company are preparing to place additional machinery in position.

Leavenworth, Kan.—C. F. Brotherton is interesting himself in the matter of converting Leavenworth's dummy line into an electric road.

L. M. ERB, manager of the Leavenworth Rapid Transit Railway, announces that his company will apply to the city for permission to change the motive power of the road to electricity.

Lincoln, Neb.—The Lincoln Street Railway Co. expect to add a number of cars soon.

London, Ont.—As a result of the offer of a new company to establish a system of electric railways in Ottawa, the president of the London Street Railway Co. has written that his company are prepared to convert their present system into an electrical one.

Madison, Wis.—The Turner Society have decided to raise $1,000 bonus to secure the extension of the electric street railway to Schuetzen Park.

Manchester, N. H.—The Board of Aldermen have granted the petition of the Consolidated Street Railway Co. for permission to use electricity as a motive power on all their lines. It is expected that the line to Quinsigamond village will be equipped first.

Mansfield, O.—The Citizens' Electric Railway will build a half mile of road, and possibly two and a half miles, depending upon whether the city does certain grading.

Marinette, Wis.—The Marinette Street Railway Co. have secured a franchise to extend their lines.

Medford, Mass.—The West End company of Boston, have asked of the Selectmen a franchise to extend their electric line through the town.

Michigan City, Ind.—The Citizens' Street Railway Co. propose to extend their lines.

Milwaukee, Wis.—As soon as the Villard syndicate can get control of the Hinsey road they will proceed to entirely rebuild it from end to end, making a new road of it. The Becker line will also be overhauled and extended.

Muskegon, Mich.—The Muskegon Railway Co. have undertaken the construction of a dummy line from Lake Michigan Park to the Hackley Park Assembly Grounds at Lake Harbor, and will have it completed by August 1.

Nashville, Tenn.—The Overland Railway Co. will build an extension to their line, and will add five double deck cars.

Natick, Mass.—The Natick Electric Street Railway Co. will build two and a half miles of line and install five cars during the coming season.

New Bedford, Mass.—The Union Street Railway is to be transformed into an electric railroad if the new management can secure the necessary permission.

New Britain, Conn.—Messrs. Dolan, proprietors of the New Britain Tramway, have petitioned for permission to introduce electricity as the motive power on their line. After the new system is in working order in the city the lines will be extended to Plainville.

New Brunswick, N. J.—The question of an electric street railway is being agitated to take the place of the present horse car railway. The consensus of opinion among the citizens is strongly in favor of the new enterprise, and the managers of the company are willing.

New Haven, Conn.—The New Haven & Centreville Street Railway Co. expect to add ten cars to their equipment.

New Whatcom, Wash.—The Fairhaven & New Whatcom Railway Co. intend to build four miles of track and add six electric cars soon.

New York, N. Y.—The Broadway & Seventh Avenue Railroad Co. have applied for permission to connect the track at Canal Street with the Metropolitan Crosstown Line at Spring Street through South Fifth Avenue.

THE North Third Avenue & Fleetwood Park Railroad Co., the Harlem Bridge, Morrisania & Fordham Railway Co., the Melrose & West Morrisania Railroad Co. have consolidated under the name of the Union Railroad Co., and the motive power will be the trolley system.

Northampton, Mass.—It is reported that a syndicate in New Haven have been trying to buy up the street railway line. Should they do so they will extend the tracks as far as the Meadow Driving Park, run a summer track to Laurel Park and possibly put in a new track to Easthampton. Electricity is to be used.

Oakland, Cal.—The Oakland, San Leandro & Haywards Electric Railway Co, have filed a petition with the Board of Supervisors asking for permission to lay double tracks from Haywards to Oakland.

Ottawa, Can.—The Ottawa Electric Street Railway Co, expect to extend their line two miles, and will probably add fifteen electric cars. The Westinghouse system will be used.

Ottumwa, Ia.—An ordinance granting a franchise to the Ottumwa Street Railway Co. for an extension to South Ottumwa, has been presented to the Council.

Pensacola, Fla.—The Pensacola Terminal Co. will build nine miles of steam road, and will add several cars.

Philadelphia, Pa.—The lines of the Traction company will be extended in Kensington, Frankford, Wissinoming, Tacony and Holmesburg.

Pittsburgh, Pa.—The Citizens' Traction Co. will build a number of extensions.

Pittsburgh, Pa.—The Second Avenue Traction Co. have asked for permission to extend their tracks from the present terminus at Hazelwood to the city line.

Three ordinances have been presented asking for the right of way for inclines from South Twenty-first Street to Mt. Oliver, and all on about the same survey lines. They were the Park incline plane company, the H. S. McKee incline company and the Mt. Oliver incline railway company.

Portland, Me.—The City & Suburban Railway Co. will build six miles of electric road and two and a half miles of steam road during 1892. They will add a number of cars about September 1.

Portsmouth, N. H.—The Portsmouth Street Railway Co. will extend their line this fall.

Pottsville, Penn.—Reading railroad capitalists have secured a controlling interest in the Schuylkill Electric Railroad Co. Extensions will be made by the electric railway company immediately to Fishback, and the People's line to Minersville is to be electrically equipped.

Poughkeepsie, N. Y.—There is a probability that the City Railroad will be equipped electrically, the electric light company having made advances looking toward an arrangement to furnish motive power.

Quincy, Mass.—The Quincy & Boston Street Railway Co. have presented a petition asking for a location of tracks for an extension of their tracks, also for authority to erect poles and string necessary wires for the proper operation of their cars.

Racine, Wis.—The Belle City Street Railway Co. have purchased four lots on Main Street and Lake Avenue on which they will erect offices and a power house for the new electric system. They have contracted for motors, rails, motor cars, trailers, ties and poles. They will have the new system completed by September 1.

Raleigh, N. C.—The street railway company have contracted for a mile of heavy rail, and are extending their lines considerably.

Reading, Pa.—The Neversink Mountain Railway Co. will probably increase their rolling stock.

Richmond, Va.—The Richmond & Manchester Railway Co. have received permission to extend their tracks on certain streets.

Rockford, Ill.—Charles Street is to have two street railways. The City railway will lay their track on the south side of the street, and the West End company will run on the north side.

St. Louis, Mo.—It is said that Drake & Orton, of Chicago, are working on a plan of joining Meramec Highlands, Kirkwood, Webster Grove, Old Orchard, Maplewood and Benton by an electric elevated road which would connect with the western terminus of a city electric line.

THE consolidated management of the Citizens', North Central, Cass Avenue & Fair Grounds and the Union railways, are commencing the reconstruction of thirty-four miles of their horse roads to electric, and are doing the work themselves.

St. Paul, Minn.—The St. Paul & White Bear Electric Railroad Co. have increased their capital stock to $350,000, and are contemplating the extension of the line to Stillwater.

Saginaw, Mich.—The Saginaw Union Street Railway Co. are improving their road and putting down five miles of double track with a forty-five pound T rail, and anticipate building a new power plant in which will be installed two 250 H. P. engines and the same horse power in generators.

Salem, Ore.—The Capital City Railway Co. will add four cars and build three miles of track during the present year.

Salt Lake City, Utah.—The West Side Rapid Transit Co. expect to build in 1892 twenty miles of track.

THE Salt Lake City Railway Co. expect to build four miles of road and add six cars during the present year.

San Francisco, Cal.—The Presidio & Ferries Railroad Co. will make some extensions soon.

THE Omnibus Cable Co. have asked a franchise to build additional tracks.

Santa Barbara, Cal.—The Santa Barbara Street Railroad Co. have applied for a franchise for a line on the Boulevard.

Santa Cruz, Cal.—A short extension is proposed by the Santa Cruz, Garfield Park & Capitola Street Railway Co.

Santa Rosa, Cal.—The Santa Rosa City Railway Co. will add a few cars during 1892.

Savannah, Ga.—The street railway company contemplate a short extension.

Seattle, Wash.—The West Street & North End Electric Railroad Co. will install four electric cars.

THE Grand Street Electric Railway Co. have recently finished their own power plant, and expect to be running with their own current by August 15. They will make an extension to their line.

Sheboygan, Wis.—The Sheboygan City Railway Co. will build one and three-quarters miles of road and add six cars during 1892.

Shreveport, La.—The Shreveport Railway & Land Improvement Co. will make an addition to their rolling stock.

Sioux City, Ia.—The Sioux City Street Railway Co. will build two miles of electric road and add five cars.

THE Sioux City Cable Railway Co. will add twelve cable cars and build one mile of cable road extension. The cars will be double deckers, and will be furnished by J. A. Trimble of New York.

Somerville, Mass.—There is talk about an electric line from West Somerville via Elm Street and Broadway, to connect with the electric system soon to be put in operation on the Winter Hill line.

Springfield, Mo.—The Metropolitan Electric Railway Co. will build one mile of road and add four cars.

A PETITION has been circulated on Scott Street and on Queen City addition, to have the Metropolitan Electric Street Railway equip the abandoned road on Campbell Street with electricity.

Topeka, Kan.—The electric road is to be extended south from Fourth to Holliday Streets, where it now stops, to the North End of Santa Fe depot.

Victoria, B. C.—The National Electric Tramway Co. expect to equip four miles of road soon.

Vincennes, Ind.—The Vincennes City Electric Railway Co. will add several cars and build one mile of track.

Waco, Tex.—The Waco Electric Railway will be extended six miles.

Wakefield, Mass.—The Wakefield & Stoneham Street Railway Co. have petitioned the Selectmen for an extension of the location of their tracks.

Washington, D. C.—The Anacostia & Potomac River Railway Co. will increase their equipment this year by the addition of eight cars.

Waterbury, Conn.—A numerously signed petition has been presented to the Common Council asking that permission be granted to the Waterbury Horse Railroad Co. to equip their line with electricity as a motive power.

Watertown, Mass.—The Newton Street Railway Co. have asked leave to locate, construct and operate a street railway on Main Street.

West Newbury, Mass.—The Haverhill & Groveland Street Railway Co. will equip their road through this town with electricity.

Wilmington, Del.—It is stated that the Wilmington City Passenger Railway Co. have in view the extension of the Riverview line as far as Shellpot this summer.

Woburn, Mass.—The North Woburn Street Railway Co. will probably equip with electric power this fall.

Worcester, Mass.—The Board of Aldermen recently granted the petition of the North End Street Railway Co. for relocation of the Consolidated Street Railway Co.'s tracks in Lincoln Street, and that of the latter company for the right to use electricity on all their lines.

Youngstown, O.—The Youngstown Street Railway Co. expect to increase the length of their line several miles.

New Roads.

Alton, Ill.—There has been incorporated the Alton & Suburban Electric Railway Co., ; capital stock, $50,000. incorporators, Manning Mayfield, Henry C. Swift, E. G. Webster.

Billerica, Mass.—A meeting of citizens was held in the Town Hall July 14, to see what action the citizens would take in securing electric street railway service between Billerica and Lowell. On the committee appointed to take charge of the matter were: H. A. King of Billerica Centre, and John E. Rowell and James Barrington of North Billerica.

Blasdell, N. Y.—It is contemplated to build an electric road to connect this place and Depew. Hiram P. Hopkins is interested.

Brooklyn, N. Y.—The Common Council have granted a franchise to the Union Railway Co. to build a street railway from Hamilton Ferry to Prospect Park. At the head of the company is R. H. Flynn, a South Brooklyn millionaire, and associated with him are John Delmer and others. The Union Street Railway Co. also wanted the franchise.

Cadiz, O.—An electric railway from Cadiz to Unionvale, to connect with the Wheeling & Lake Erie, is to be built.

Cambridge, Mass.—The Storage Battery Street Railway Co. is the title of a new corporation, capitalized at $50,000, to build a road in Cambridge from the corner of Mt. Auburn Street and Putnam Avenue to Mt. Auburn Cemeetry and to Fresh Pond. The directors are Edwin H. Abbot, A. L. Richards, H. O. Houghton, Jr., E. P. Usher, W. Jones, Woodward Emery and W. S. Hall.

Chicago, Ill.—The ordinance granting to the Chicago & Jefferson Urban Transit Co. the right to build and operate a street railway on certain streets, has been adopted by the City Council. According to the provisions of the franchise, the company are required to complete the construction of the lines authorized within a year and four months from the passage of the ordinance, unless delayed by an order or in junction of court. The company have the privilege of operating cars by animal power, cable or electric power, or by any noiseless motor or power approved by the mayor and commissioner of public works.

THE Chicago City Council has passed the ordinance authorizing the Grand Crossing & Windsor Park Railway Co. to operate a railway on Seventy-fifth Street, between the two points mentioned in the title of the company. The ordinance provides that the company may use animal, cable or electric power. If electric is used, the wires are to be eighteen and a half feet above the rails. The company are required to have the road in operation within eighteen months.

THE Chicago City Council has granted a franchise to the Chicago North Shore Street Railway Co. who will operate a street railway from the terminus of the cable road on the North Side to Evanston. An amendment to the franchise as proposed provides that within a year after a suitable conduit electric system is discovered it shall be adopted by the company.

Cincinnati, O.—At a recent meeting of the Board of Administration L. A. Russell, the attorney for the Cleveland Street Railroad Co., put in a formal application for the right of way to build the Price Hill Route. The application was signed by Sidney H. Short, L. A. Russell and Albert L. Johnson.

Clayton, Ill.—An electric road is to be built connecting this place with St. Louis.

Concord, N. H.—An important meeting of those interested in the construction of a railroad between Concord and Rochester, was lately held here. Among those interested are J. W. Jewell of Strafford, J. B. Tennant of Epsom and A. H. Chase, of Concord.

Deer Park, L. I.—The Deer Park & Babylon Railway Co. has been incorporated to construct and operate a street railroad of five miles in length from Deer Park to Babylon. Some of the directors are: Peter Alexander, New York City; Washington F. Norton, Fire Island, Joseph M. Sammis and Frederick S. Bunce, Babylon.

Denver, Colo.—A franchise has been granted to the Metropolitan Street Railway to construct and operate an electric railway beginning at the intersection of Fortiethand Williams Streets and running to the city limits, the line to be extended to Riverside cemetery.

THE Tramway Co. have been given a franchise to build a road as the connecting link between their present system and Banana Street, the terminus of their franchise in Elyria.

A FRANCHISE has been granted to the Metropolitan Railway Co. to run an electric line from Fortieth Avenue and Williams Street through Swansea to Riverside. The franchise was supported by petitions of residents and property owners.

Dillsburg, Pa.—A charter was granted July 7, for the Dillsburg, New York Springs & Gettysburg Street Railway Co.; capital $150,000. The president is Dr. William Hegle of Harrisburg.

Easton, Pa.—A charter has been granted to the Easton & Bethlehem Transit Co.; capital, $125,000. Three of the incorporators are Howard Mutchler, of Easton; George W. Cope, of Nazareth, and E. H. Laubach, of Stemton.

East St. Louis, Ill.—Messrs. Obermeyer and McCasland have petitioned for a franchise for a street car line on Broadway from the intersection of Collinsville Avenue to Walnut street.

Eldorado Springs, Mo.—At a mass meeting of the citizens of this place held lately it was resolved to take steps at once looking to the construction of a dummy line to Nevada. C. A. Edgar, W. P. Cruce, E. W. Bannester. O. R. Deland and J. B. Warren were appointed a committee on the matter.

Elgin, Ill.—The Elgin, Aurora & Fox River Electric Railway Co. has been organized and the following officers elected: William Grote, president; John M. Egan, vice-president; Henry A. Gardner, secretary; Henry H. Evans. treasurer; Arthur M, Beaupre, auditor; T. E. Ryan, general solicitor. Steps were taken to secure the right of way and begin the construction of the road immediately.

Elizabeth, N. J.—Articles of incorporation were filed lately for two street railways in Elizabeth. One road is to be known as the West End Railway Co., with a capital of $70,000. This line will traverse the western and northern sections of the city. The other is the Citizens' Street Railway Co., with a capital of $50,000. It will traverse the central and eastern sections of the city and connect with the West End Line. Applications for franchises for both roads have been made to the City Council.

IT is rumored, that a company has been organized for the purpose building an electric railway from Elizabeth to Plainfield, passing through Roselle, Cranford, Westfield, Fanwood and Netherwood.

Elmira, N. Y.—The East & West Side Railroad Co, expect to build between seven and eight miles of road at once, under the new organization.

Elwood, Ind.—Articles of incorporation were recently filed with the Secretary of State, of the Elwood Electric Railway Co.; capital stock $150,000. The directors are: A. W. Hatch, Willard C. Nichols, A. T. Hart, Edward McDevitt and J.C. Devore.

Erie, Pa.—There is talk of a stock company to build an electric railway to the Grove House Park on Four Mile Creek.

Etna, Pa.—The Connecting Street Railway Co. with a capital of $18,000, was chartered to build a three mile electric line in the borough. Daniel T. McCann, William D. Evans, and W. Wallace Bell are directors.

Faribault, Minn.—W. P. McKinley, of Champaign, Ill., has been in this city looking up the matter of establishing a street railway here.

Green Bay, Wis.—J. L. Case of Racine has made application to the City Council for a franchise to construct an electric street railway here.

Jefferson, Mo.—The Delmar Avenue & Clayton Railway Co, with a capital of $5,000, was lately incorporated by L. Dosenbach, G. K. Ramsay and others.

Kankakee, Ill.—Kankakee and Bourbonnais are to be connected by an electric street railway. The North Kankakee Electric Light & Railway Co. have closed a contract with the Detroit Electrical Works for a five mile line.

Lansing, Mich.—The Capital Street Railway Co., capitalized at $25,000, has been organized at Lansing to extend the present system to the agricultural college.

Le Mars, Ia,—A. C. Colledge is the grantee of a franchise to construct a street railway here.

Lincoln, Neb.—A movement has been inaugurated in Lincoln for the construction of an electric railway to connect the city with the several pleasure resorts near that place. The proposed line will reach Lincoln Park, Salton Lake and Cushman Park. It will be twelve miles in length, and the cars will be propelled by the storage battery system.

Lock Haven, Pa.—The Lock Haven Street Railway Co. with a capital of $30,000, has been incorporated by Henry T. Harvey, Lock Haven; James North, Mifflintown; P. B. Crider, Bellefonte, and others.

Marion, Ind.—The Queen City Electric Railway Co. has been incorporated. The company propose to build a line from Marion to Jonesboro. The capital stock of the company is $150,000. Some of the directors are K. W. Hatch, J. C. Devoy, and William C. Nichols.

Matteawan, N. Y.—Articles of incorporation of the Citizens' Street Railway Co., of Matteawan, have been filed. The capital stock is $20,000.

Mt. Vernon, N. Y,—A new surface railway company, known as the North Mt. Vernon Railway, has been organized, and will soon begin work in constructing the road. The directors are: County Judge Mills, Joseph S. Woods, Edward Hartley, Col. Edward Henneberger and R. M. Winfield.

Muskegon, Mich,—A dummy line is being rapidly constructed along the lake front beach between Lake Michigan Park (West Muskegon) and Lake Harbor. This will connect with the Muskegon Street Railway, affording convenient and quick access to the assembly grounds and Lake Harbor.

Norwalk, O.—Esbon Blackmar has received an amended franchise to construct and operate an electric railway.

Oakland, Cal.—G. W. McNear has asked for a fifty year franchise to build and operate an electric road.

Oskaloosa, Ia.—The Oskaloosa Electric Street Car Co. have decided to build seven miles of electric railway.

Philadelphia, Pa.—An ordinance has been granted to the Kessler Street Connecting Passenger Railway Co. to construct a single track railway on Kessler Street from Wallace Street, to Spring Garden Street, with necessary curves and switches.

Phœnix, Ariz.—On July 6 the City Council granted two franchises to build and operate electric railways in Phœnix. One was to men representing San Francisco capital and the other to L. Harrison, of Denver. They are compelled to begin work in six months.

Pittsburgh, Pa.—There has been chartered the Morningside & Highland Park Street Railway Co.; capital $55,000.

Rat Portage, Ont.—Arrangements are being made for the formation of a company to construct an electric street railway in this town.

Rochester, N. H.—In pursuance to the charter granted for an electric railway connecting Rochester, East Rochester and Gonic, and finally with Great Falls, the grantees have organized and chosen the following officers: President, Edwin Wallace; vice-president, Charles S. Whitehouse; treasurer, Henry W. Burgett; clerk, Stephen D. Wentworth.

St. Louis, Mo.—An ordinance has been passed authorizing the City Central Railway Co. to construct, operate and maintain a double track passenger railroad by electric power.

THE Manchester Road Electric Railway Co. have been organized. capital $20,000. The incorporators are: Thos. Howard, M. C. Orton and Jas. Daniels.

RESOLUTIONS of the Benton Taxpayers' Club have been introduced in Council urging favorable action on the proposition to establish a belt line electric railway around Forest Park.

AN ordinance has been introduced authorizing the North & South Rapid Transit Railway Co. to construct a railway from Eighteenth Street over routes to Florissant Avenue and thence north to Calvary Cemetery. The company are authorized to operate by storage batteries.

Sandusky, O.—It is said that a charter has been applied for by a new street railway company, whose intention it is to build a line from Sandusky to Milan.

Sanford, Me.—An electric road is to be built and put in operation here by next November. Probably it will be built on the charter of the Mousam River Railroad, incorporated March 12, 1889, by E. M. Goodall, Chas. H. Frost, Robert W. Lord and others.

Salisbury, Md.—A company to build a street railway here, who tried unsuccessfully a year ago to obtain a charter, are reviving the project. The incorporators of the company are: L. E. Williams, Jas. A. Perry, C. L. Waller, W. H. McConkey and I. Malone.

Sheboygan, Wis.—Articles have been filed incorporating the Sheboygan & Sheboygan Falls Transit Co. with a capital stock of

$50,000. The incorporators are: Gerhard Schneider, C. A. Dean and Jos. G. End. An electric line of some sort between the city and the Falls over the toll road, is the object of the company.

ANOTHER scheme talked of is that of building a road from Concord through Northwood to Rochester. The distance is thirty miles.

Somerset, Ky.—The Somerset Electric Street Railway Co. have decided to commence operations on the prospective line at once.

Stroudsburg, Pa.—Mr. J. H. VanderVeer, formerly of the People's Street Railway Co., of Scranton, Pa., is constructing a street railway here, to be operated, probably, by steam dummy, unless the consent is obtained for the trolley system. The road will probably be extended as far as Bushkill Falls, making in all about fifteen miles.

Tarentum, Pa.—A company was organized in Pittsburgh, July 8, for the purpose of building an electric street railway, with Tarentum and Natrona as the termini. The road will be five miles long and will pass through Creighton. The company is composed of Howard Wheeler, Edward Waters, Pittsburgh; J. C. Breckridge, James Lane, Tarentum, and J. C. Whitla, Beaver Falls.

Tiffin, O.—Articles of incorporation have been filed of the Electric Railway & Power Co.; capital stock $50,000.

Topeka, Kan.—Several Topeka and Potwin citizens are discussing the advisability of organizing a new street railway company for Topeka and suburbs.

Vernon, Ind.—A company has been organized, capitalized at $15,000, looking to connecting North Vernon with Vernon by a street railway, with mules as a motive power. The line will be two miles long. Jacob Foedle is president, Moses Alexander vice-president, Elmer Wagner secretary, and O. Bacon treasurer.

Warren, O.—The County Commissioners have granted the petition of Henry Garlick, of Youngstown, to be allowed to construct an electric railway on the Warren and Youngstown road, between the Mahoning County line and Girard village.

White Hall, Ill.—A street car line bedween White Hall and Roodhouse, a distance of four and a half miles, is talked of.

Elevation of Tracks in Chicago.

A few months ago Mayor Washburne, of Chicago, appointed three commissioners to consider the matter of elevating the railroad tracks in Chicago. The grade crossing problem had become so serious that it was felt that the day had come when radical action should be taken. The local street railway companies have been sufferers from the multiplicity of crossings at grade, as a number of collisions more or less serious have occurred at these points.

The commission recently submitted its report in which the subway plan, the viaduct plan, the plan of partially depressing streets and the elevated plan were considered. It discards the first three means of abolishing grade crossings, and expresses its approval of the last. After stating that the city has abundant power to compel the compliance of railroads with any plan for the protection of life and for the maintenance of rights. On thoroughfares the commission, in its reports, says:

This plan contemplates the entire separation of the traffic of the streets from the traffic of the railroads, thus securing the restoration of the streets and highways of the city to all the uses and purposes for which they were originally created. This, in the opinion of your commission, is the only plan which is sufficiently comprehensive to meet all the requirements of the present and the future of this city. Any plan to be satisfactory must provide not only that the existing restrictions be removed, but must also admit of the widest development and expansion of the traffic upon the streets and highways of the city and the railroads entering it.

In dealing with this problem, which is, beyond question, the most important one confronting this city in its business and other interests, partial solution, which will be merely a temporary makeshift, will be altogether unacceptable to the public and unwise in every respect. As Chicago is now one of the most important railroad centres of the world, and is clearly destined in the near future to lead all other cities on this continent in the struggle for commercial supremacy, we believe that this question should now be dealt with on the most comprehensive basis, and once for all.

Your commission is of opinion that at an early day the government of the city should take steps to cause the different railroad companies now occupying the streets and highways of the city with their tracks, to remove the same and restore the streets and highways to the uses for which they were originally intended. The present crowded condition of the streets, the difficulty in transacting business and the certainty of a large increase in the volume of travel, trade and business upon the streets in all parts of the city, make this plan an imperative necessity.

In making these recommendations, your commission is not unmindful of the expense and inconvenience which will be occasioned by their adoption, but is of opinion that these disadvantages will be more than counterbalanced by the increased facilities which the railroad companies will have and the diminished expense of maintenance and operation of their roads.

Personal.

Mr. C. D. Shain, formerly manager of the Eastern district of the Edison General Electric Co., has resigned his position.

Mr. S.S. Leonard of the Hill Clutch Works, Cleveland O., was in New York last month, and gave us the pleasure of a call.

Mr. William F. Carleton, of Carleton and Kissam, sailed for Europe July 23, on "La Champagne." He will remain abroad about ten months.

Mr. A. L. Scott, general manager of the St. Paul City Railway Co. of St. Paul, Minn., has resigned his position. The company will have their headquarters in Minneapolis in the future.

Mr. Thomas C. Nash, formerly of the John A. Roebling's Sons Co., and the inventor of the Nash splice for cable roads, has been appointed superintendent of cables for the West Chicago Street Railway Co.

Mr. J. H. Hanna, who for the past eight years has been with the J. G. Brill Co. of Philadelphia, has severed his connection with that company and is now traveling in the interest of the McGuire Manufacturing Co. of Chicago.

Mr. George Flett, of the firm of Messrs. Dick, Kerr & Co., engineers and contractors, London, Eng., is visiting the principal cities of this country in the interests of his firm, and incidentally is studying our systems of rapid transit.

Mr. Peter Moar who has for the last six years been connected with the Melbourne cable tramways as rope splicer, has recently taken a position with the North Chicago Co., having been sent out by Thomas & William Smith, ropemakers, Newcastle-on-Tyne, England, to superintend the splicing of Lang lay ropes which are being introduced. in this country.

Mr. J. Holt Gates has accepted the position of general sales agent of the American branch of the Siemens & Halske Co, of Berlin. Mr. Gates has for several years been connected with the Westinghouse Electric & Manufacturing Co., more recently as special agent for the territory from Chicago to the Pacific Coast. Mr. Gates has a wide acquaintance, abundant experience in selling electrical apparatus, and a capacity for hard work.

Mr. Edward E. Higgins, general manager of the Short Electric Railway Co., sailed for Europe on July 14 on a combined business and pleasure trip. Mr. Higgins will attend the Convention of European Tramway Managers in Buda-Pesth, September 9 to 12, and in the course of his travels will also visit Germany, Holland, Belgium, France and England, making a special study of methods of transportation and roadbed construction in the different European capitals.

Mr. G. S. Duncan, of Melbourne, Australia, whose coming to this country was announced in our June issue, arrived about the first of July, and is now visiting the principal Western cities with the view of making a careful study of electric traction. The entire cable system of Melbourne, Australia, has been constructed under Mr. Duncan's supervision, and he is thoroughly posted in cable railway matters. In case he finds electric traction better adapted for transit purposes, he will recommend its adoption in the cities of Australia on his return.

Mr. H. Durant Cheever, manager of the Okonite Company Ltd., well known manufacturers of Okonite insulated wires and cables, has gone to Europe on a well earned vacation, and generally in the business interests of the company. This is the third trip Mr. Cheever has made across the great pond. It will be remembered that, owing to an enormous European demand for Okonite wire, it was found necessary to erect large branch factories in London. Mr. Cheever will inspect the factories, and besides make a circuit of the Continental cities.

New Publications.

Latest Improved Heavy Duty Engines. Published by the Ball Engine Co., Erie, Pa.

This little circular shows the different types of engines for electric railway service manufactured by the Ball Engine Co., of Erie, Pa., together with a statement of the manufacturers concerning them. Views are also given of the interior of the power station of the Buffalo Electric Railway Co., and of that of the Rochester Railway Co., in both of which Ball engines are used. A list of the railway companies using the Ball engine is also given.

Railway Car Construction; by William Voss. Published by R. M. Van Arsdale, New York. Large quarto, 200 pages. Price $3.00.

The work illustrates and describes in detail the construction of all the different types of steam cars employed in American practice. The The matter is treated under twenty-six chapters and an appendix which gives all the standards adopted by the M. C. B, and M. M. associations, together with a code of rules governing the repair of freight cars. The illustrations are from scale drawings, and the accompanying matter not only describes minutely the material and methods of construction, but as well the office of every separate part. The description is interspersed with sufficient advice, and record of results and behavior of certain devices in actual practice, to relieve it of monotony, making the work intensely interesting even to the unmechanical reader. The work would seem to be a necessity to every foreman and mechanic employed in steam railway building and repair shops, as well as to inspectors employed in the rolling stock branch of the business. Street railway master mechanics will also find much valuable matter and helpful suggestions from the illustrations.

A Consolidation in New York City.

The North Third Avenue & Fleetwood Park Railroad Co., the Harlem Bridge, Morrisania & Fordham Railway Co., the Melrose & West Morrisania Railroad Co. have consolidated under the name of the Union Railroad Co., with $2,000,000 of capital stock, which is more than double the present capital stock of the three companies. The directors elected recently are as follows: Charles A. Stadler, William Cauldwell, John C. De La Vergne, Thomas W. Olcott, J. W. McNamara and Edward A. Maher of New York; Anthony M. Brady and Robert C. Pruyn of Albany; Albert Shaw of Troy.

The officers are: President, Edward A. Maher; vice-president, Charles A. Stadler; secretary and treasurer, Thomas W. Olcott.

About seventeen miles of the Union Railway are now in operation by horse power. It is expected that by next November the entire seventeen miles will be operated by the trolley system. Eight miles of new road will be constructed without delay, making twenty-five miles of road, all on the trolley system. The wires are being attached to the Suburban Elevated Railway's structure and the power station is being constructed.

Ammonia Motor Cars.

A company entitled The Railway Ammonia Motor Co. have been organized with headquarters at 280 Broadway, New York, to promote the manufacture and sale in the Eastern and Middle states, of the McMahon ammonia motors for street railway work. This device was illustrated and described in our January issue, and the car mentioned there has been in operation during the last six months on an experimental track on the grounds of the World's Columbian Exposition, Chicago. The officers of the Railway Ammonia Motor Co., are: Hon. W. A. Crombie of New York, president; Alex. H. Ross of Newark, N. J., vice-president; Brackett W. Burleigh of New York, treasurer; Henry Graham, secretary and T. C. Dunn, general manager. The company is organized with a capital stock of $1,250,000. Records made by the ammonia car at Chicago show the number of gallons of anhydrous ammonia used per mile average about four, and the cost for motive power was about one cent per car mile. The company will soon have a car in operation on one of the surface lines in New York City. The system is also applicable to elevated railways.

Some Uses for Graphite.

A correspondent in a contemporary says: If engineers, machinists and millwrights in general and pipe fitters in particular knew of the good qualities of graphite, I dare say there would be ten times the demand for it. Its lubricating qualities are questioned only by the impractical, and it is this quality alone that sounds its keynote, so to speak. During the past three years I have used about fifteen or twenty pounds of dry Ticonderoga flake graphite for pipe joints, cylinder heads, piston rod packing, etc. Bolts, smeared with graphite mixed as above, I have unscrewed after having been in the dampest places for upward of two years or more, proving the anti-rusting qualities of graphite. To cool hot bearings put it on as thick as it will mix with oil. Almost any oil or grease will answer but don't use poor graphite.

Equipment Notes.

The Eastern Electrical Cable Co., of Boston, Mass., have issued in handy form a little pamphlet "Wire Tables and Price List of Clark Wire and Cables."

The Jewell Belting Co., of Hartford, Conn., have on their books a large number of orders for belts from street railway companies, and their belts are giving the best of satisfaction in all installations.

The Van-Choate Electric Car & Light Co., of Boston, have moved into offices in the Exchange Building, and are arranging for an extensive plant where they will begin the manufacture of dynamos, lamps and motors. They will also put on the market an electric railway motor.

G. F. Whitney, of Boston, reports that the soap manufactured by him for cleaning cars is being used extensively in the street railway field, and that his orders among street railway companies are constantly increasing. He also manufactures soap for inside work, and an amber soap for cleaning varnished surfaces.

The United States Steam Railway Advertising Co., Carleton & Kissam proprietors, have leased the advertising privilege in the cars of the Duluth Street Railway Co., Duluth, Minn. This company are constantly extending their business connections with railroads, and are to-day, without doubt, the largest concern in the street railway advertising business.

The Reliable Manufacturing Co., of Boston, Mass., have their Reliable street car switch ready to place on the market, and are installing one on the Lynn & Boston and East Middlesex street railways. The manufacturers state that it has given very good results where tried, and that they anticipate a large sale. A description of the switch will be given in an early issue of this journal.

The Louis & Fowler Manufacturing Co., of Brooklyn, report business as in a satisfactory state with them, many orders for cars and other street railway appliances on hand testifying to the appreciation in which their appliances are held. They anticipate a large call for their snow plows for the coming season, and during the last week in July received orders for six of these appliances.

The Pittsburgh Steel Hollow Ware Co., of Pittsburgh, are meeting with great success in the sale of their rolled steel gongs, two types of which were illustrated in our last issue. These gongs are made from steel by a special process of rolling, and are guaranteed not to crack or lose tone. They are made in all sizes, and are attached for either overhead or foot use, and where they have been installed have given good satisfaction.

The Berlin Iron Bridge Co., of East Berlin, Conn., have received the contract for the new tin plate works which Hughes & Patterson are to erect at Philadelphia, Pa. The buildings will be of iron from the designs of the Berlin company. The main building will be 40×253 ft., with a wing 40×300 ft., both two stories high. The rolling mill will be 120×160 ft., with an annealing room 75×160 ft. The whole plant will require the use of 800 tons of iron in its construction.

A. Groetzinger & Sons, of Allegheny City, Pa., have a noiseless pinion of improved process raw hide, which is meeting with much success for electric street car service and mechanical purposes. The material is called dermaglutine, and the manufacturers claim that it has wearing qualities equal to steel, and at the same time is inexpensive to install. A. Groetzinger & Sons supply blanks or finished gears for all systems, and will be pleased to give full particulars of their gears upon application.

The Dickson Manufacturing Co., of Scranton, Pa., are very busy with the numerous orders for engines which they have on hand. This company have recently completed the engines which they will supply for the power house of the Broadway (New York) Cable Railway. The Dickson Manufacturing Co. are also building, among other engines, one of 1,250 H. P. and two of 600 H. P. each, triple expansion, for the Edison Illuminating Co., of New York, and report that the call for their engines for street railway and electrical purposes is large.

The Engineering Equipment Co., 143 Liberty Street, New York, have secured, by papers just executed, United States rights of manufacture and sale of the Goodell boiler and pipe covering. This is an important addition to the company's business which is now divided into three special departments, viz.: First, belting; second, boiler and pipe covering; third, overhead electric railway materials. In each of these specialties the company purpose to enlarge their facilities and strengthen their position in the trade from time to time.

The New York Car Wheel Works, Buffalo, N. Y., have removed their New York office from 115 Broadway to the corner of Bank and West Streets, where their well-known representative, Mr. J. R. Ellicott, has very comfortable quarters and is glad to welcome any street railway men. Adjoining this office they have secured three large rooms, two of which will be fitted up with all the machinery necessary for refitting wheels and axles, and for furnishing new work of the kind. Special arrangements are made for electrical fitting work. In their store room in New York a large supply of wheels and axles will be kept on hand to be furnished promptly for all standard cars, gears and motors, and the company guarantee all such work to be true to the closest specifications.

The Eddy Electric Manufacturing Co., of Windsor, Conn., are building a large addition to their present works, which is almost completed, and when finished will give a factory 330 ft. long and two stories high. The works are built in the most substantial manner, and the company are installing in place a large amount of machinery of the latest and most approved type, as well as a new 150 H. P. engine with boilers for motive power. This company are devoting much attention to the manufacture of generators for railway work and power transmission, and enjoy a large business in this line. They are also turning out many stationary motors for hoists, machine shops, general mining work, etc., and when their new factory is completed will undoubtedly have one of the most complete and perfect plants in the country for the manufacture of electric motors and generators.

The Lamokin Car Works, of Chester, Pa., are, as usual, very busy, and find the demand for the cars manufactured by them increasing. This company state that they have recently closed orders with the Belle City Street Railway Co., of Racine, Wis., for four 16 ft. palace furnished car bodies, August delivery, and with the Consolidated Street Railway & Light Co. of Oskaloosa, Ia., for eight 18 ft. palace finished cars complete, to be mounted on the Robinson motor truck, of Altoona, Pa. The Lamokin Car Works are also building for the Beaver & Elmwood Railway Co., of Pittsburgh, Pa., one 14 ft. open trail car. This car is constructed so that passengers are protected from danger incident to the open side car, as the seats are in the centre of the car, back to back, with an aisle on each side and sliding doors at each end. Passengers enter and leave the car at the ends of the car. At the sides of the car are iron rods with wire netting, making an open car, embodying all the elements of safety of a closed car.

The New York Insulated Wire Co., of New York, have recently closed a large contract by which the well known Grimshaw white core cables, tapes, etc., will be used in the installation of the entire incandescent lighting plant for the grounds and buildings of the World's Columbian Exposition, by the contractors, the Westinghouse Electric & Manufacturing Co. Since many of the buildings will probably also be tubed with the vulca ducts, the current for every incandescent light used in the grounds and the buildings, and many of the arc lights, motors, etc., will get their current from this well known wire. It would seem as if the Grimshaw white core wire could well be called the "world's choice," from the fact that it has been selected exclusively for what will probably be the equipment of 150,000 sixteen candle power lamps. In spite of the large demand for wire which this contract calls for, the whole over 15,000,000 ft., it is unnecessary to say that the

company always will carry a sufficient stock in their warehouse to fill all orders that they receive.

The New Process Raw Hide Co. of Syracuse, N. Y., have recently received a letter from F. O. Rusling, general manager of the West Bay City (Mich.) Street Railway Co., which gives some very interesting information in regard to the life of the new process raw hide pinions. Mr. Rusling states: "We purchased of you in September, 1891, a number of your raw hide pinions for the armature and intermediate shafts. These pinions have been running up to this date continuously since then, and we have within the past ten days discarded the first worn out armature pinion; of the intermediate pinions we have yet to take the first one off. Our cars run sixteen and seventeen hours per day, making an average of eight miles per hour. We send you this day *via* express an armature pinion taken off June, 29, 1892. This pinion has run 26,000 car miles on a Sprague No. 6 motor. Since adopting your raw hide pinions we have not lost one gear wheel from breaking teeth. We get more wear out of raw hide than we formerly got from steel, bronze or gun metal. The percentage of gains for raw hide over metal pinions on the wearing of gear wheels is very large. We shall soon give you another order, being satisfied we cannot get another make of pinion that will give us the service we have been able to get out of your goods."

The Ball Engine Co., of Erie, Pa., have, during the past six weeks, made the following sales through their New York agent, F. R. Chinnock: Prohibition Park Railway Co., Port Richmond, one 150 H. P. engine; Baltimore Traction Co., Baltimore, Md., two 130 H. P. heavy duty engines; Metropolitan Telephone & Telegraph Co., New York City, one 50 H. P. engine; Brokaw Bros., New York City, two 150 H. P. and one 80 H. P engine; Curtis & Dean, New York City, one 50 H. P. engine; Royal Light, Heat & Power Co., Front Royal, one complete steam plant, 100 H. P. engine and 125 H. P. boiler; Hot Springs Electric Co., Hot Springs, Va., one complete steam plant, 100 H. P. engine and two 80 H. P. boilers; Wm. Kynoch, Guantanamo, Cuba, two 80 H. P. engines; Buffalo Board of Trade, one 60 H. P. engine; Navy Yard, Brooklyn, N. Y., two 80 H. P. engines. Less than a year ago, owing to the great expansion in their business, they were forced to erect a large and complete machine shop, which was filled with the latest and most modern improved tools. No idea was entertained, they state, at the time that any further increase would be necessary for several years to come; but the demand for the latest improved Ball engines, built by this company, has been so great, especially for electric railway work, that already the makers of the engine have been again compelled to make a further extension of the same building. This extension, which is now under way, will be built on the gallery plan, the same as the rest of the building. It will contain, among other valuable features the most complete testing blocks and apparatus in the country, and will be capable of testing engines of very large capacity. Every engine that leaves the works of the Ball Engine Co. is thoroughly tested and guaranteed to give satisfaction under the most unfavorable circumstances. We also learn that the North Hudson County Railroad Co., Hoboken, N. J., in March purchased a 300 H. P. latest improved Ball engine from the Ball Engine Co., Erie, Pa., and they have been so well satisfied with the performance of the engine that they have ordered an additional engine of the same power from the same company. The Englewood Electric Light Co., Englewood, Ill., have ordered a 500 H. P. latest improved Ball cross compound engine, through the Chicago office of the Ball Engine Co., Erie, Pa.; and the Port Huron Electric Railway Co., Port Huron, Mich., have awarded order for one of their latest improved engines to the Ball Engine Co., Erie, Pa. The engine is a 400 H. P. cross compound of the latest type.

WESTERN NOTES.

The Chicago Raw Hide Co. are doing an excellent business, and are securing a number of contracts from electric railway companies.

The H. M. Loud & Sons Lumber Co., of Au Sable, Mich., have been awarded the contract for the diagonal poles for the Fort Wayne & Elmwood road, Detroit.

L. K. Hirsch, of 549 Rookery, Chicago, has on hand at the present time a large amount of second-hand rails suitable for use by street railroads. He also has for sale a large number of narrow gauge cars and locomotives.

The Cushion Car Wheel Co. of Indianapolis, recently furnished several sets of wheels to the Citizens' Street Railroad Co. of Indianapolis. They are giving satisfaction, and are found to contribute in no small degree to the smooth riding qualities of the cars equipped with them.

The Standard Railway Supply Co., of 1117 Monadnock Building, Chicago, Garson Myers, manager, are bringing out a new type of street car stove. It has meet the approval of car builders who especially appreciate the fact that when it is used it is unnecessary to cut the car seat.

The McGuire Manufacturing Co. have recently closed among other large contracts, orders with the following companies: the South Chicago City Railway Co.; the Kankakee (Ill.) Electric Co.; the Toledo (O.) Consolidated Street Railway Co. and the Pueblo (Colo.) City Railway Co.

The Valentine-Clark Co., of the Rookery, Chicago, make a specialty of wooden and steel poles and ties for street railway companies. This company have, heretofore, been known as the Ernest L. Clark Co., but the change in name has not involved any changes in the company. The company are receiving many orders for ties and poles.

The Ohio Machine Tool Works, of Cincinnati, O., have increared their line of manufacture, and are now making pulley lathes of improved design for the simultaneous boring and turning of pulleys, blank gears, etc. The machines will cut down both sides of a gear at one operation, while the diameter is being turned, and bore at the same time. The company state that they can deliver at once the twenty-six inch and thirty inch sizes, and can deliver the thirty-six inch and sixty inch on short notice.

The Electrical Supply Co., of Chicago, have recently made a new and advantageous arrangement with George W. LaRue, representing the Crocker-Wheeler Electric Co., whereby they become agents for the well-known products of the Crocker-Wheeler company. H. C. Hutchison, formerly of the Edison General Electric Co., will have charge of the motor department for the Electrical Supply Co., and will devote his entire time to this interest. The deserved popularity of the Crocker-Wheeler goods, and the well known reputation of the Electrical Supply Co. as "pushers" indicate that these arrangements cannot fail to prove profitable to both parties concerned.

Julius Lefmann, of 2200 North Second Street, St. Louis, has just issued a new catalogue. Mr. Lefmann makes a specialty of three joint iron and steel poles and railway appliances. Following is a list of street railways using the three joint poles: Benton-Bellefontaine Railway, Lindell Railway, Missouri Railroad, St. Louis Railroad, South St. Louis Railway, St, Louis & Suburban Railway, Union Depot Railway all of St. Louis; Brooklyn & Coney Island Railway, Eckington & Soldiers' Home Railway, Washington, D. C.; Fulton County Railway, Atlanta, Ga.; Jacksonville Railway, Jacksonville, Ill.; Minneapolis (Minn.) Street Railway; St. Paul (Minn.) City Railway; West End Railway, Boston, Mass.; Citizens Rapid Transit Co., Nashville, Tenn.

The Stirling Co., Pullman Building. Chicago, have had a splendid business since January 1. The aggregate capacity of the boilers since that time has been 24,000 H. P. The recent sales to electrical stations aggregate 4,468 H. P. as follows: South Chicago City Railway Co., three 300 H. P. boilers; Excelsior Electric Co., of Port Huron, Mich., one 250 H. P.; Pittsburgh & West End Railway, three 206 H. P.; Madison Electric Co., of Madison, Wis., one 200 H. P.; Defiance Light & Power Co., 100 H. P.; Hull Electric Light & Power Co., two 150 H. P.; Evansville Street Railway, Evansville, Ind., three 250 H. P.; St. Joseph & Benton Harbor Street Railway, two 200 H. P.; Ottumwa Electric Railway Co., Ottumwa, Ia., three 250 H. P.; Braddock & Turtle Creek Street Railway, one 200 H. P.

The Brownell Car Co., of St. Louis, Mo., are receiving letters from street railway companies in various sections of the country speaking in the highest terms of the "Accelerator" type of car manufactured by them. They have recently sent us three letters, from, respectively, Thomas H. McLean, general manager, Twenty-third Street Railway Co., N. Y., Geo. W. Baumhoff, general superintendent, Lindell Railway Co., St. Louis, and G. W. Hommell, manager of the Milwaukee (City division) Street Railway Co. In each of these letters the writer expresses himself as greatly pleased with the operation of the Accelerator as used upon his road, and the letters are exceedingly interesting as showing the decision reached by these gentlemen. Mr. Hommell's letter is given in full in the advertisement of the Brownell Car Co., in this issue.

The Springfield Emery Wheel Manufacturing Co. were put into insolvency by their creditors May 16, and James Staples of Bridgeport was appointed trustee. A new company have been formed, adding new capital and new machinery, and the incorporators have purchased from the trustee the plant, machinery, etc., of the old company, and will add a number of improved machines for the manufacture of emery wheels and emery wheel machinery. The new company have all the records of shipment of the old company and can, consequently, supply duplicate orders given to the old company at any time during the last eight years. They have also retained the principal foreman, superintendent and general manager, and are in better shape to fill all orders promptly than the old company ever were. The new company will be known as the Springfield Emery Wheel Co., taking the name of the old company with the exception of the word "Manufacturing," which is dropped.

Pullman's Palace Car Co., of Chicago and New York, have of late received orders for a large number of cars in their several departments. Among the contracts are the following: Fifty closed motor cars for the Milwaukee Street Railway Co.; four closed motor cars for the Galesburg Electric Motor & Power Co., Galesburg, Ill.; three closed motor cars for the Marshalltown Light, Power & Railway Co.'s road, Marshalltown, Ia.; 100 furniture cars, 200 gondola cars and 300 box cars for the Chesapeake, Ohio & Southwestern Railway Co.; 300 gondola cars for the Columbus & Hocking Coal & Iron Co.; 500 box cars for the Louisville, New Orleans & Texas Railway Co.; one private car for the Columbus, Hocking Valley & Toledo Railway Co.; one passenger coach for the Toledo & Ohio Central Railway Co.; three passenger coaches for the Kanawha & Michigan Railway Co.; twenty passenger coaches for the Chicago, Rock Island & Pacific Railway; one private car for Mr. A. A. McLeod, president, Philadelphia & Reading Railroad.

The Railway Equipment Co. of Chicago, are receiving a large number of contracts; in fact, they are fairly crowded with orders. The company are now well settled in their new quarters in the Pullman Building, and with every facility at their disposal, they are handling their increasing business with dispatch. Some idea of the large proportions which the business is assuming may be gained from the fact that the company have of late closed contracts for the line material for the Woodland & West Side road, Cleveland, the Interstate Elevated Road Kansas City, and for the electric railways in the following cities: Racine, Wis.; Kankakee, Ill.; Baltimore, Md.; St. Joseph, Mich.; Galesburg, Ill.; Lima. O.; Waco, Tex.; Michigan City, Ind.; Janesville, Wis. The company are also furnishing a large quantity of special material for the Atlantic Avenue road in Brooklyn. Owing to

the amount of trouble experienced this season on many electric roads from lightning, this company state that they are about ready to place on the market a lightning arrester of unusual merit for station, car and line use, and that full information concerning it will be cheerfully given on application.

The Charles Munson Belting Co., of Chicago, have secured an additional order for the new belting required by the Toledo Consolidated Street Railway Co. in the recent extension to their power station which was made necessary by the increase of traffic. This order consists of one 54 in. belt 126 ft. long, three 48 in. belts, and 154 ft. of 34 in. belt. This company also number among their recent contracts, one with the Brooklyn City Railway Co. for a 72 in. belt and two with the St. Paul Gas Co. for a 60 in. belt, and 72 in. belt 170 ft. long. They have also supplied belts recently to the Duquesne Traction Co., and the Pittsburgh, Allegheny & Manchester Street Railway Co. of Pittsburgh, comprising in all over 1,100 ft. of 48 in belts. Also one 72 in. belt at the station of the Missouri Street Railway Co., of St. Louis, as well as two 54 in. belts, five 16 in. belts and two 34 in. belts. At the station of the Union Depot Street Railway Co. of the same city they have two 54 in. belts, and to the Allentown & Bethlehem Street Railway have supplied two 40 in. belts, besides those needed for the generators. Their belts for street railway work, of which they are making a specialty, are meeting with great demand and are giving thoroughly good satisfaction.

The Sioux City Engine Works, of Sioux City, Ia., number among their recent sales the following: One 12×18 Gidding's automatic, boiler and complete plant for Chardon Electric Light Co., Chardon, Neb.; five 5½ and 9×14 Gidding's automatic compound engines to G. Y. Bonus; five 6½ and 11×16 Gidding's automatic compound engines to G. Y. Bonus; one 12×30 Corliss, boiler and complete steam plant to Diamond Iron Works, Minneapolis, Minn.; one 12×30 Corliss to Stratton & White, Fort Worth, Tex.; one 12×30 Corliss to Brookman & Barrett, Vermillin, S. Dak.; one 16×30 Corliss to the Joliet Enterprise Co., Joliet, Ill.; and one 20×48 Corliss to the Salem Electric Light & Power Co., Salem, Ore.; one 12×36 Corliss to Cavalier Roller Mill Co., Cavalier, N. Dak.; one 11×18 Gidding's automatic to Corvallis Roller Mill Co., Corvallis, Ore.; and one 12×30 Corliss to Chouch Bros., St. Edwards, Neb. The Sioux City Engine Works also report a decided increase in the demand for engines since June 20, and state that they have every prospect for a very large demand for their engines during the balance of the season, and in anticipation of this, have completed a number of standard selling sizes, ready for prompt delivery, and are now engaging additional force for a night gang, to take care of the rush of orders on hand. They also have in preparation a new list of users of the Sioux City engine, which will be soon ready for the trade and have also in preparation a descriptive catalogue of the Corliss engines, which they hope to issue a little later.

The Short Electric Railway Co., of Cleveland, report orders for additional apparatus from the Bloomington City Railway Co., Bloomington, Ill., ten 40 H. P. single reduction equipments and one 100 H. P. generator; South Covington & Cincinnati Street Railway Co., four 40 H. P. single reduction equipments; Schuylkill Electric Railway Co., Pottsville, Pa., four 50 H. P. single reduction equipments; West End Street Railway Co., Rockford, Ill., six 20 H. P. gearless equipments; Georgetown & Tenalleytown Railway Co., Washington, D. C., two 40 H. P. single reduction equipments; Wilkesbarre & Wyoming Valley Traction Co., Wilkesbarre. Pa., three 60 H. P. single reduction equipments, one 200 H. P. generator; and the Baddock Electric Railway Co., Braddock, Pa., one 40 H. P. single reduction equipments. They have also closed contracts recently with the Baltimore Traction Co., Baltimore, Md., and the Janesville Street Railway Co., Janesville, Wis. The Short Electric Railway Co. have, as usual, a large number of orders on hand. They report from their New York office through Mr. Edward J. Wessels, general Eastern agent, that they have just closed a contract with the Syracuse, Eastwood Heights & DeWitt Railroad Co., of Syracuse, N. Y., for one 135 H. P. generator, and four 30 H. P. single reduction motors. This is a preliminary order, and the economy will probably require a number of additional cars before long. The road will probably be in operation within the next sixty days, and will serve a territory between Syracuse and East Syracuse where there is at present no street railway line.

The Detroit Electrical Works have received a number of orders for their new generators, illustrated in this issue. Among recent purchasers they number the following: *Times* Building, Chattanooga, Tenn., two 30 K. W. generators, one 9 and one 15 K. W. motor; Bagley Estate, Detroit, one 40 K. W. generator and five 9 K W. motors. This contract also includes five freight elevators and controlling devices for motors, so that elevator is operated by one 9 K. W. motor, which is controlled, started and stopped by means of the starting rope of the elevator, the motor only running when the elevator is in use; Detroit Dry Dock Co., Detroit, two 250 light generators for lighting machine shop, boiler shop, dry dock, engine rooms and offices, etc., one 40 K.W. generator to furnish current for electric cranes; Detroit Dry Dock Co., for boats which they are building, one 125, one 150 and one 250 light plant, complete; Detroit Foundry Equipment Co, Detroit, one 9 and one 15 K. W. motor complete, with controlling devices, etc., for electric cranes. The Chicago office of this company has been given a number of contracts within the last few weeks. Mr. L. E. Myers, the special agent, received an order for fourteen 30 H. P. equipments for Racine, as well as for three 80,000 watt generators, the general station appliances, and the contract for 13 miles of overhead work. An order has also been secured from Kankakee for two 30 H. P. equipments, a 65,000 watt generator, and the contract for four and a half miles of overhead work. The Calumet Electric Railway Co. have ordered the third increase of motors for their road from the Detroit Electrical Works.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, JUNE 28, 1892, TO JULY 19, 1892, INCLUSIVE.

JUNE 28.

Automatic Tramway Switch, Waldo G. Fay, Columbus, O. 477,749
Brace Chair for Railroad Rails, William M. Brown, Johnstown, Pa. 477,641
Cable Railway Conduit, Milton H. Bronsdon, Providence, R. I. 477 884
Carrier Pulley for Cable Roads, Milton H. Bronsdon, Providence, R. I. 477 885
Car Brake, William F. Gibbs, Auburn, N. Y. 478,003
Car Truck, Henry C. Hodges and Clarence B. Hodges, Detroit, Mich. 477,657
Combined Rail and Cross Tie, Arthur J. Moxham, Johnstown, Pa. 477,679
Combination Safety Railway Track, Solon G. Howe, Detroit, Mich 478,059
Conduit for Electric Railways, Carl T. H. Schwieger, Berlin, Germany 478,025
Device for Suspending Trolley Wires, Joseph Sachs, New York, N.Y. 477,781
Electric Railway, Joseph W. Bates, Minneapolis, Minn. 477,734
Expansion Rail for Railroads, Arthur J. Moxham, Johnstown, Pa 477,672
Expansion Rail for Railroads, Arthur J. Moxham, Johnstown, Pa. 477,675
Frog or Cross for Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,681
Heater for Vehicles, Edmond Molloy, Philadelphia, Pa. 477,811
Lightning Arrester, Frederic Haselwander, Frankfort, Germany 477,656
Mechanism for Cable Traction, William A. Butler, New York, N. Y. 478,046
Rail for Railroads, Arthur J. Moxham, Johnstown, Pa. 477,673
Rail for Railroads, Arthur J. Moxham, Johnstown, Pa. 477,674
Rail for Railroads, Arthur J. Moxham, Johnstown, Pa. 477,683
Rail Joint, Arthur J. Moxham, Johnstown, Pa. 477,677
Rail Joint, Milton C. Niles, Oak Park, Ill. 477,694
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,676
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,681
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,682
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,685
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,687
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,688
Railroad Rail Joint, Arthur J. Moxham, Johnstown, Pa. 477,689
Railroad Rail and Process of Making the Same, Arthur J. Moxham, Johnstown, Pa. 477,690
Railroad Rail Joint, Arthur J. Moxham, Johnstown, Pa. 477,678
Railroad Rail Joint, Arthur J. Moxham, Johnstown, Pa. 477,680
Railway Car, George M Hoadley and Sumner A. Bemis, Springfield, Mass. 477,935
Railway Rail Curve, James G. Jordan, Des Moines, Ia. 477,801
Street Locomotive, Ezra Dederick, Milwaukee, Wis. 477,889
Switch Piece for Railroad Tracks, Arthur J. Moxham, Johnstown, Pa ... 477,686
Thrust Collar for Axles of Electrically Propelled Vehicles, Richard P. Osgood, Methuen, Mass. 477,695

JULY 5.

Ball Bearing, for Railroad Cars, John E. Norwood, Sykesville, Md. 478,351
Car Truck, George M. Brill, Philadelphia, Pa. 478,218
Car Wheel and Axle, Abner Johnston and William A. Johnston, Jersey City, N. J. 478,512
Dynamo Electric Machine or Motor, Elmer A. Sperry, Chicago, Ill. 478,142
Electric Locomotive, Elmer A. Sperry, Chicago, Ill. 478,139
Electric Locomotive, Sidney H. Short, Cleveland, O. 478,477
Electric Locomotive, Sidney H. Short, Cleveland, O. 478,242
Electric Railway Conduit, Milton Shoemaker, Sioux City, Ia. 478,175
Electric Railway, Frank Mansfield, New York, N. Y. 478,345
Fare Register, John W. Meaker, Chicago, Ill. 478,167
Insulator, Louis McCarthy, Boston, Mass. 478,518
Railway Chair, Silas Harris, San Francisco, Cal. 478,427
Railway Chair, Silas Harris, San Francisco, Cal. 478,428
Support for Street Railways or Tramways, James M. Price, Phila, Pa. 478,362
Trolley, John W. Davis, Lynn, Mass. 478,410
Trolley Wire Splice, Elmer A. Sperry, Chicago, Ill. 478,140

JULY 12.

Arc Extinguisher for Electric Switches, Sidney H. Short, Cleveland, O. 478,718
Automatic Trap for Cable Conduit, Ira Bishop and Arthur F. L. Bell. 478,910
Brace Chair for Railroad Rail, George Murray, Johnstown, Pa. 478,806
Cable Railway Grip, Charles Vogel, San Francisco, Cal. 478,773
Car Brake, Frederick A. Baier, St. Louis, Mo. 478,902
Conduit System for Electric Railways, William H. Ford, St. Louis, Mo. 478,956
Electric Locomotive, Joshua Gray, Medford, Mass. 478,591
Electric Rail Bond, Thomas J. McTighe, New York, N. Y. 478,629
Lifting Mechanism for Cable Grips, Ira Bishop and Arthur F. L. Bell. 478,911
Railroad Rail Joint, Warren H. Carr, Bath, Me. 478,920
Railway and Truck, James G. Johnson, Chicago, Ill. 478,332
Railway Rail, John T. Smith, San Francisco, Cal. 478,706
Street Railway Switch, Ira F. Harris, Nashua, N. H. 478,858
Street Railway Switching Device, Ira F. Harris, Nashua, N. H. 478,859

JULY 19.

Car Brake, Charles H. Allen, Stroudsburg, Pa. 479,236
Car Starter, George B. Warner and Llewellyn J. Allen, Woodbury, Conn. 479,127
Car Truck, John E. Anger, Green Island, N. Y. 479,237
Conduit Trolley for Street Cars, Arthur H. Heatman, Baltimore, Md. 479,327
Fare Register, Frederick C Boyd and Richard Martin, New Haven, Conn. 479,388
Railroad Rail Fastening, Henry A. Lyddon, Brainerd, Minn. 479,289
Railway Joint, Frederic W. Bond, Springfield, Mo. 478,993
Street Railway Switch, Roswell T. Smith, Nashua, N. H. 479,028
Signal for Electric Railways, Frank F. Loomis, Akron, O. 479,138

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, July 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co ...	50	1,250,000	Q.—J.	1½	.....	112	.....
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	240	.....
Broookyln City R. R. Co....	10	6,000,000	Q.—J.	2	.....	187	190
Coney Island & Brooklyn R. R. Co.....	100	500,000	.....	...	.....	145	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.....	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	104
Broadway R. R. Co.....	.....	350,000	J. & J.	5	6m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds.....	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates.....	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st.....	....	125,000	F. & A.	7	Aug. 1897	106	.....
South Brooklyn Central R. R. Co., 2d.....	.....	150,000	F. & A.	6	July, 1941	102	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	108	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.....	100	750,000	Q Feb.	1½	1890	115	120
Watervleit Turnpike & R. R. Co.....	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid	Ask'd
Albany R. R. Co., 1st Mort...	1865	40,000	J. & J.	5	1905	103	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	102	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	105	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	105	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	105	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	104¼	.....
" " " Debenture..	1891	200,000	M. & N.	6	1901	109	110½
Watervliet Turnpike & R. R., 1st Mort.....	1889	350,000	M. & N.	6	1919	114	117
Watervliet Turnpike & R. R., 2d Mort.....	1889	150,000	M. & N.	6	1919	108½	109½

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, July 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1	.....	150	152
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	117	120
42d & Grand St. Ferry.....	100	748,000	Q.—F.	3	.....	250	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	50	55
Eighth Avenue.....	100	1,600,000	Q.—J.	2	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	J. & J.	5	.....	115	118
Sixth Avenue.....	100	1,500,000	M. & S.	3	.....	196	200
Third Avenue.....	100	2,000,000	M. & N.	6	.....	205	210
23d St.....	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue.....	100	800,000	.....	3	.....	130	135

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	113
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	104	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	105	.....
Additional.....	.....	1,000,000	J. & J.	5	July, 1905	95	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	116	120
Central Crosstown.....	.....	250,000	M. & N.	6	Nov., 1922	115	117
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	100	101
Scrip.....	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry.....	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.....	.....	1,200,000	J. & J.	6	1915	59	61
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	100	107
Second Avenue.....	.....	1,600,000	M. & N.	5	Nov., 1909	103	105
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	112	114
23d St.....	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. July 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.....	50	$6,400,000	J. & J.	4	1887	87½	88
West End Com'n.....	50	9,085,000	J. & J.	5	1890–1892	74	74½

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, July 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co.....	100	$270,000	New.	...	Oct., 1887	95	100
Union R. R Co., Prov.....	100	2,000,000	Q.—J.	2	1862–1863	200	210
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co....	100	$360,000	J. & J.	4	.....	245	250
Holyoke Street R. R.....	100	240,000	J. & J.	4	.....	212	225
Northampton Street R. R.....	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.....	50	$100,000	J. & J.	3	.....	.....	55
Enterprise Ry. Co.....	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co.....	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.....	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
*Carrollton R. R. Co.....	100	800.000	Quart.	1½	1867	127	134¼
Crescent City R. Co.....	100	1,150 000	"	1¾	.866	97¾	98½
Canal & Claiborne R. R. Co..	40	240,000	.....	...	1888	26	.....
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	139¾	143
Orleans R. R. Co.....	50	185,000	"	2	1868	58¾	65
St. Charles Street R. R. Co..	50	600,000	"	2	1866	93	94

Bonds.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150.000	A & O	6	* 1887	102¼	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93-'99	.....	.....
do do new	1886	40.000	M & N	6	1896	.....	.....
N. O. City R. R. Co.....	1879	495,200	J & D	6	1903	122⅝	.....
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92-'06	113½	.....
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89-'01	.....	.....

* Bids on Carrollton R. R. are ex-privilege of new stock.

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$30⁰,000	J. & J.	4	.....	35	.....
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	25	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	26	.....
New Haven & Cent lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	.....
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1889	100	.....
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R Co.. Deb. Series C. (Not yet Issued).....	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & CO., Members Montreal Stock Exchange, 9 St. Sacrament Street, July 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	223½	225

BONDS.	Date of Issue	Amount Out-standing.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	89	90
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	26	27

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	99	100
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	114½	.....
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	114½	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	400	.....
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	97	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	223	224
West Division City	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	183	184

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	98½	99¼
Chicago Passenger	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,850,000	M. & N.	4½	1927	96¾	97½
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100¾	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101¼	101¾
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	97½	.....

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & CO., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, July 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co ...	50	1,500,000	.....	..	.....	28⅞	29¾
Citizens' Traction R. R. Co ..	50	3,000,000	J. & J.	3	.....	62	62½
Pitts. & Birmingham R. R. Co	25	3,000,000	.....	...	.....	25¼	25¾
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	.....	59½
Federal St. & Pleasant Valley	50	1,400,000	J. & J.	3	.....	25½	25¾
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	.....	45¾
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	.....	...	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	28¼	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co ..	1887	1,250,000	A. & O	5	1927	108	.....
Pitts. & Birmingham Traction Co.	1889	1,500,000	M. & N.	5	1929	.....	101½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	.....	.....
Pleasant Valley Ry.	1891	1,250,000	J. & J.	5	1919	100½	101
P., A. & M. R. R. Co.	1891	1,500 000	J. & J.	5	1931	.....	104¾
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	100⅛	100¾
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.	1883	125,000	.....	6	1903	102½	.....
Monongahela Incline Plane Co.	1887	50,000	A. & O.	5	1892	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH Broker, 440 California Street, San Francisco, Cal., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.	100	1,000,000	Monthly	5	.....	.....	115
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	95	.....
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	45	65
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	33	39
Omnibus Cable Co.	100	2,000 000	Monthly	4	.....	56	58½
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	22½	25½

Bonds.	Date of Issue	Am't Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	101	.....
Market Street R. R.	.....	3,000,000	J. & J.	6	1913	120	.....
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	114⅛	116¾
Powell Street R. R.	.....	700,000	M. & S.	6	1912	112	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	111½	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	95	.....
Cal. St. Cable R. R.	.....	.....	.....	...	.....	103	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., July 18. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.	50	$50,000	Q.—J.	3	1864	30	32
Cass Ave. & Fair Grounds.	50	300,000	.....	...	1876	45	46
Citizens'	100	1,500,000	A. & O.	1⅛	1887	90	95
Jefferson Avenue.	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	70	72
Missouri.	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central.	100	200,000	.....	...	1884	100	105
People's.	50	1,000,000	M. & S.	6	1889	45	50
St. Louis.	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal.	50	150,000	Jan.	.50	1872	15	25
Union.	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban.	100	2,500,000	.....	...	1891	48	50

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine.	1891	$500,000	F. & A.	6	1911	102	102½
* Cass Avenue.	1886	200,000	.....	...	.....	.....	.....
Citizens' Cable.	1887	1,500,000	J. & J.	6	1907	105½	106
Lindell	1890	1,500,000	J. & J.	5	1895–1910	99	100
Mound City.	1890	525,000	A. & O.	6	1900–1910	105	106
Missouri Cable.	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort.	1882	125,000	J. & D.	6	1902	102	105
" 2d mort.	1886	75,000	M. & N.	7	1902	104	105
People's Cable.	1889	800,000	J. & J.	6	1889–1914	97	100
* Northern Central.	1884	200,000	J. & J.	6	.....	.....	.....
St. Louis Cable.	1890	1,500,000	M. & N.	5	1900–1910	97½	98
Union.	1885	150,000	M. & N.	6	1895–1915	102	103
Union Depot.	1890	1,600,000	A. & O.	6	1900–1910	105	106

* Called for Redemption.

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & CO., 143 South Fourth st. (Bullitt Building), Philadelphia, July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'.	50	$500,000	Q.—J.	4	1858	260	270
Continental.	50	1,000,000	J.—J.	6	1873	125	126
Frankford & Southwark.	50	1,250,000	Q.—J.	5	1854	210	212
Germantown.	50	1,500,000	Q.—J.	2½	1858	102	103
Green & Coates...	50	500,000	Q.—J.	3	1858	120	121
Hestonville.	50	2,050,000	.....	...	1859	32	34
Lombard & South.	25	500,000	A.—O.	8	1861	55	60
People's Common.	25	1,500,000	M.—S.	2½	1873	49	50
" Preferred.	25	750,000	M.—S.	2½	.....	49	.....
Philadelphia City.	50	1,000,000	J.—J.	7½	1859	150	151
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	65	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	84	85
Ridge Avenue.	50	750,000	Q.—J.	5	1872	220	230
Second & Third.	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth.	50	1,000,000	J.—J.	9	1858	200	203
Union.	50	1,250,000	J.—J.	9½	1864	186	188
West Philadelphia.	50	750,000	J.—J.	10	1857	200	202
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	129¾	130
Baltimore Traction.	25	5,000,000	.....	1	1889	23¾	24
Buffalo (N. Y.) Railway.	100	6,000,000	.....	...	.....	39	40
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	26	27

BONDS.	Date of Issue	Amount Out-standing	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1,250,000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	106	107
Germantown, 1st mort.	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & CO. Bankers and Brokers, 26 West Third Street, Cincinnati, July 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	109¾	109¾
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	108½	109
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	118	120
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	40
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	89	90
" " " Pref.	100	100,000	.....	6	.....	100	101

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	103	.....
" "	.....	50,000	J. & J.	7	July, 1894	107	.....
" "	.....	50,000	J. & J.	7	July, 1895	108½	109
" "	.....	50,000	J. & J.	7	July, 1896	110½	111½
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	106
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104½	105¾
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	116	.....
" " "	.....	300,000	J. & J.	6	Jan. 1914	107	108
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	100
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	111¼
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	112	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & CO., Bankers, 9 South Street, Baltimore, Md., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	23½	24

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	105	110—
" " " cons. mort.	1892	500,000	.....	5	.....	102½	103
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " gen. mort.	.....	1,500,000	.....	5	.....	105	.....
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	110	110½
Balt. Trac. Co., No. Balt Div	1892	1,750,000	J. & D.	...	1942	106	106¼
" " "	1891	1,250,000	M. & S.	6	1901	105	.....
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	110¾	111

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & CO., Bankers, 1344 F Street, N.W., Washington, D. C., July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	310	350
Metropolitan R. R.	50	750,000	Q. J.	...	1864	90	100
Columbia R. R.	50	400,000	Q. M.	...	1870	.....	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	33	37
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	32	.....
Georgetown & Tenallytown	50	200,000	.....	...	.....	50	.....
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	100	.....
do. do. convert.	'83-'91	3,000,000	J. & J.	6	1899-1929	120	132½
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	99	.....
Capitol & North O St. R. R.	1891	240,000	J. & J.	5	1921	103½	112
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	109	114
Anacosta R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & CO., 139 So. Fourth St. (Bullitt Building), Philadelphia, July 18.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	37	39
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	39	40
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	15	25
Newark (N. J.) Pass. Ry	100	6,000,000	.....	...	1890	29	30

BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	91	94
Buffalo (N.Y.) Ry.	1891	5,000 000	F & A	5	1931	93	97
Paterson (N. J.) Ry.	1891	850.000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry	1890	6,000 000	J & J	5	1930	89½	91

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	176	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	86½	87½
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

Financial.

THE Baltimore (Md.) Traction Co. showed as earnings in June, 1892, $65,100; in June, 1891, $57,717.

$ $ $

THE directors of the Albany (N. Y.) Railway Co. have decided to increase the capital of that company by $500,000 to $1,250,000.

$ $ $

THE Philadelphia (Pa.) Traction Co. showed total earnings in June, 1892, $364,877; in June, 1891, $332,096; increase, $32,781.

$ $ $

THE Newark (N. J.) Passenger Railway Co. report receipts for the month of June $104,440, compared with $92,495 for the same month in 1891.

$ $ $

THE Western Cable Railway Co. of St. Louis have filed a statement with the Secretary of State, increasing their capital stock from $20,000 to $200,000.

$ $ $

THE Janesville (Wis.) Street Railway Co. have filed articles with the Secretary of State of amendment to their franchise, increasing their capital from $30,000 to $50,000.

$ $ $

THE Union Railway Co. of Providence, R. I., have issued $3,000,000 in twenty year, 4 per cent., first mortgage gold bonds. The Industrial Trust Co., of Providence, is trustee.

$ $ $

THE West Philadelphia Passenger Railway Co. and the Union Passenger Railway Co. have declared the usual semi-annual dividend of $5 and $4.75 a share respectively, payable June 21.

$ $ $

THE Northern Central and the Case Avenue & Fair Grounds (St. Louis) Railway Co.'s bonds, called for July 14 and 26, will be cashed or exchanged at the office of James Campbell, St. Louis.

$ $ $

IT is stated that the Metropolitan Elevated Railroad Co., of Chicago, which proposed to build an elevated road on the West Side, have disposed of $9,000,000 of their 5 per cent. bonds.

$ $ $

THE control of the stock of the State Street Horse Railway Co., of New Haven, Conn., have been secured by a Boston company. The price paid per share for the controlling interest was $75.

$ $ $

THE gross earnings of the West End Street Railway Co., of Boston, for June, were stated to be about $600,000, or about $50,000 more than for the corresponding period last year, and $18,000 more than for August, 1891, the company's best month.

$ $ $

WHILE July is not considered as good a month for street railway travel as is June, the officials of the West End Street Railway Co., of Boston, it is said, anticipate that the gross receipts, during July, will aggregate about $580,000, against $554,431 last year.

$ $ $

THE stockholders of the Springfield (Mass.) Street Railway Co. have voted that the directors be given power to increase the capital

stock of the company from $700,000 to $1,000,000, and have petitioned the railroad commissioners for permission to carry out this plan.

$ $ $

AT a special meeting of the stockholders of the Brooklyn (N. Y.) City Railroad Co. July 26, a resolution was passed to increase the capital stock from $6,000,000 to $12,000,000. The object of the increase is to provide for the further equipment of the line with the overhead electric system.

$ $ $

AT a meeting of directors of the Toledo Electric Co. of Toledo, O., held June 30, 1892, it was unanimously resolved that a special meeting of the stockholders be held at the office of the company on August 9, 1892, to consider the advisability of increasing the capital stock to $500,000.

$ $ $

THE counsel for the receiver of the United Electric Traction Co. of Jersey City is reported as saying that the affairs of the insolvent company are being rapidly straightened out and are assuming a very satisfactory shape, and that there is every prospect that the works at Marion will be reopened this fall.

$ $ $

IT is announced that the control of the Love Electric Traction Co. has passed into the hands of an Eastern syndicate, The Love Electric Traction Co. was organized with a capital stock of $10,000,000. Of this amount $4,000,000 is retained in the treasury, and it is the outstanding $6,000,000 that has passed into the control of Eastern parties. Among the Chicagoans now interested in the Love Electric Co. are P. C. Hanford, J. G. Shortall and J. G. Wheeler.

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PFEIFFER & PRONICK,

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FOR SALE—STREET CARS.—On account of increase of business calling for larger cars, we have for sale 9 twelve-foot double-end, box cars, with fare box in each end. Gauge 4 feet 8½ inches. Apply to UNION STREET RAILWAY CO., New Bedford, Mass.

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WANTED.—Position as Manager or Superintendent of a Street Railway. Can give the best of references. Twenty years' experience. Twelve years as Superintendent in last position. Address, "W. G. H.," care of STREET RAILWAY JOURNAL, New York. 2t

WANTED.—Position as Engineer and Constructor for Power Plant with prominent Electrical Contractor or Street Railway Company desiring great economy. Over twenty-two years' practical experience. Highest references. Address, "A. J.," care STREET RAILWAY JOURNAL, New York. 1t

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☞Would purchase Entire Equipment of Road desiring to sell. Address with full particulars and price,

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15 Wall Street, NEW YORK.

THE earnings of the West Side Street Railway Co. of Chicago, Ill., for June are given as follows: In 1892, $412,693; in 1891, $369,116; increase, $43,577. It will be noticed that the gains average nearly $1,500 per day. During twenty-nine days of June the North Side of the same city showed, in 1892, $217,948; in 1891, 190,637; increase, $27,311.

$ $ $

AT a meeting of the majority of the stockholders of the Union Street Railway Co , of New Bedford, Mass., it was decided to sell their interest to James Irvine and others of New York, who will be the majority of the stockholders. The new board of officers is as follows, the old board having resigned: President, James Irvine ; treasurer, Edward S. Brown ; secretary, Wm. H. Allen ; acting manager, Moritmer McCarthy. The directors are: James Irvine, Ex-governor Waller, J. A. Beauvais, Chas. H. Cifford, Abbott P. Smith, Chas. E. Cook, James E. Dwight.

$ $ $

THE San Francisco *Examiner*, in a recent issue, outlines a plan of consolidation which, it is stated, will soon be adopted by the electric and cable roads of Los Angeles. The property of the electric company and first mortgage bonds of the cable company, amounting in the aggregate to more than $3,000,000, are to be transferred to John McKee of Pallant & Co., bankers, and B. F. Dorn, of the law firm of Dorn & Dorn, and new bonds and stock will be issued. The president of the new company, it is said, will be Gen. M. H. Sherman of Los Angeles, and the secretary, Frank B. McDonald of San Francisco.

$ $ $

THE Baltimore stock exchange has received application from the Traction company to list the 5 per cent. bonds of the North Baltimore division and the extension and improvement 6 per cent. bonds. The statement filed with the application contains some interesting figures, showing the prosperity of the company. Their total receipts for the year ending April 30, were $665,920. After deducting operating and general expenses, a surplus remained of $135,452, or over 20 per cent. of receipts. The net earnings of last June were nearly 40 per cent. of receipts. The Traction company's daily receipts are said to be some $3,000.

$ $ $

WEST Chicago Street Railway stock sold on July 19 up to 186½ and North Chicago Street Railway stock advanced to 226, breaking all previous records. The advance is said to have been due to large purchases by Eastern capitalists. Commenting on this rise, a Chicago paper says: "One of the most frequent arguments that are heard advanced by the bulls on these street railway properties is that this increase will go almost wholly into net earnings. They say that it costs about so much to operate the road anyway, and if the receipts can be increased $1,000 a day the net earnings will be increased almost an equal amount. The statistics of street railway operations in Chicago by no means bear out that view. The South Side line ought to furnish a fair illustration of the cheapening of the cost of carrying passengers, for the lines have been practically completed for some time, and the traffic rapidly increasing. The South Side company carried, in 1890, 68,734,000 passengers. The expenses of operation were $2,297,651. This makes the average cost of carrying a passenger 3.34 cents. In 1891 the traffic increased to 77,463,000 and the expenses to $2,534,315. This made the average cost per passenger 3.27 cents. While the traffic increased nearly 9,000,000 passengers the cost per passenger decreased only 7-10 of a mill. In the case of the North Side company the average cost per passenger in 1890 was 2.79 cents, and in 1891 2.75 cents. The traffic in 1891 increased nearly 5,000,000 passengers, but the cost of carrying each passenger decreased only 4-10 of a mill. It cost the West Side company in 1890 2.93 cents and in 1891 2.88 cents. The traffic had increased over 10,000,000 passengers, but the cost per passenger decreased only half a mill. These statistics hardly coincide with the view that the present increase in traffic is to result in nearly a like increase in net earnings."

Great Railroad Traveling.

"I happened to take the 10:30 A. M. train the other day, from Chicago, on the Lake Shore and N. Y. Central, and thought the entire trip would be a bore," said Geo. W. Lederer to a DRAMATIC TIMES reporter. "But imagine my surprise, when I found upon entering the train, a *fac-simile* of their famous Chicago limited, and positively the same comfort, convenience and equipment which I have so often enjoyed on the latter. I arrived in New York City at 2:10 the next day, the train being on time to the minute, and had sufficient time left that day to transact a great deal of very important business. I shall return again to Chicago on the very same train, as it leaves here at 1.55 P. M., and gives me a good half day to settle up my unfinished business."—*New York Dramatic Times.*

The 10:30 A. M. train to which Mr. Lederer refers, is the popular "Chicago and Boston Special," the latest addition to the train service of the Lake Shore & Michigan Southern R'y. The equipment, which is of Wagner build, consists of two Vestibule Sleeping Cars, one Vestibule Buffet Smoking and Library Car, running through to Boston, arriving at 3:40 P. M. next day; one Vestibule Sleeper through to New York, arriving at 2:10 P. M.; a vestibule Dining Car, Chicago to Cleveland, and Utica to Boston, and day Coach, Chicago to Buffalo, and Buffalo to Boston.

The train leaves daily from Van Buren Street Station at the hour named above, and is the greatest favorite with business men and tourists, as by it not only are the cities on the B. & A. R. R. reached early in the afternoon, but the Atlantic Coast resorts are reached before dark.

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THE STREET RAILWAY JOURNAL

Vol. VIII. *NEW YORK & CHICAGO, SEPTEMBER.* *No. 9.*

The Annual Convention of the New York State Street Railway Association.

The tenth annual meeting of the Street Railway Association of the State of New York will be held at the United States Hotel, Saratoga Springs, on Tuesday, September 20, at 10 A. M. As already stated, there will be two papers presented to the Association, entitled "Recent Improvements in Cable Traction," by Geo. W. McNulty, engineer of the Broadway & Seventh Avenue Railroad Co., New York, and "Recent Improvements in Electric Traction," by L. H. McIntire, engneer of the Union Railway Co., New York. These papers will undoubtedly be followed by a very interesting discussion on these subjects by the gentlemen present. It is hoped that an unusually large delegation will attend the meeting.

We take pleasure in presenting the portrait of Mr. John N. Beckley, president of the Association for the current year, with a brief sketch of his life. Mr. Beckley was born in Orleans County, December 30, 1848. He received his education at the Genesee Wesleyan Seminary and Genesee College at Lima, N. Y. Choosing law as a profession, he was admitted to the bar in June, 1875, at Batavia, N. Y., where he practised for two years. In 1877 he removed to Rochester, N. Y., and was appointed city attorney of Rochester in 1882, and reappointed twice to that office, first in May, 1884, and again in May, 1886. In June of the latter year Mr. Beckley resigned the office of city attorney and entered the law firm of Bacon, Briggs & Beckley with which he has since been connected. The firm has since been increased by the addition of C. J. Bissell, and is now Bacon, Briggs, Beckley & Bissell.



JOHN N. BECKLEY.

PRESIDENT OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION.

Mr. Beckley was instrumental in the organization of the South Park Street Railway Co., of Rochester, and the Crosstown Street Railway Co., of Rochester, and aided in the organization of the syndicate which purchased all the street railway interests of Rochester and vicinity in 1890. He was appointed secretary of the Rochester City & Brighton Railroad Co. in November, 1890, and held that office until the organization of the Rochester Railway Co., which last named company took over all the street railway companies mentioned above. The first year of the organization of the Rochester Railway Co., Mr. Beckley was vice-president and secretary, and succeeded in the following year to the office of president of that company, which position he now holds.

Mr. Beckley is also largely interested in street railway affairs of other cities, where his administration, as in Rochester, has been marked with great executive ability and foresight. The paper read by him at the last meeting of the New York Street Railway Association on "Electric Motive Power for Street Railways," shows that he is an enthusiastic advocate of the use of the electric system for street railway purposes, and his company being one of the first in New York to adopt electric power on a large scale, the street railway fraternity owe a debt to Mr. Beckley for the exposition of the fact that the electric railway can be made commercially successful under the conditions imposed in large cities.

Electric Progress in Chicago.

The plans for the electrical equipment of the South Chicago City Railway Co. have been decided upon, and are as follows: The road will be twelve miles long, all double track, and a seventy five pound Wharton girder rail will be used throughout. About three-fourths of the track is now laid, and work on the remainder is being pushed rapidly forward. The power house, for which the ground was broken August 8, is located very near to the centre of the system and on the Calumet River. The building is to be of brick, 180 ft. deep by 100 ft. front. The car house will also be of brick, and will be 270 × 73 ft. The equipment of the power house includes three 22 × 48 Allis-Corliss condensing engines belted direct to 200 K. W., Edison, bipolar generators. The boiler room will contain three Stirling water tube boilers, each fitted with a Stilwell & Bierce live steam purifier.

The car equipment will consist of twenty-five eighteen foot, closed car bodies, made by the St. Louis Car Co., and mounted upon McGuire pressed steel trucks, each having a seven foot wheel base. Each of the cars will be equipped with two twenty horse power, Westinghouse, single reduction motors. The number of cars will probably be increased by fifty in the spring.

The Washington & Georgetown Railroad Co.'s System Completed.

On August 6, last, just two years from the date of the passage of an act by Congress requiring that within two years the two principal railway companies in the city of Washington equip their lines for mechanical traction, the first cable train was run over the Pennsylvania Avenue division of the Washington & Georgetown company's system. Within a week twenty trains were running, and before this paper reaches our readers all the horses will have been withdrawn and the entire system, embracing twenty-two miles of track, will be operating by cable. The company, and especially its president, Mr. Henry Hurt, the engineers and contractors are to be congratulated on having completed their Herculean task on time and in so creditable a manner. All parties engaged in the work must certainly experience a thrill of satisfaction in having been the agents for the construction of such an admirable system.

The accompanying diagram (Fig. 1) gives an excellent illustration of the relation of the different lines, embracing the system and their location with reference to the public buildings. The Seventh Street line (seven miles), it will be remembered, has been in operation about two and a half years, and it was the success had with this line that determined the company to cable the entire system. The new construction, therefore, embraces fifteen miles, and, as above stated, has been completed within the last two years.

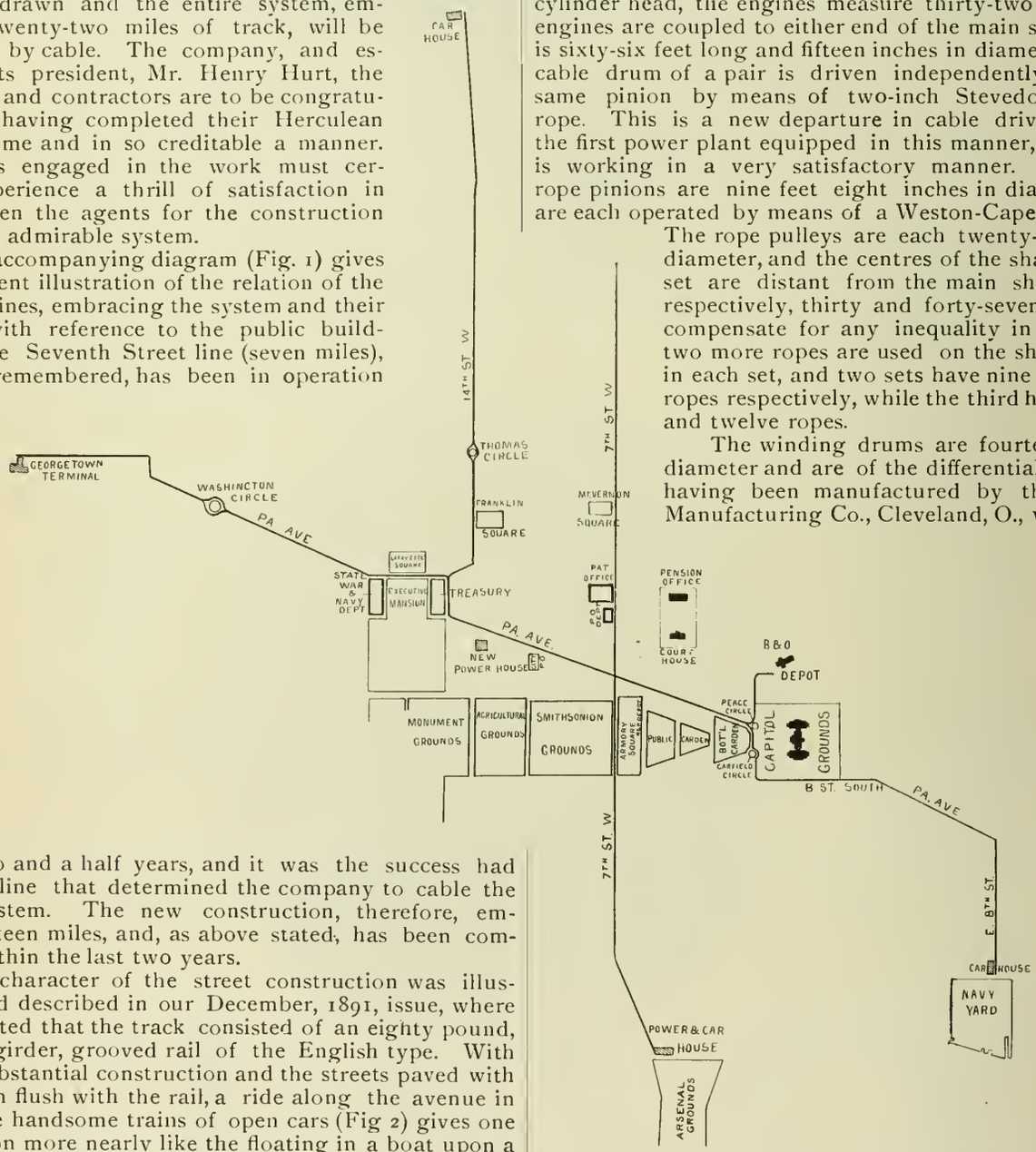


FIG. 1.—CABLE SYSTEM OF THE WASHINGTON & GEORGETOWN RAILWAY CO.

The character of the street construction was illustrated and described in our December, 1891, issue, where it was stated that the track consisted of an eighty pound, Johnson girder, grooved rail of the English type. With such a substantial construction and the streets paved with asphaltum flush with the rail, a ride along the avenue in one of the handsome trains of open cars (Fig 2) gives one a sensation more nearly like the floating in a boat upon a placid lake than we remember to have found on any other line.

The power house, which is to operate the new lines, and which we have before illustrated, is a handsome six story brick and iron structure, 190 × 240 ft. and 100 ft. high, on ground occupying an entire block facing on D Street a short distance from the avenue. The power house occupies the rear of the ground floor, and the company's offices, the first two floors, front to the right of the main entrance. The upper stories will be leased for manufacturing purposes. The building is constructed with a large open court above the first floor which is roofed with skylights, thus admitting light to the tension and engine rooms. The engine and driving drums (Fig. 3) occupy a large, high, light and airy room handsomely finished, being ceiled overhead with Georgia pine, and the side walls wainscoted to a height of five feet with the same material, but above finished with white Keen cement. The floor is of white maple in narrow strips, and the iron columns are to be encased in terra cotta, terminating in a handsome capital of the same material and protected for about four feet above the floor by a bronze base. On one side opening out from the company's offices is a visitors' gallery, having swelled fronts or bays, and ornamented with a wrought iron guard with a brass railing.

The two engines are of the Reynolds-Corliss type, 750 H. P. each, with 36 × 72 in. cylinders, and were manufactured by the E. P. Allis Co., of Milwaukee, Wis. From the centre of the crank shaft to the rear end of the cylinder head, the engines measure thirty-two feet. The engines are coupled to either end of the main shaft which is sixty-six feet long and fifteen inches in diameter. Each cable drum of a pair is driven independently from the same pinion by means of two-inch Stevedore manilla rope. This is a new departure in cable driving, being the first power plant equipped in this manner, and so far is working in a very satisfactory manner. The three rope pinions are nine feet eight inches in diameter, and are each operated by means of a Weston-Caperon clutch. The rope pulleys are each twenty-six feet in diameter, and the centres of the shaft of each set are distant from the main shaft centre, respectively, thirty and forty-seven feet. To compensate for any inequality in the drive, two more ropes are used on the short centres in each set, and two sets have nine and seven ropes respectively, while the third has fourteen and twelve ropes.

The winding drums are fourteen feet in diameter and are of the differential ring type, having been manufactured by the Walker Manufacturing Co., Cleveland, O., which company also manufactured the tension carriages and elevating sheaves and frames. There are three sets of winding drums, each making 18.56 revolutions per minute and giving to the ropes a speed of nine miles per hour. The three ropes are of the following length: That on the Navy Yard division, 31,435 ft.; the one on Fourteenth Street, 27,699 ft., and the Georgetown division 23,468 ft. There is also a fourth rope, 3,822 ft. in length, which operates a branch line to the Baltimore & Ohio Depot, and which is driven by a set of auxiliary machinery located in a pit at the foot of the avenue near the Peace Monument, and operated by power transmitted from the Navy Yard or New York Avenue rope.

Fig. 4 is a plan of the auxiliary drive, from which it will be noted that the return rope from the Navy Yard

passes around a large sheave to the left, then back and around a horizontal driving sheave, having upon its axle a smaller two grooved winding drum, by means of which the auxiliary rope is moved at a slower speed. The auxiliary rope also passes over a one grooved idler, and from the drivers to a tension carriage (Fig. 5) anchored by a heavy spiral spring and located in a second pit beneath the track some distance along the avenue, but connected with the first by a low tunnel. Two of the ropes were manufactured by the John A. Roebling's Sons Co., one of them being of the Lang lay type, the other made by the Broderick & Bascom Co., St. Louis. The ropes from the power plant are led out on the Fourteenth Street side, where they are deflected around twelve foot sheaves mounted in U frames along the street to a second pit located at the avenue. Both west bound ropes are deflected towards Fifteenth Street and pass the Treasury Building, where they separate, one going to Georgetown the other out Fifteenth Street. The lines, it will be noted from Fig. 1, have a large number of curves, there being about 5,200 ft. of curve construction; but all the curves are of compound type with the smallest radius not less than sixty feet.

The curve pulleys (Figs. 6 and 7) are two feet in diameter and have no bottom flange, the rope being held in place by carrying pulleys placed between the curve pulleys. They are mounted in adjustable frames, their position with reference to the slot being regulated by set screws. The wheels turn on a fixed spindle which is provided with a gun metal washer on which they rest. The bearings are lined with babbit, and the spindle has an oil passage drilled as shown, with an oil cup attached to the top.

The carrying pulleys are of cast iron with a chilled face, and are about fourteen inches in diameter. The arms are cast very dishing to prevent shrinkage checks. They are pressed on a plain steel spindle and mounted in self-centering babbit bearings enclosed in a grease cup with a leather lined cover. The box contains a wooden thrust block and dust collar. This type of sheave has been adopted in preference to the wrought iron arm pulleys used on the Seventh Street line. The wrought spokes frequently became loosened and rendered the sheave unserviceable.

The boilers are eight in number and arranged in two batteries, one of which is shown in Fig. 8 and are each 184 H. P., and were manufactured by the Babcock & Wilcox Co. The same type of boilers is employed in the Seventh Street station and they have given excellent satisfaction. The boilers are equipped with the Roney mechanical furnaces which are operated by a Westinghouse compound engine, and which were installed by Westinghouse, Church, Kerr & Co., of New York, who also supplied the separator or steam loop in the vertical steam pipe above the engine shown in Fig. 3. The coal is elevated to storage bins and is delivered by gravity to the furnaces. The cinders are drawn directly into a tram car located beneath the boiler room floor, and are then elevated and run out into wagons. The additional steam equipment consists of an 200 H. P. Berryman heater, two Deane duplex feed pumps, while all pipes are provided with Chapman valves of the latest patern.

The tension carriages (Figs. 9 and 10) have several novel features. The reel mechanism or winch of the carriage proper is provided with a rope drum in place of a hand crank, upon which several turns of one inch manilla rope are wound. The end of this rope, being made to wrap a capstan on the end of the revolving shaft, which transmits power to winch reel and hauls the carriage back, thus taking up the stretch of the rope. The tension weight is hung by means of a second carriage and anchorage as shown in Fig. 10. This method of attaching the tension weight was devised and patented by Mr. W. B. Upton, chief engineer of the company, and has been working for some time at the Seventh Street power house in a very satisfactory manner. From the illustration it will be seen that the weight is graduated automatically according to the strain on the rope, two carriages being connected by wire ropes.



FIG. 2.—CABLE TRAIN ON PENNSYLVANIA AVENUE, PASSING THE WHITE HOUSE.

In addition to the power equipment for working the lines, there has been installed another 250 H. P. Reynolds-Corliss engine for supplying power to the tenants. Rope belts will be employed for transmitting power to the different floors, which will operate in a vertical shaft directly above the driving drum which has grooves for forty-eight three-quarter inch ropes, the intention being to lead a set of ropes out at each floor according to the power required.

Another novel feature about the power house is the drainage system. The basement floor being located, as we have noted in former articles, below tide water and several feet below the city sewers, some means of getting rid of the seepage water was necessary. Accordingly a number of iron tanks were sunk, to which sub-drain pipes were led and which deliver all the water to the tanks, from which it is lifted and discharged into the sewers by means of Shone pneumatic ejectors, manufactured by Hughes & Lancaster, Chester, Pa. The compressed air for operating the ejectors is provided by a small air compressor located near the engine room. The sanitary pipes of the building lead directly into the sewers, so that only the surface water reaches the seepage tanks.

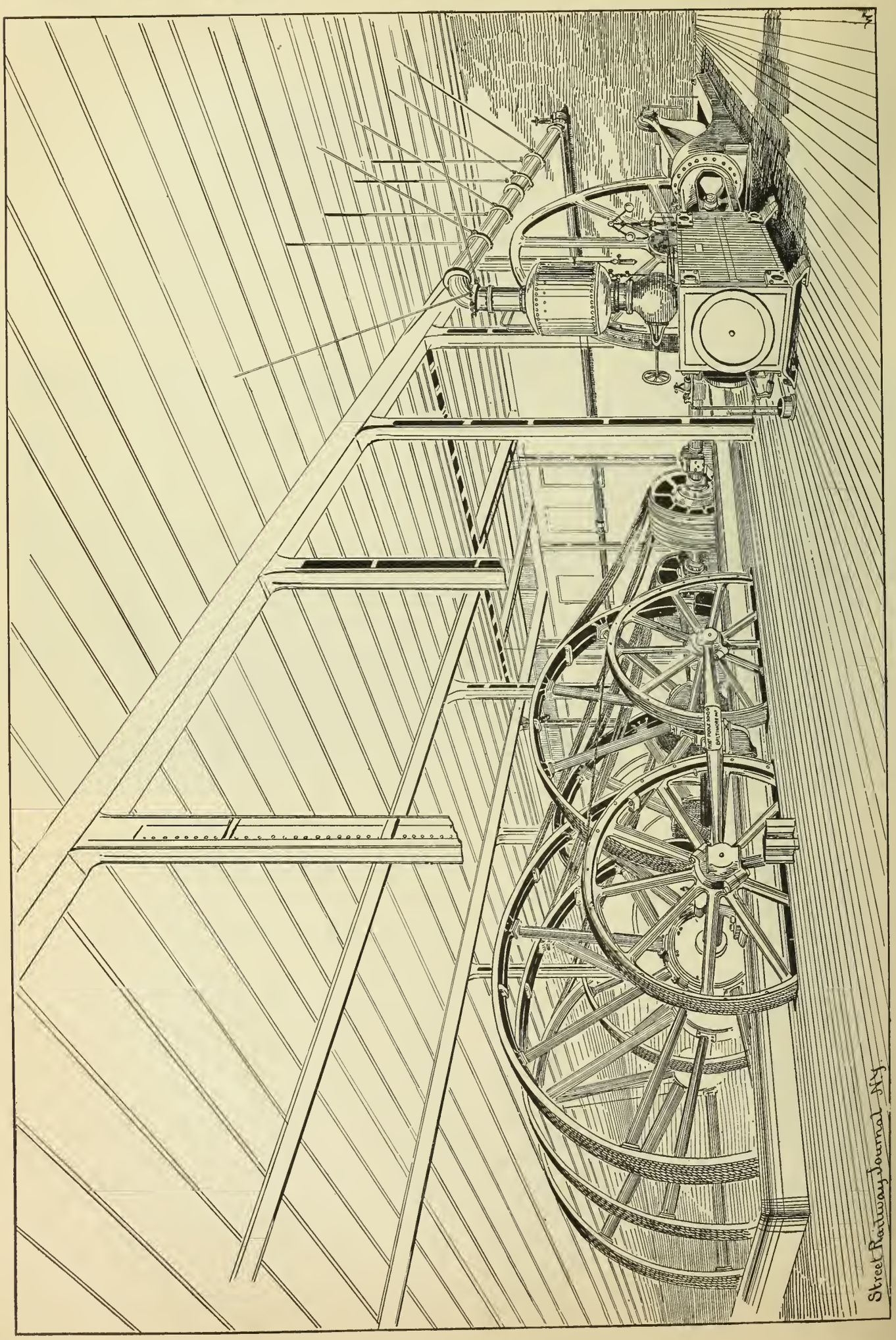


FIG. 3.—NEW CABLE POWER PLANT—WASHINGTON & GEORGETOWN RAILWAY CO.

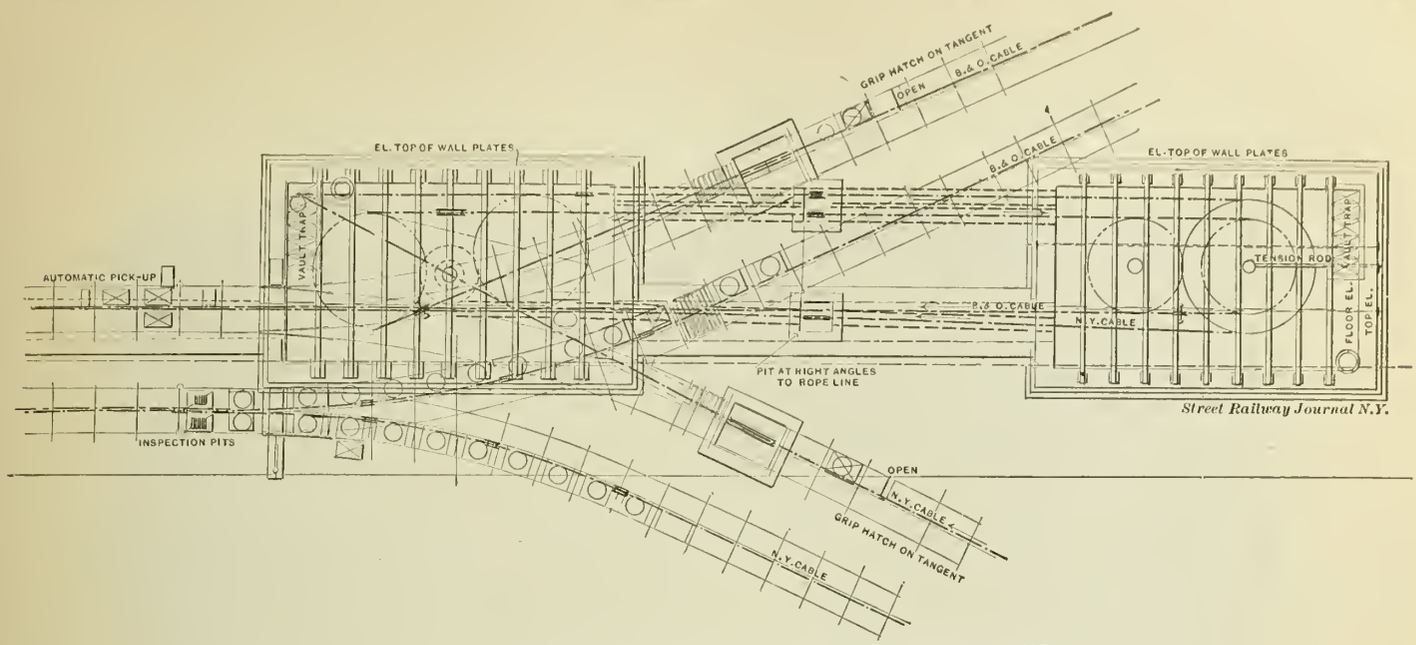


FIG. 4.—AUXILIARY ROPE DRIVE—FOOT OF PENNSYLVANIA AVENUE.

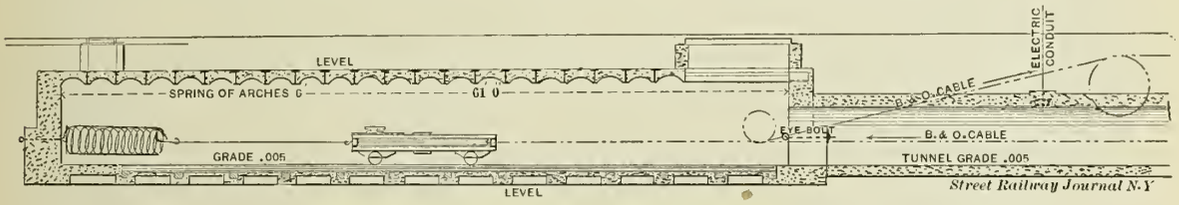


FIG. 5.—TENSION CAR TO AUXILIARY DRIVE IN PIT.

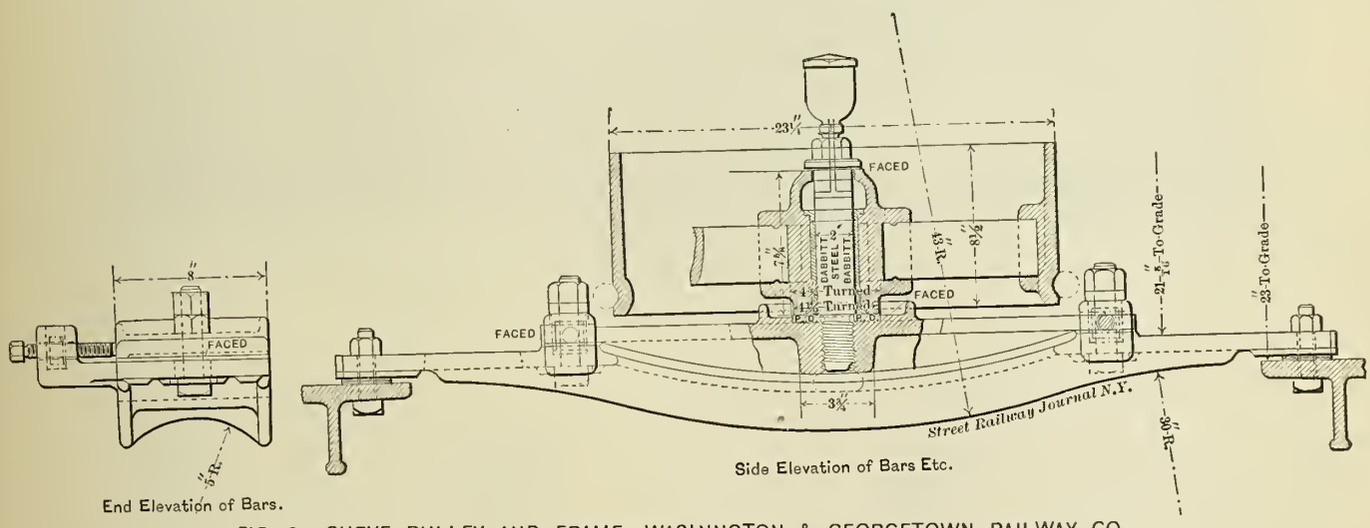


FIG. 6.—CURVE PULLEY AND FRAME—WASHINGTON & GEORGETOWN RAILWAY CO.

The new car equipment of the line consists of seventy grip cars, manufactured by the John Stephenson Co., Ltd., and 180 twenty-two foot open cars, manufactured by the American Car Co., of St. Louis. Contracts have also been let for ninety-two box cars. All the cars are equipped with the Baltimore running gear, furnished by the Baltimore Car Wheel Co., and the grip cars are provided with track brakes. That these cars are a credit to the manufacturers as the train illustrated in Fig 2 will show. The California or Root type of grip is employed, with certain improvements and modifications. Fifty trains of twe or three cars will be run according to the demands of traffic. A three minute headway is maintained on the Georgetown and Fourteenth Street divisions, and as all trains run on the avenue this will give a minute and a half service on this line to the Peace Monument, where the trains again divide and go a part to the Navy Yard and a part to the Baltimore & Ohio Depot.

Fig. 11. illustrates the crossover switch at the Georgetown terminal. There being a slight grade to the west the grip drops the trailers as it approaches the first

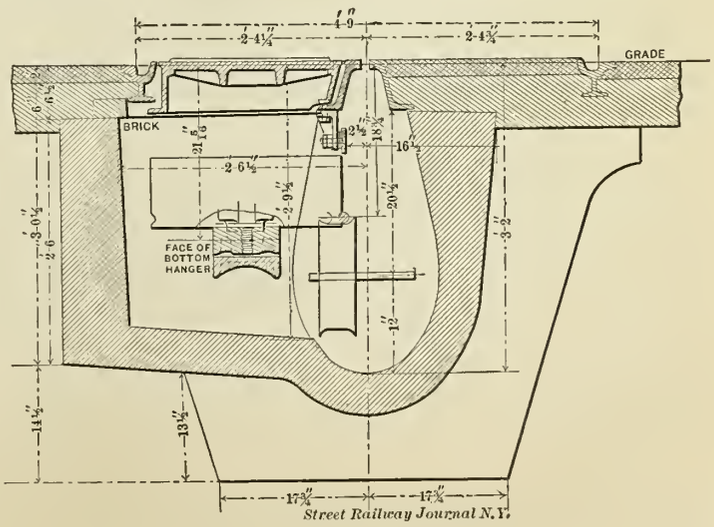


FIG. 7.—CURVE PULLEY AND YOKE.

switch and passes along on the straight track to a point between the two crossovers. The train is then run by gravity over the surface crossover, the grip car takes the cable for a short distance and shunts over and couples to the other end of the train and starts out on the straight track. This arrangement requires but one grip car at the

The chief engineer of the company, Mr. W. B. Upton, of Kansas City, designed all the plans of the road, and has frequently been on the ground to watch the construction and in consultation with Mr. D. Bontecou, the consulting engineer of the company, of Kansas City, but the execution of the work has been mainly under the direction of

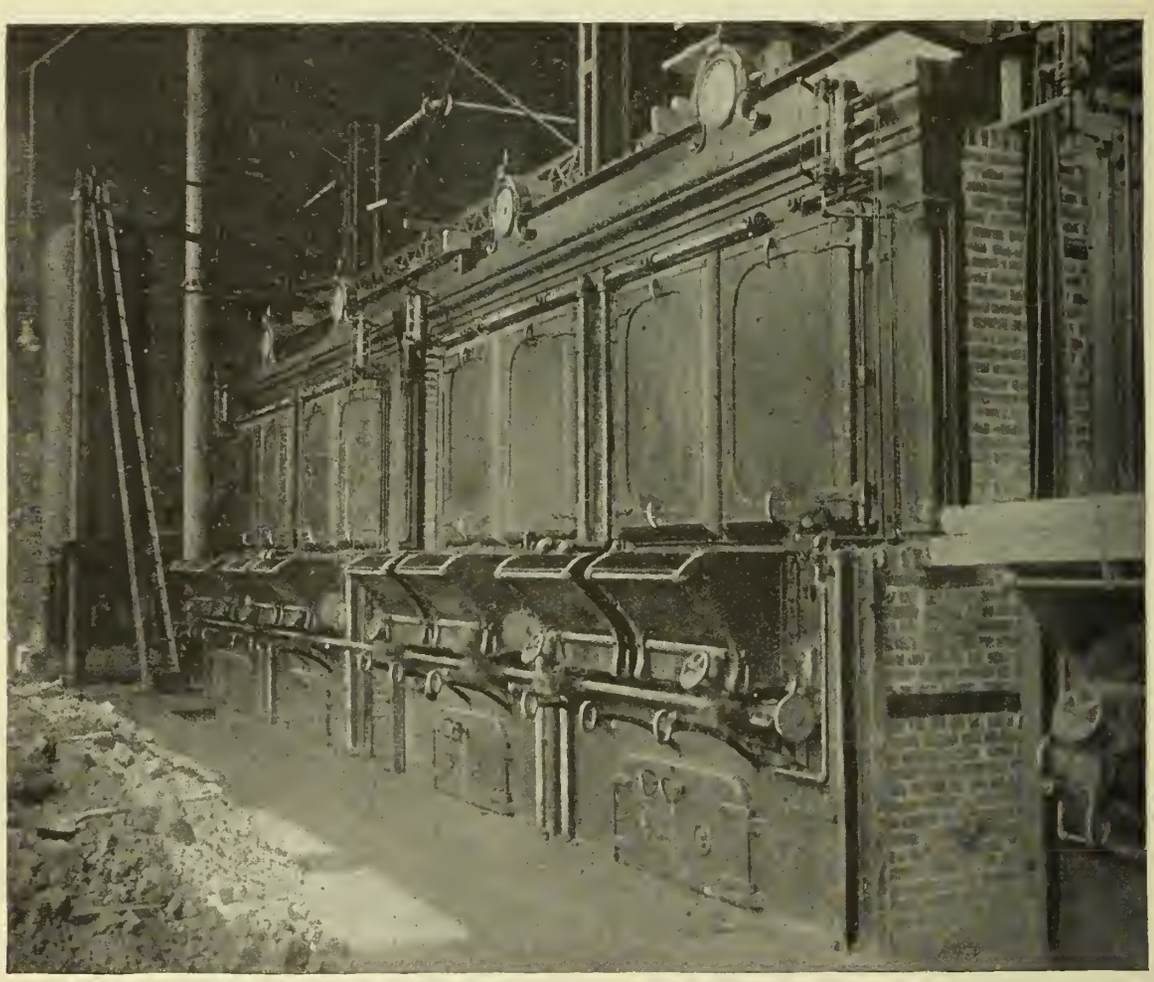


FIG. 8.—HALF VIEW OF BOILER ROOM, CABLE POWER PLANT—WASHINGTON & GEORGETOWN RAILWAY CO.

terminals, and an extra grip is not kept in waiting as on the Seventh Street line.

The ordinary gypsy pickups are provided at the terminal switches, but at the crossing at Seventh Street and at the branch switches the rope is automatically replaced in the grip by a new gypsy recently devised by the chief engineer and which is working very satisfactorily.

Nearly all the special iron work required in the construction of the line has been gotten out in the company's own shops. One of the old stables near the foot of Seventh Street was converted into a machine shop and equipped with steam power and a complement of iron working tools. With this equipment the switches and crossings have been gotten out, the carrying and curve pulleys bored, frames drilled and fitted, and the grips (over 150) made.

Besides the power house above described, the new equipment includes two commodious car barns, one near the Navy Yard terminal, with a capacity for 150 cars, and one at Mount Pleasant near the Fifteenth Street terminal, having a capacity for 300 cars, which we have before illustrated. These buildings are handsome brick structures and are provided with all modern conveniences, including a steam equipment for operating the car elevators and electric light plants. The receiver's room, waiting room, conductors' and drivers' rooms are nicely furnished and provided with lockers and elaborate sanitary arrangements.

The entire cost of the system, including the buildings, has been about $3,500,000. Exclusive of the buildings and rolling stock, the lines have cost about $100,000 per mile of double track.

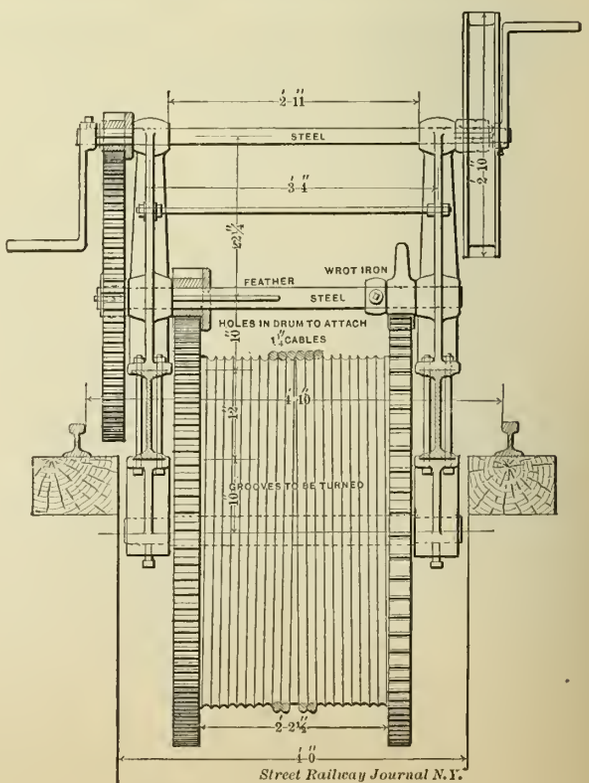


FIG. 9.—TENSION CARRIAGE REEL.

Mr. David S. Carll, to whom and to the contractor, Mr. E. Saxton, great credit is due for the substantial character of the work and the successful manner in which the lines are operating. Mr. Walter C. Root, of Kansas City, was the architect of all the buildings.

The contractors for material and work, other than those already named, were The Chapman Iron Co., of Kenton O., iron work on power house; Pennock Bros., of Philadelphia, general contractors of power house; Pullman, of Kansas City, power house foundations; C. W. Hunt Co., New York, manilla rope belts; Steadman Foundry, Aurora, Ind., carrying pulleys and boxes; Chester Steel Castings Co., Chester, Pa., grip castings; General Electric Co., all the lighting; Smith & Vaile Co., Dayton, O., yokes, etc.; J. L. Parsons, Washington, D. C., contractor Mt. Pleasant car house; S. H. & P. F. Adams, Navy Yard car house; Thos. C. Bosshor, of Baltimore, steam heating.

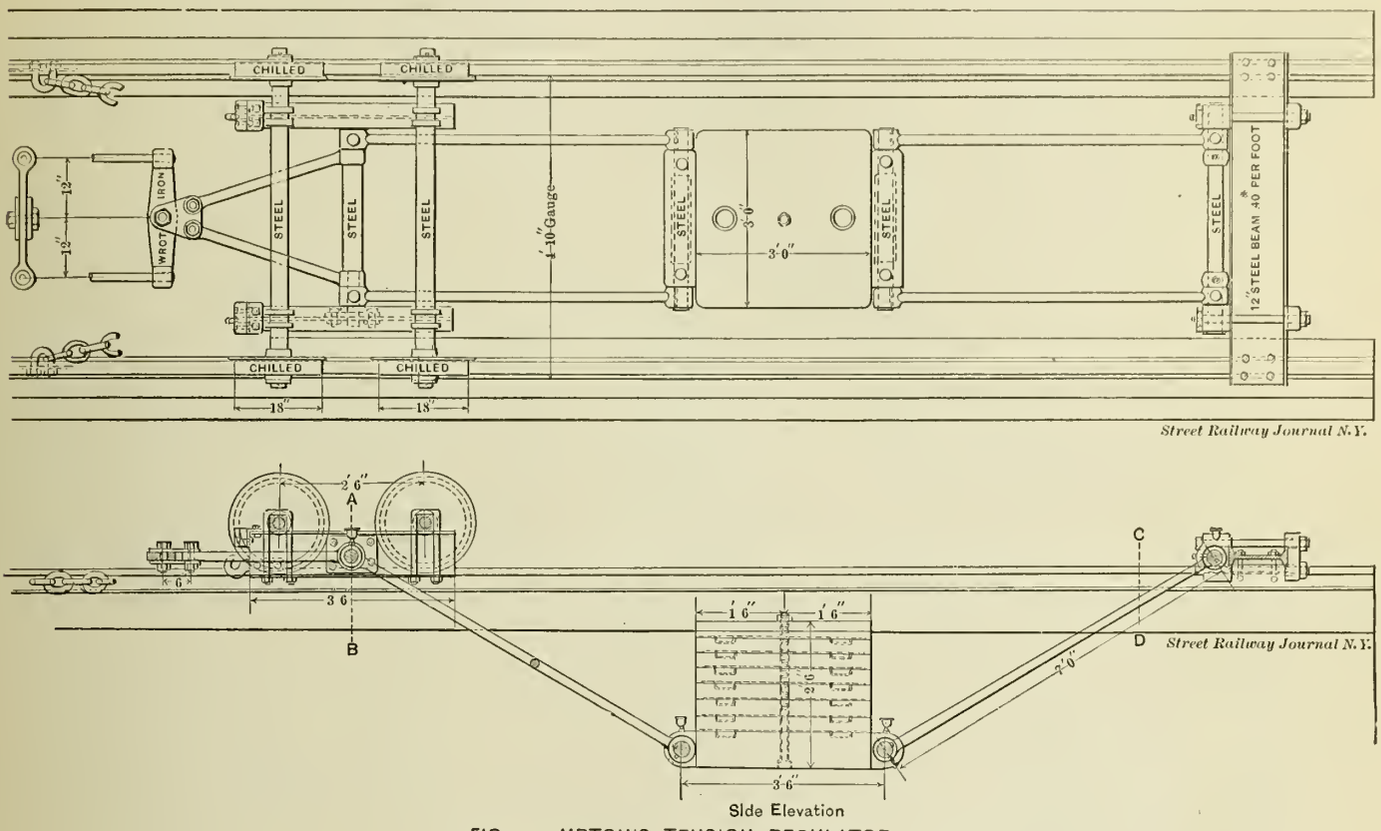


FIG. 10.—UPTON'S TENSION REGULATOR.

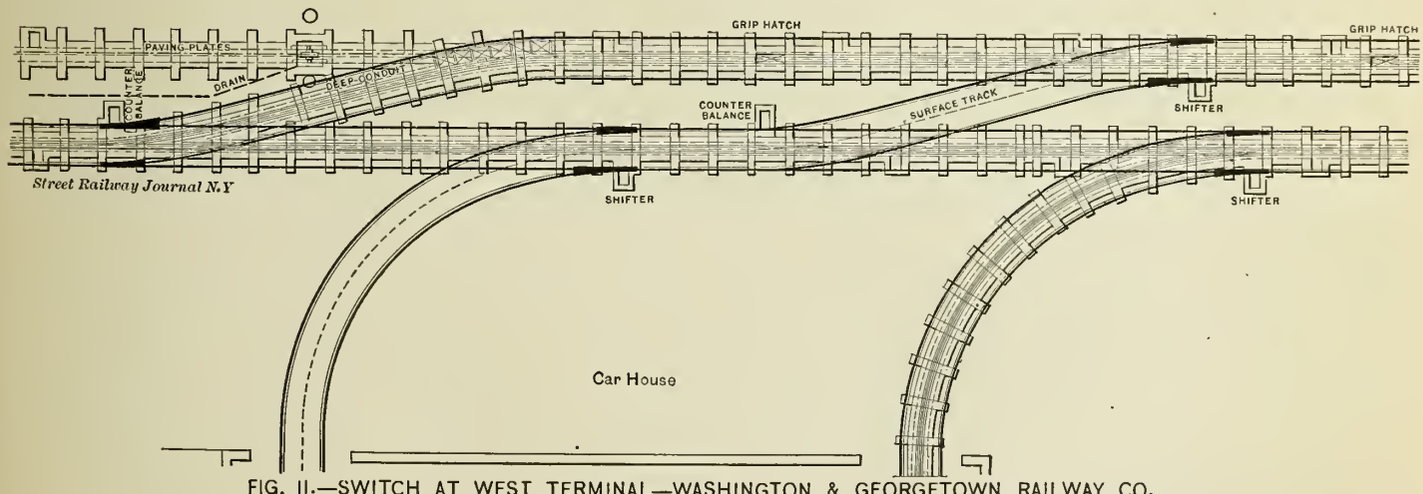


FIG. 11.—SWITCH AT WEST TERMINAL—WASHINGTON & GEORGETOWN RAILWAY CO.

South Side Elevated Road, Chicago.

It has been said of the Alley L road in Chicago, that it starts from nowhere and does not go anywhere. There is truth in the statement. The fact that the line stops considerably south of the business centre is a decided detriment; still the road is doing a good business. At the present time the officers are planning for a loop terminal. W. W. Gurley, the attorney of the company, states that the line will probably go north on Wabash Avenue as far as Madison Street or Randolph, returning by way of Dearborn or Clark Streets to Congress Street and joining the main line, and that the plan of supporting two tracks on a single line of supports will be adopted. These supports will be placed between the present street car tracks. Plans are now under consideration and a move in this direction will be taken in the near future.

The road, up to August 15, had been operated only as far south as Thirty-ninth Street. On that day the extension to Forty-seventh Street was included in the regular line. The structure willl soon reach Fifty-first Street, at which point Washington Park begins.

THE People's Electric Street Railway of Beaver, Pa. was put in operation August 13, with appropriate ceremonies. The road is equipped with Thomson-Houston W. P. motors. The cars are carrying a large number of passengers.

THE Haverhill (Mass.) & Amesbury Street Railway Co. have decided to issue bonds to the extent of $300,000.

Central Power Station, West End Street Railway Co., Boston.

The first half of this mammoth plant, which has been three years in building and which we illustrated in our January, 1890, issue, is now completed and is in daily operation. The ultimate steam capacity of the plant is to be 26,000 H. P., of which 12,000 H. P. is now installed. The original plans of the company provided for equipping this station with fine machinery better adapted to railway purposes than that of any other line in the world, and that they have succeeded the accompanying engravings show.

Fig. 1 illustrates half of a cross section of the building and shows the relative position of engines and generators, while Fig. 2 shows very accurately the position of the three cylinders and other details of the triple cross

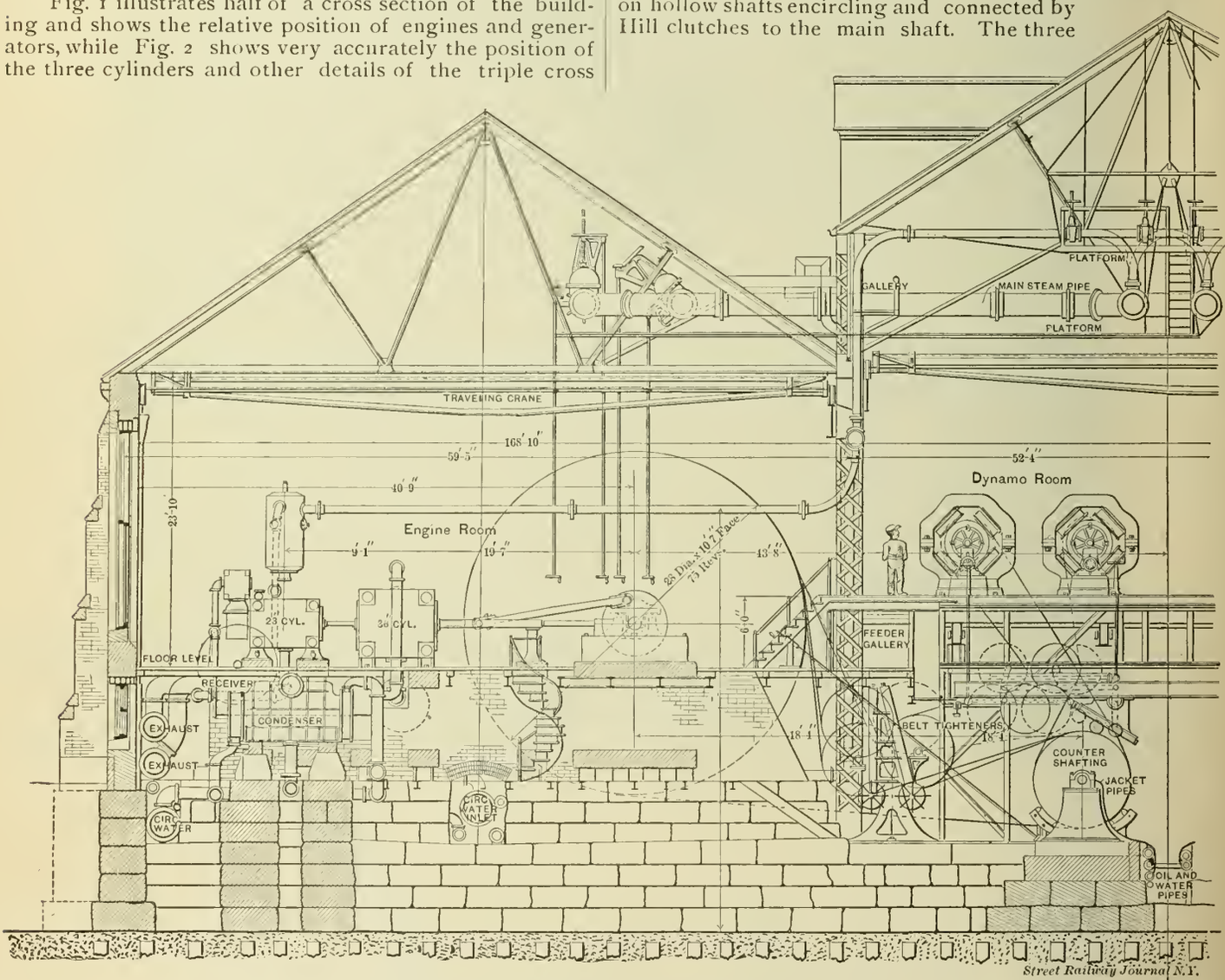


FIG. 1.—HALF CROSS SECTION, CENTRAL POWER STATION—WEST END STREET RAILWAY.

compound engines, of which there are six in place, three on each side of the main floor.

The engines and shafting were manufactured after specifications and plans furnished by the engineers of the West End company, the engines being designed by Mr. Edwin Reynolds, superintendent of the E. P. Allis Co., who were the contractors for the entire machine work at the station, including shafting and appurtenances. The dimensions of the three cylinders of the engine are, respectively, 23, 36 and 52 × 48 in. stroke, and the steam pressure of each is 160, 35 and 5 lbs. The piston of the tandem cylinders is coupled to one end of the crank shaft, and that of the third cylinder to the other end, and the speed is from seventy to seventy-two revolutions per minute. These engines were designed to develop 1,000 H. P. under the most economical conditions and to work up to 2,000 H P. as a maximum. The builders guaranteed the steam consumption per hour, under a load of 1,000 H. P., should not exceed thirteen pounds per horse power, and careful tests show it to be less than this amount.

The condensing pumps are shown on the left of the engraving, but the condensers are beneath the floor. The flywheels are each twenty-eight feet in diameter, with a ten foot seven inch face, and weigh eighty tons. Each engine is coupled to a countershaft by means of two belts, fifty-four inches wide and about 150 ft. in length.

A very complete system of belt tighteners, with adjusting mechanism is provided both for the engine and generator belts (Figs. 3, and 5), the large tightener and pulleys being six feet in diameter. The countershafts, which are located on each side of the sub-gallery are 120 ft. long, in three sections of forty feet for each engine, and nine inches in diameter. The driven and driving pulleys are eight feet in diameter, and the former are mounted on hollow shafts encircling and connected by Hill clutches to the main shaft. The three lengths of shafting are connected together by similar clutches, all of which are operated from the floor of the engine room by means of a long shaft and hand wheel set at an angle as shown in Fig. 4. The drivers are coupled by means of thirty-inch belts to the 500 H. P., Thomson-Houston, M. P. generators which are located directly above the shafting on an iron platform constructed of heavy plate girders and channel iron posts. A portion of the station was equipped temporarily with 100 H. P. generators, but as soon as the larger generators are completed they will be substituted as shown in the figure. These generators were manufactured after specifications furnished by the engineers of the West End company, and are operating in a very satisfactory manner.

The water tube boilers are of the well known Babcock & Wilcox type, and are arranged on each side of the boiler room as illustrated in Fig. 6. Those on the right are already in place and consist of six batteries of 500 H. P. each. The left line is being erected and will ultimately supply the steam for operating the other seven engines. The arrangement of the steam domes and piping is shown in the left of the engraving. The steam pipes and mains

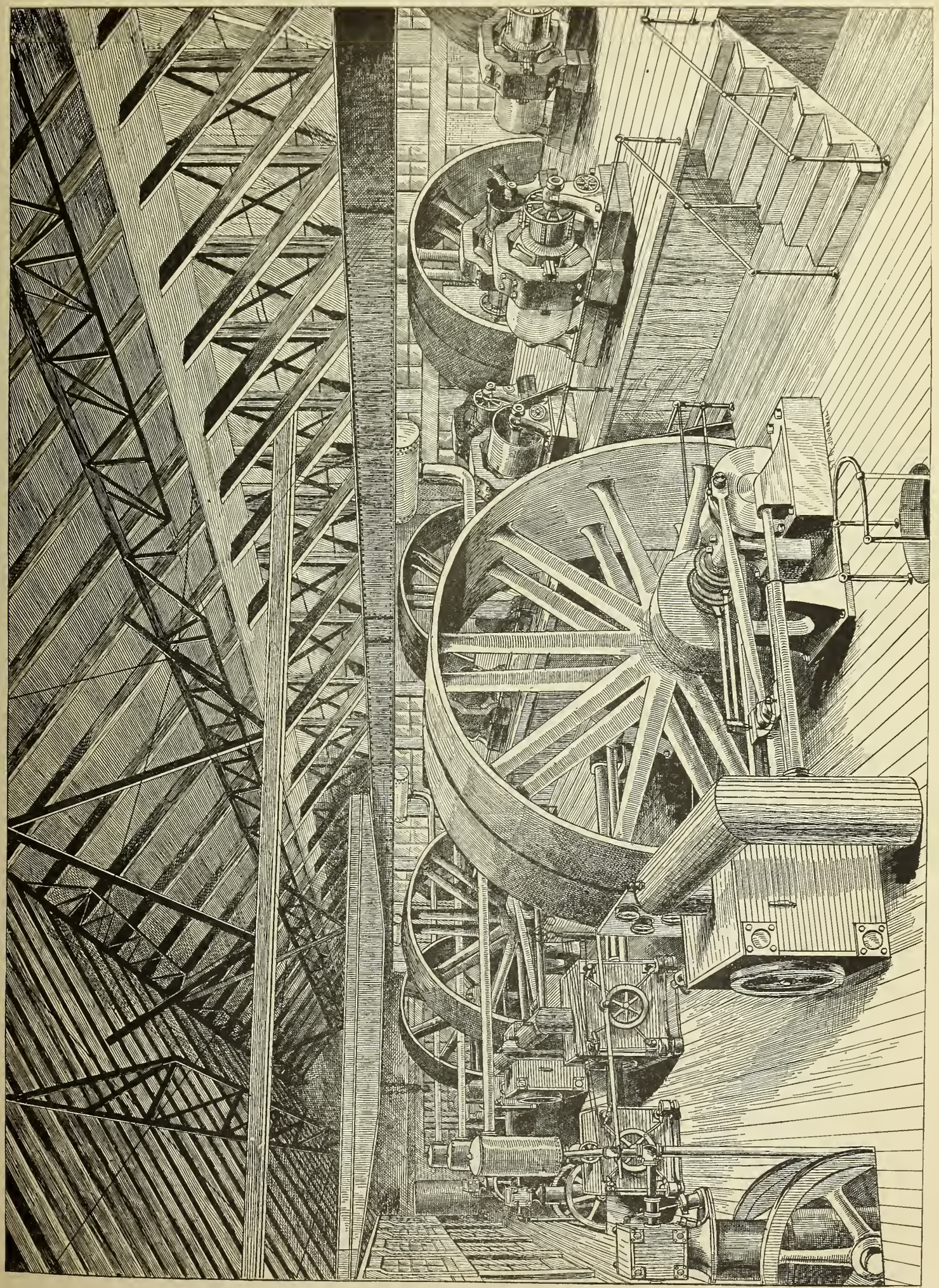


FIG. 2.—SIX 1,000 H. P. TRIPLE EXPANSION ENGINES—CENTRAL POWER STATION, WEST END STREET RAILWAY.

leading to the engines are in duplicate throughout, and the mains are led along near the roof over the generator floor (Fig. 1), from which the connections to each engine curve down, and pass under the truss to the high pressure cylinder, a separator being located in each at the point of entering the engine room proper.

The mammoth condensers are of the Wheeler type, and from these the condensed water is discharged into the hot well tanks, from whence it is pumped through the feed water pipes to the two economizer chambers located near the base of the smoke stack (Fig. 6) into which the boiler flues lead, so that the hot gases from the fires are utilized for heating the feed water before the escape into the chimney. Each of these chambers contains two Lowcock economizers with a total of 24,000 ft. of four inch pipe. A valve room is located near by, and with this all the oil and water pipes, equipped with Chapman valves, communicate, so that one attendant can regulate the flow from all the pipes. Salt water for condensing purposes is drawn from the bay through two thirty-six inch iron mains, each 600 ft. in length.

All the bearings of the main and counter shafts are water jacketed, and from these the water pipes communicate with the boiler feed pipes. All journal bearings are automatically oiled by means of pipes which communicate with a reservoir to which the oil is pumped, and from which it flows by gravity to the journals, thence to a filter when it is pumped again to the reservoir.

The switchboard is located in the feeder room adjoining one of the economizer rooms, and all the conductors from the generators will communicate with this room, the wires being led under the floor, so that one attendant can watch the requirements of each division of the extensive system and regulate the current accordingly. The traveling cranes, one each over the engine and generator floors are provided, handling the heavy parts. The tracks extend the entire length of the building.

The boiler room (see Fig. 7) is also equipped with every facility for handling the coal and ashes; the latter are removed by means of tram cars located beneath the floor on a track running the entire length of the boiler room and connecting with the yard and outside shipping facilities.

In front of the main building, just outside the temporary wall, are located four water rheostats for testing the efficiency of the generators. These consist of wooden tanks about four feet wide and eight feet long, having adjustable metal plates to which the circuit terminals are attached. These tanks are about four feet deep and contain a weak solution of sulphate of soda.

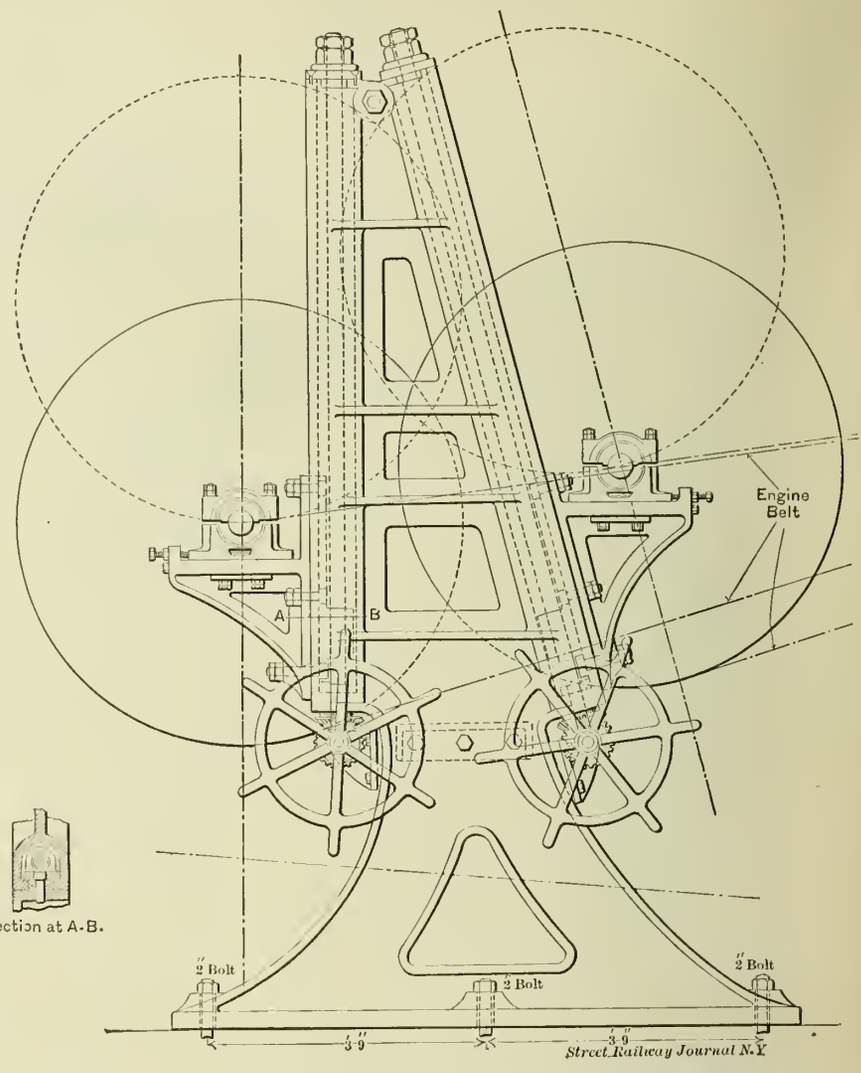


FIG. 3.—ENGINE BELT TIGHTENERS—CENTRAL POWER STATION.

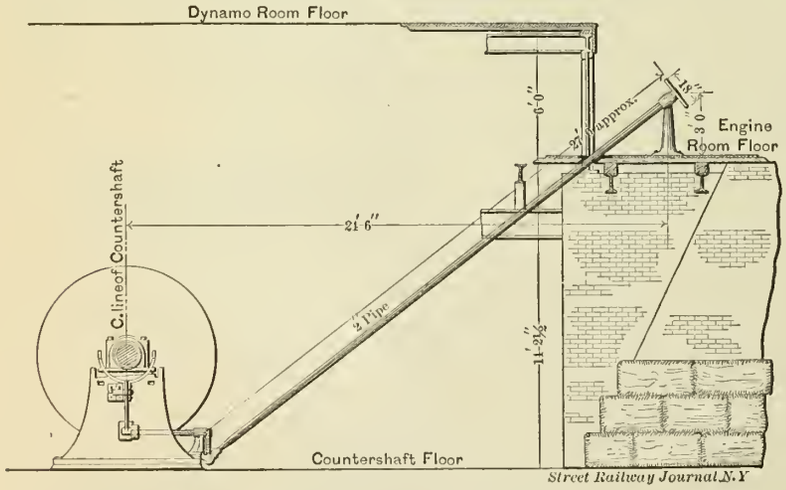


FIG. 4.—HAND WHEEL AND SHAFT FOR OPERATING CLUTCHES ON MAIN SHAFT.

The central power station building is of brick with iron and slate roof, and the interior dimensions of the engine and generator room are 169×160 ft. The ultimate length will be 319 ft. The boiler room is 163×84 ft. The smokestack is 250 ft. high, circular, with a double brick shell. The diameter at the base is twenty-six feet and at the top seventeen feet, the flue being of a uniform diameter of 13 ft. 8 ins. Massive granite foundations are provided for the engines, boilers and smokestack, and these rest upon piling, there being 816 piles forty-five feet in length beneath the stack, and a total of 600 piles under the building foundations.

Such are the outlines of this interesting station which is designed to operate, in connection with the Cambridge plant, the largest electric railway system in the world, as the temporary plants which have heretofore been employed will now be abandoned. The magnitude of the undertaking illustrates very forcibly the faith that the West End company early had and still has in electricity as a motive power for street railways, and the planning and erection of the plant which is one of the boldest engineering feats in the history of street railway practice, reflects great credit upon the company's chief engineer, Mr. F. S. Pearson.

The following well known firms were the manufacturers of the various appliances above noticed: Engines

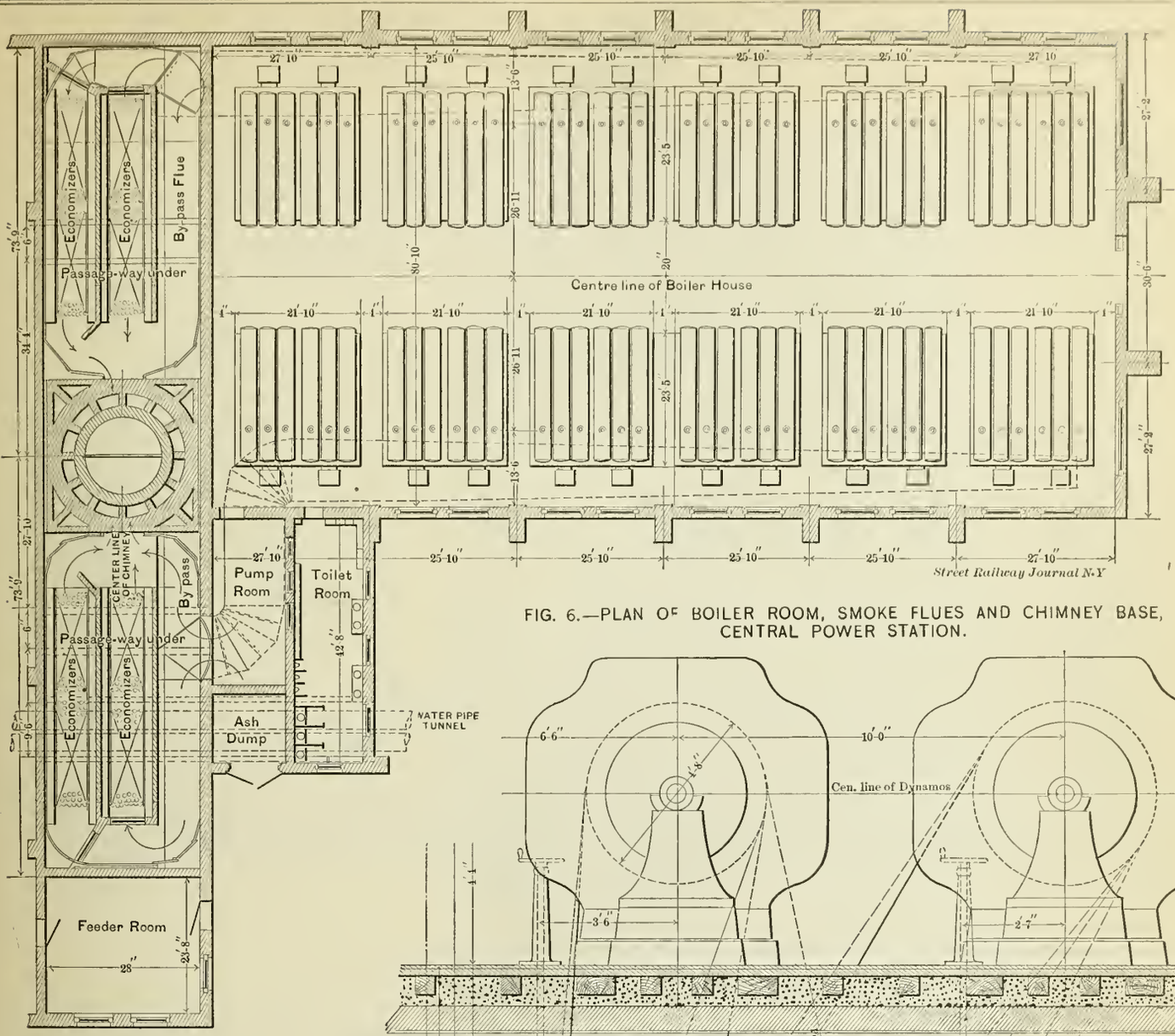


FIG. 6.—PLAN OF BOILER ROOM, SMOKE FLUES AND CHIMNEY BASE, CENTRAL POWER STATION.

and condensers: The E. P. Allis Co., Milwaukee, Wis. Boilers: The Babcock & Wilcox Co., New York. Belting: Irison Leather Belt Co., Boston, Mass. Valves: Chapman Valve Manufacturing Co., Indian Orchard, Mass.

ONE of the conditions attached to the recent extension of franchise granted by the municipality of Rio de Janeiro to the Jardin Botanico Street Railway Co. of that city, required that the street railway company should construct at their own cost a tunnel through one of the numerous hills of the city. This has recently been finished, and on July 6 the tunnel was formally opened for traffic in the presence of the president of the republic, the minister of the navy and many other prominent officials. The tunnel is about 830 ft. long by 19.7 ft. wide, and has an average height of about twenty-three feet. Throughout the entire distance the work was through the hardest granite. Owing to the liberal height there will be no need of lighting the tunnel during the day, while at night the necessary illumination will be furnished by a small Gramme dynamo driven by an Otto gas engine.

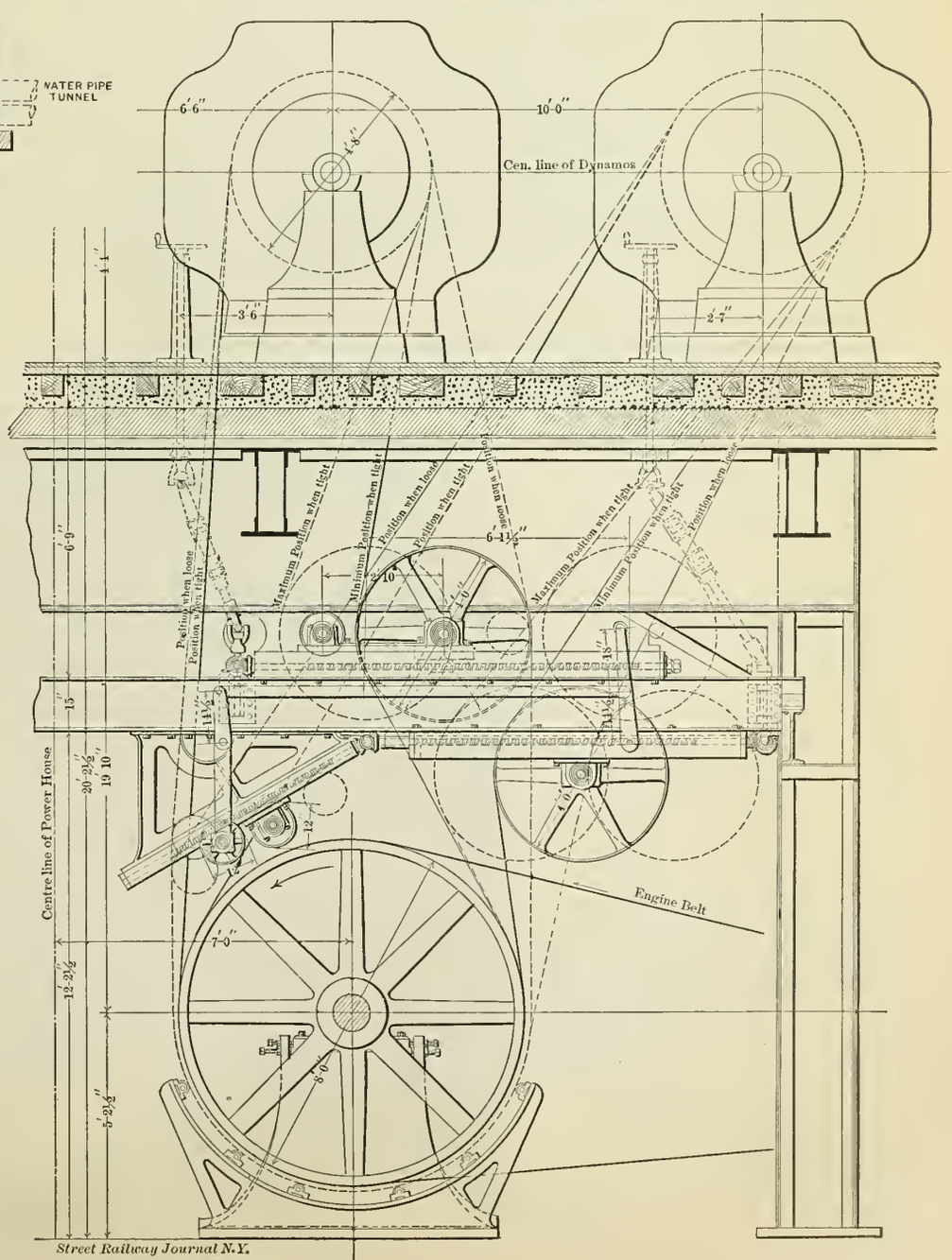


FIG. 5.—GENERATOR BELT TIGHTENERS.

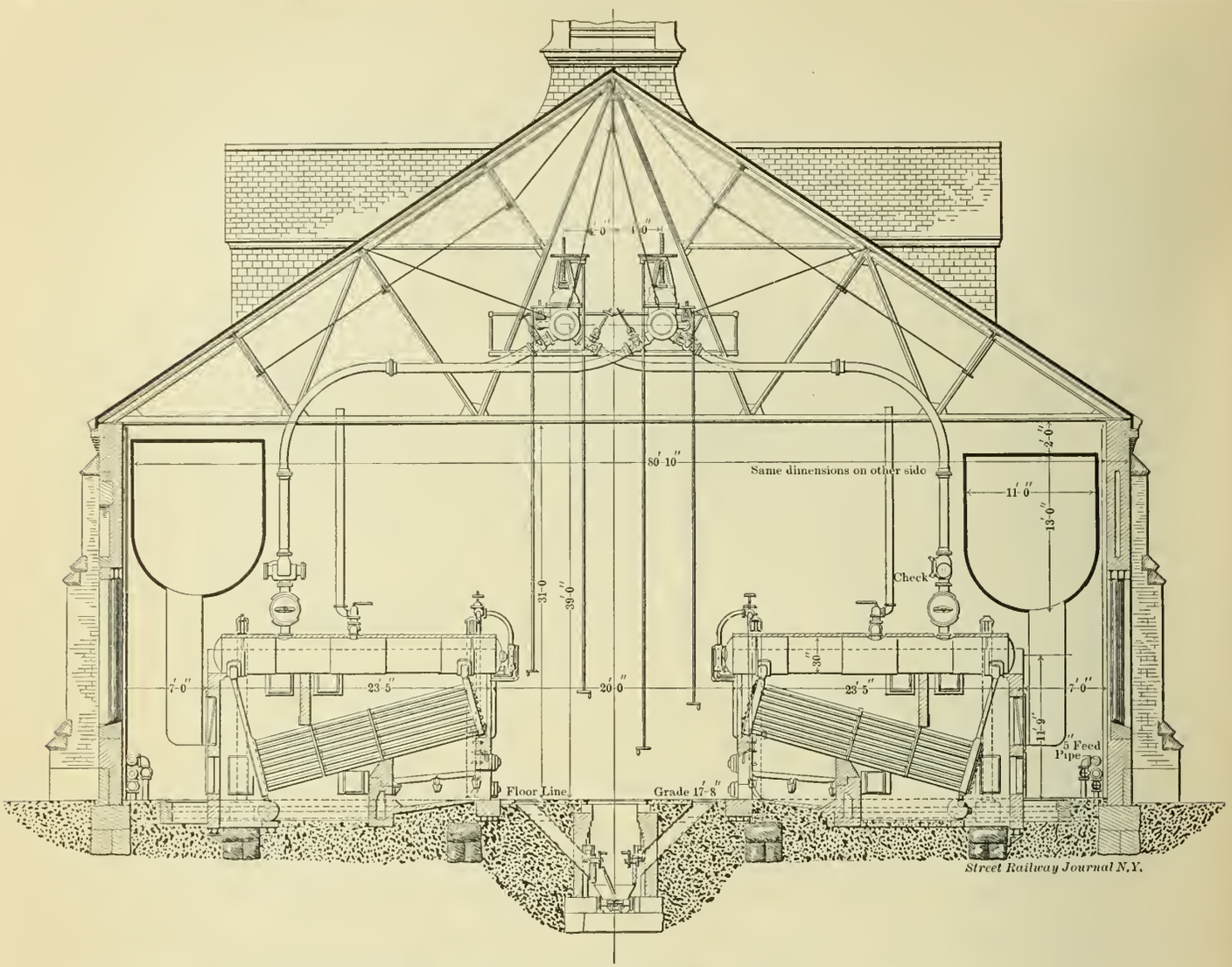


FIG. 7.—CROSS SECTION BOILER ROOM, CENTRAL POWER STATION.

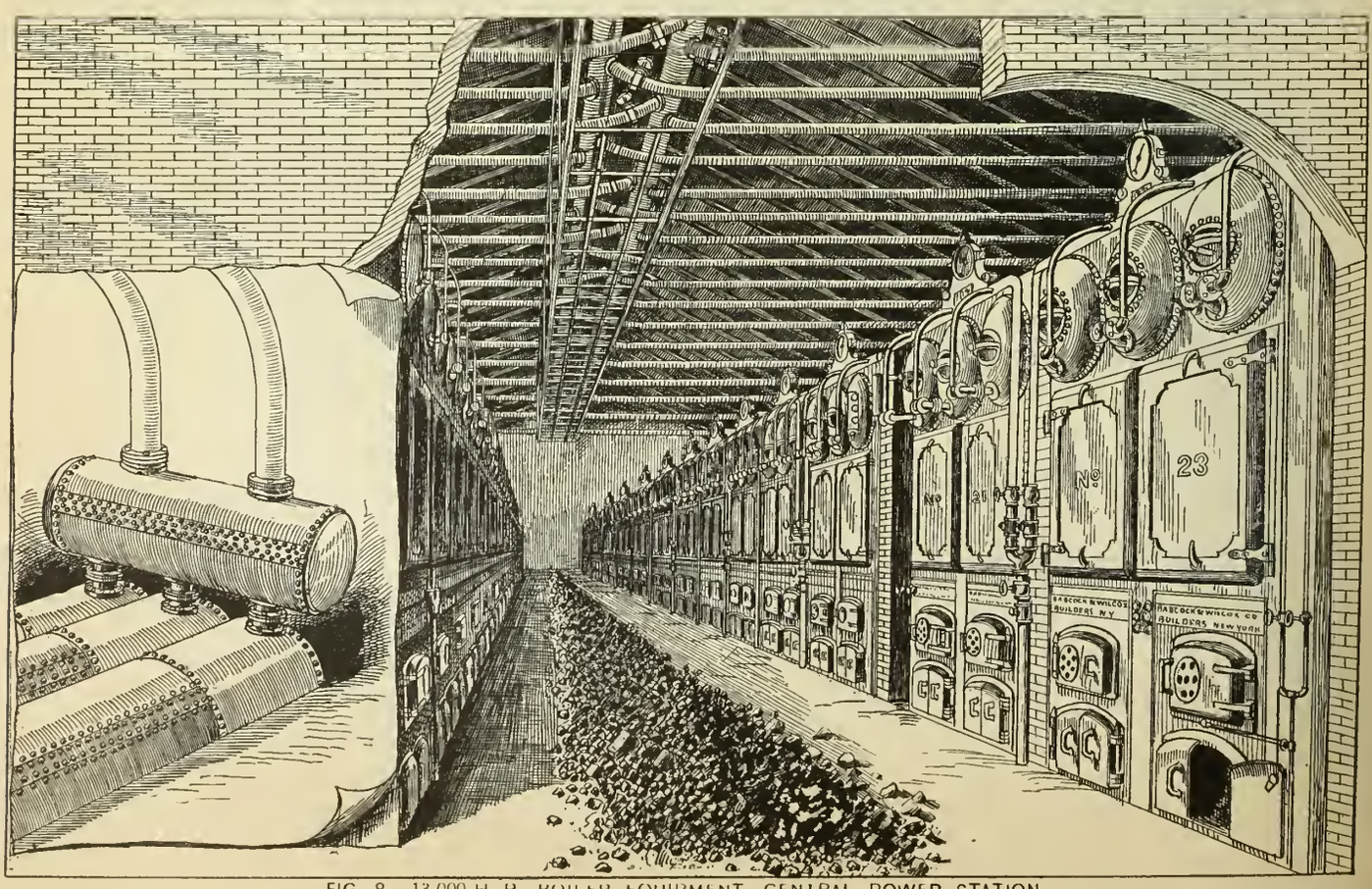


FIG. 8.—13,000 H. P. BOILER EQUIPMENT, CENTRAL POWER STATION.

The Cleveland Convention.

There is every reason to believe that the Convention of the American Street Railway Association at Cleveland, October 10, 20 and 21, will be of marked interest. The local committee of arrangements is daily receiving letters which indicate that a lively interest is being taken in the meeting by railway men and manufacturers. The former promise to be present in large numbers, and the latter give assurance that they will send exhibits which will prove a great attraction.

The local committee have engaged Army and Navy Hall as a place for the exhibition of apparatus. The location is exceedingly convenient, as it is on Superior Street, almost opposite the Hollenden, where will be the headquarters of the Association. The accompanying diagram shows the dimensions of the exhibition hall and the general arrangement of the available space. It will be noticed that the corridor, sixty feet in length, will offer advantageous location for exhibits as well as the main hall. On the second floor the committee has secured a large room, 33 × 54 ft., which will also be used for the exhibit of apparatus. An abundance of room for out-of-door exhibits will probably be available, as, fortunately, the vacant lot immediately adjoining the exhibition hall on the east can be used for this purpose. Other exhibits will be located in the lot directly back of the Hollenden.

It has been definitely decided that the sessions of the convention will be held in the Y. M. C. A. building, which is one of the handsomest structures in the city.

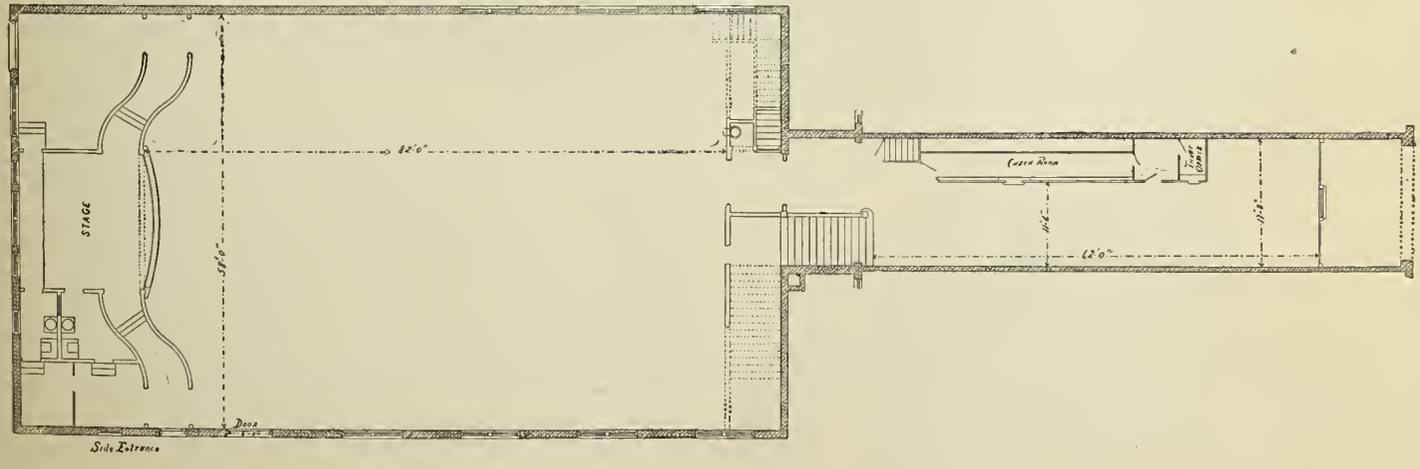
The arrangements for the entertainment of visitors have been nearly decided upon by the local committee, and a most enjoyable time may be anticipated by those who attend the meeting.



CONVENTION HALL BUILDING, CLEVELAND.

West & South Towns Electric Railway, Chicago.

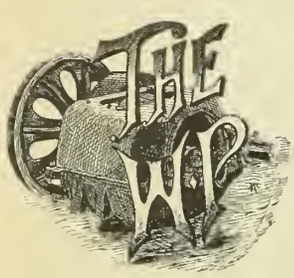
It is stated that work on the West & South Towns Street Railway Co., of Chicago, will be commenced at once, and that cars will be running by January next. The company have an ordinance granting them to operate a street railway on Twenty-second Street from Grove Street to Crawford Avenue, and on Lawndale Avenue from Twenty-second Street to Thirty-fifth Street. The company are allowed to use five kinds of motive power, cable, gas motor, compressed air, animal power and electricity. Beyond all question electric motors will be used, as the only restriction on the overhead privilege is that the feeders shall be underground. The vice-president of the company is Congressman Lawrence W. Gann. A great many rumors have been in circulation about the policy of the new company. It has been stated that in all probability they would lease crosstown lines of other companies and operate them as a belt road, as their franchise gives them the right to operate on the tracks of other corporations.



PLAN OF EXHIBITION HALL—CLEVELAND CONVENTION.

RAILWAY DYNAMOS AND THEIR MANUFACTURE.

Part II.—Shop Practice as Found at the Thomson-Houston Electric Co.'s Works, Lynn, Mass.



MOTOR, which is a modification of the single reduction type, was originally designed for narrow gauge lines, but it proved so efficient and popular that it was tried on lines of standard gauge, and has now become a universal favorite, having superseded nearly all the other types of Thomson-Houston motors; in fact, the manufacture of the double reduction motors has almost ceased with the company, except as they are made to order to replace disabled motors on such lines as were originally equipped with this type, and which wish to keep the equipment uniform. Its popularity is evidenced by the fact that about 140 motors per week are now being turned out of the Lynn shops; a large number are also being made at the Schenectady shops, formerly known as the Edison Works.

In the previous number of this series we described in detail the manufacture of the M. P. generators, and we have now to study the construction of the popular W. P. motor. Naturally, since we learned that M. P. stood for multipolar in reference to generators we would expect that W. P. would have a similar significance when used in connection with the motor, but this is not the case, and our W. P. simply means "waterproof," a name given to this machine because its vital parts are so thoroughly protected from moisture by the peculiar shape of the frame or fields.

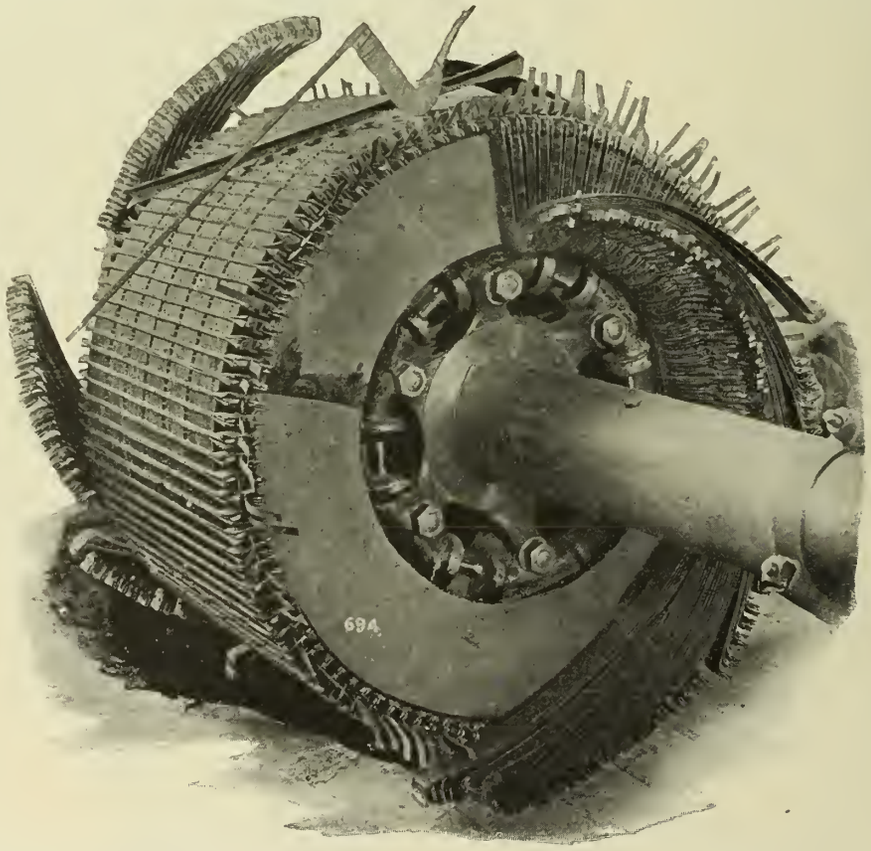


FIG. 2.—METHOD OF WINDING M. P. 500 H. P. GENERATOR ARMATURES

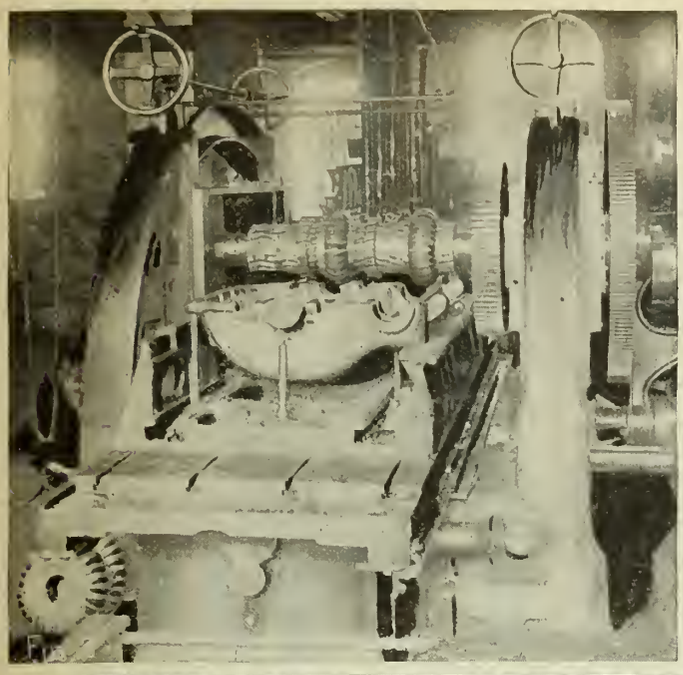
(See page 455.)

As will be seen from the initial figure, the general outline of this motor is spherical, the frame being formed in two parts with the corners of the lower half of the frame rounded off to facilitate the passage of the car over obstacles, should such be met with in the way. The parts of the frame or the field magnets are of soft cast steel, having the poles on the inner surface slightly projecting towards the centre, while there are depressions on the outer surfaces of the fields to compensate for the metal on the poles. The present form of frame has been developed by successive steps, and is very complete, even containing chambers which serve as grease cups so that only covers, are required.

The castings being delivered, the first work consists in planing the faces and bearings to insure close fitting joints. This work is done in some cases on ordinary planers, but a three-spindle universal milling machine (Fig. 3) is employed for doing the most of this work, which saves three or four days' work on a frame. As will be seen from the illustration, one passage of the frame through this machine brings all the numerous surfaces to a perfect fit. Each spindle is supplied with a variety of cutting knives (seventeen in all) adapted to the shape of the surface to be planed. One spindle as it revolves cuts off the rough or outer surfaces, and the next as the frame passes under it cuts a little deeper and finishes the work. To prevent the cutting tools from heating, water is allowed to flow continually over the spindles, being conducted by strings to each cutter from an overhead perforated supply pipe, as shown. The two halves of the frame are then joined, the journal boxes adjusted, when it is placed in a two-spindle, horizontal, boring mill in which the bearings for the armature shaft and car axle are reamed out, insuring a parallel bearing for each. For this work ten boring mills are employed.

Following the work, we next find the frame mounted in a machine where the inner faces of the poles are planed to correspond to the curve of the armature. The shaft of the revolving cutting tool is mounted in the bearings of the armature shaft, which insures a surface on the pole faces equally distant at all points from the periphery of the armature when mounted. The frames being completed, they are stored in convenient positions (Fig. 4.) to await the completion of the armature, to the details of which we will now give attention.

The cores for the armature are constructed of laminated iron, in about the same manner as described for the generator core. The disks of which it is composed are stamped from sheet iron (Fig. 5), and each separate piece has its edge notched so that when laid up the notches form slots or peculiar shaped channels across the face of the core, which are designed to receive the wiring. The disks are then annealed, when they are laid up with tissue paper between each plate, and when a sufficient thickness has been secured the core is transferred to a powerful hydraulic press, and the plates are firmly compressed, making the core almost solid. Several small presses are provided for this work, each receiving its power from a common reservoir. For this purpose only one pump is provided, which runs continually and acts upon a piston which is loaded with twenty tons of metal. Each press is connected by suitable piping with this reservoir, and by opening a faucet the entire weight is at once utilized for compressing the plates. The core is then



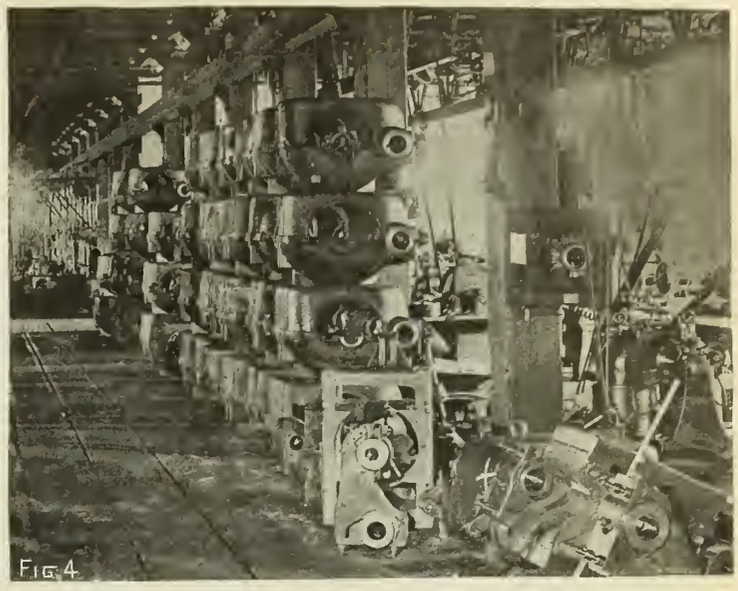
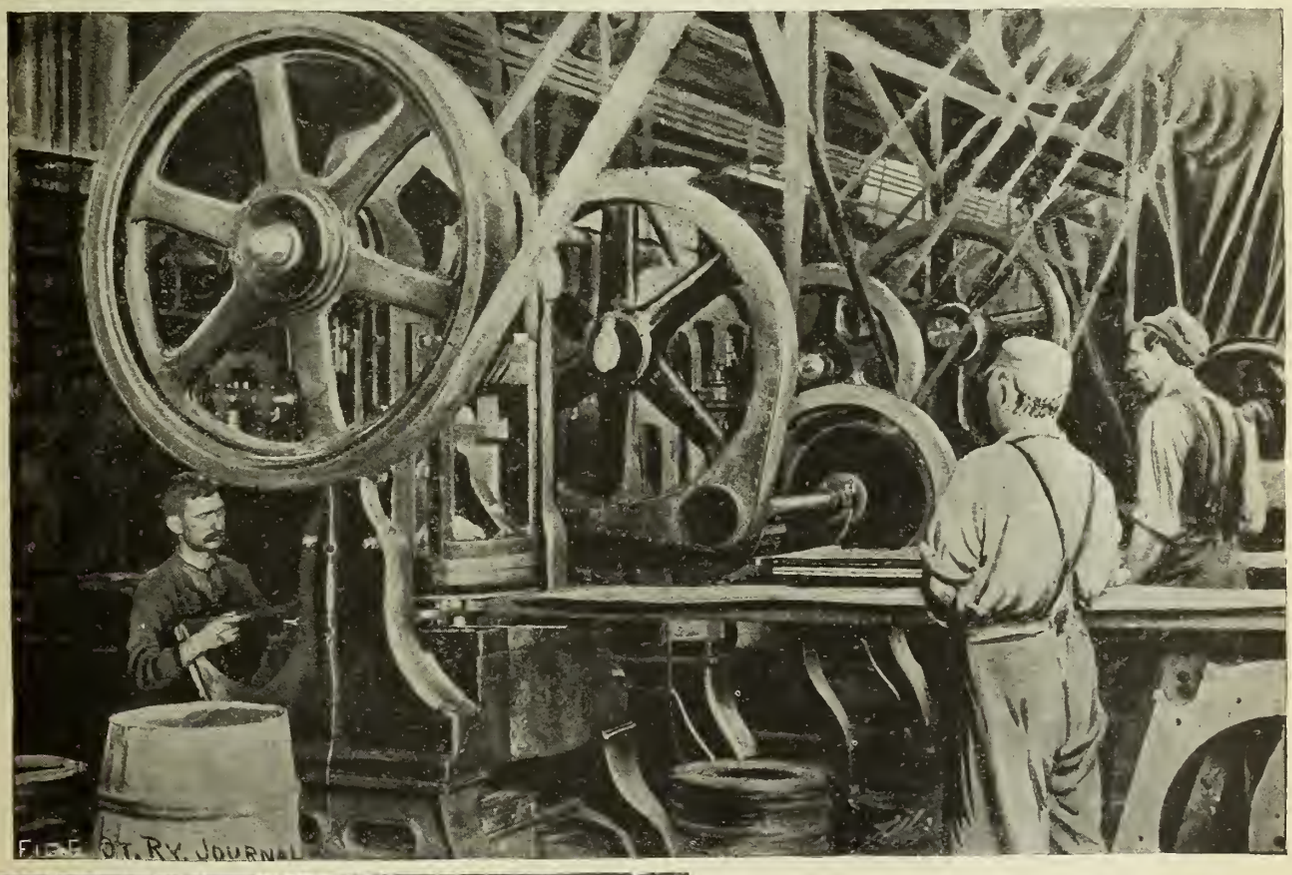


FIG. 4.



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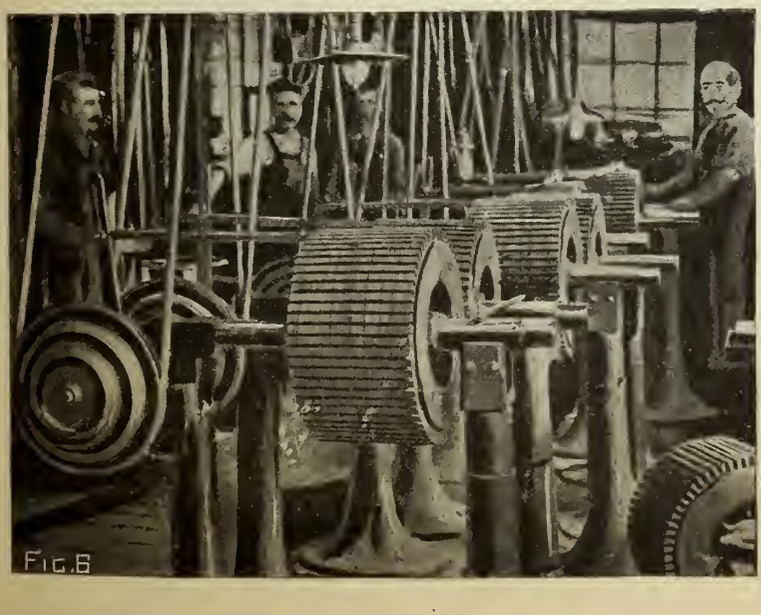
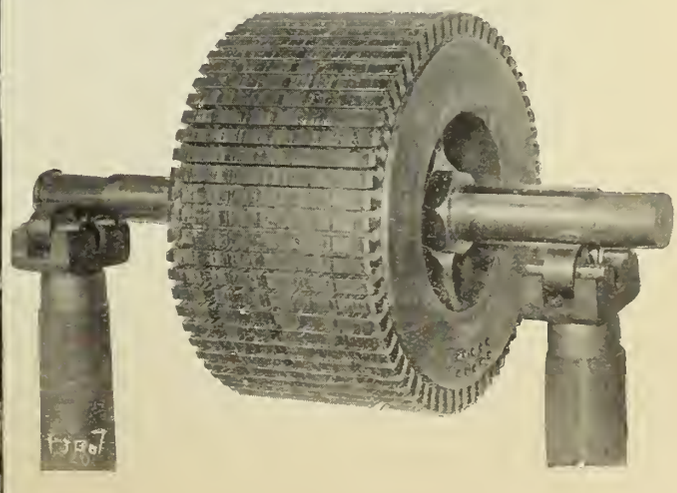


FIG. 6.



mounted on a gun metal spider similar to that employed in generator construction, and then pressed onto the shaft and secured by a collar nut, when the piece is mounted in a convenient position for filing out the channels, which is done mechanically as shown in Fig. 6.

The core with its shaft (Fig. 7) is now ready for the winding; those for the twenty-five horse power machines being twenty inches in diameter, and those for the fifteen horse power motors eight inches.

The motor winding department (Fig. 8) occupies a gallery on one side of the machine shop building L and



FIG. 8.—WINDING W. P. MOTOR ARMATURES.

here about 300 hands are employed during the day, and the work is continued by a night gang. The process is a very interesting one, and the life of the armature largely depends upon the care exercised in the winding.

Round wire is employed in winding the fifteen horse power armatures, and flat wire for the larger machines. Each armature is wound with a continuous wire, the breaks being united by electric welding, for which purpose a small portable welding machine is provided, which is moved about from stand to stand, the current being conveyed to it by means of an insulated flexible connection. The wire is first wound upon long narrow shuttles, by means of which the operator, by passing it through between the arms of the spider, wraps the rim of the core until each channel, which has previously been lined with insulating material, is filled. The bobbins are each composed of from eight to fourteen turns of wire, depending upon the desired speed; those of the high speed, twenty-five horse power motors, have nine turns and the slow speed thirteen turns. The wiring is secured in the channels by means of wooden wedges in the same way as described for the generator. The flexible leads which connect the bobbins with the bars of the commutator are composed of exceedingly fine copper wire, and are attached to the bobbins at the middle of the face of the core, the insulation being first removed from the wire and lead, when the parts are laid alongside of each other for three or four inches and carefully bound with insulating tape. So carefully is this work done that burnouts seldom occur with this machine. No solder is used in attaching the flexibles either to the bobbins or commutator bars, and thus an element of weakness which was common in the old motors is eliminated. The commutator end of the flexibles is inserted in a short copper tube or ferule which is then placed for about half its length between the jaws of a powerful press which flattens it out and bends it to the desired angle. A small hole is then punched through the ferule and wires at the flattened end, for the purpose of receiving the square headed screw which attaches the lead to the commutator bars. The screw being in place, the end of the ferule is then split and a portion turned up against the head of the screw thus forming a complete "nutlock." The armature is wound in sixty-four bobbins, and it requires about a week or fifty-eight hours for one man to wind an armature.

The winding room is equipped with a number of light traveling cranes with hand hoists to facilitate the handling of the armatures, and for safe handling a steel sling is employed as shown in Fig. 9.

While we have been watching the winding the construction of the commutator has been going on in another department. The process is about the same as described and illustrated for the generator commutators, and so we leave it in place without further comment.

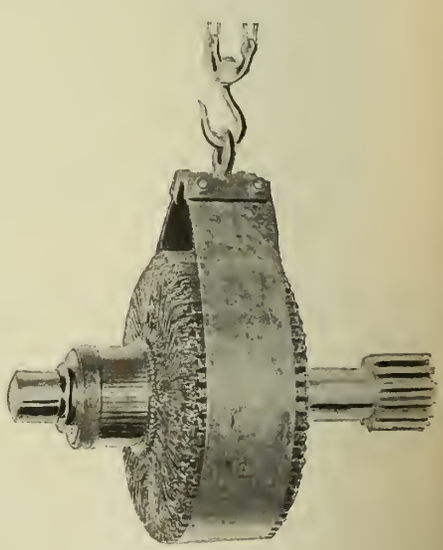


FIG. 9.—SLING FOR HANDLING ARMATURES.

The pinions, only a few of which are manufactured in the Lynn shops (the most of them being purchased from outside parties), are next attached to the shafts, and the completed armatures are stored in an adjoining department to await the assembling of the parts (Fig. 10).

The field spools, a number of which are shown in the right of the last figure, are wound the same as before described for generator spools. These are bolted

in place over the shallow poles, and are so placed that they nearly embrace the armature, insuring the utilization of nearly all the lines of force. All the bolts are provided with nutlocks to prevent their working loose.

The gear casings, a number of which are shown in process of testing for electrical efficiency. For this purpose two motors are coupled together and are run alternately as generator and motor, the results being measured and recorded. The upper field of one motor is removed, and we are able to note that the lower field is supported

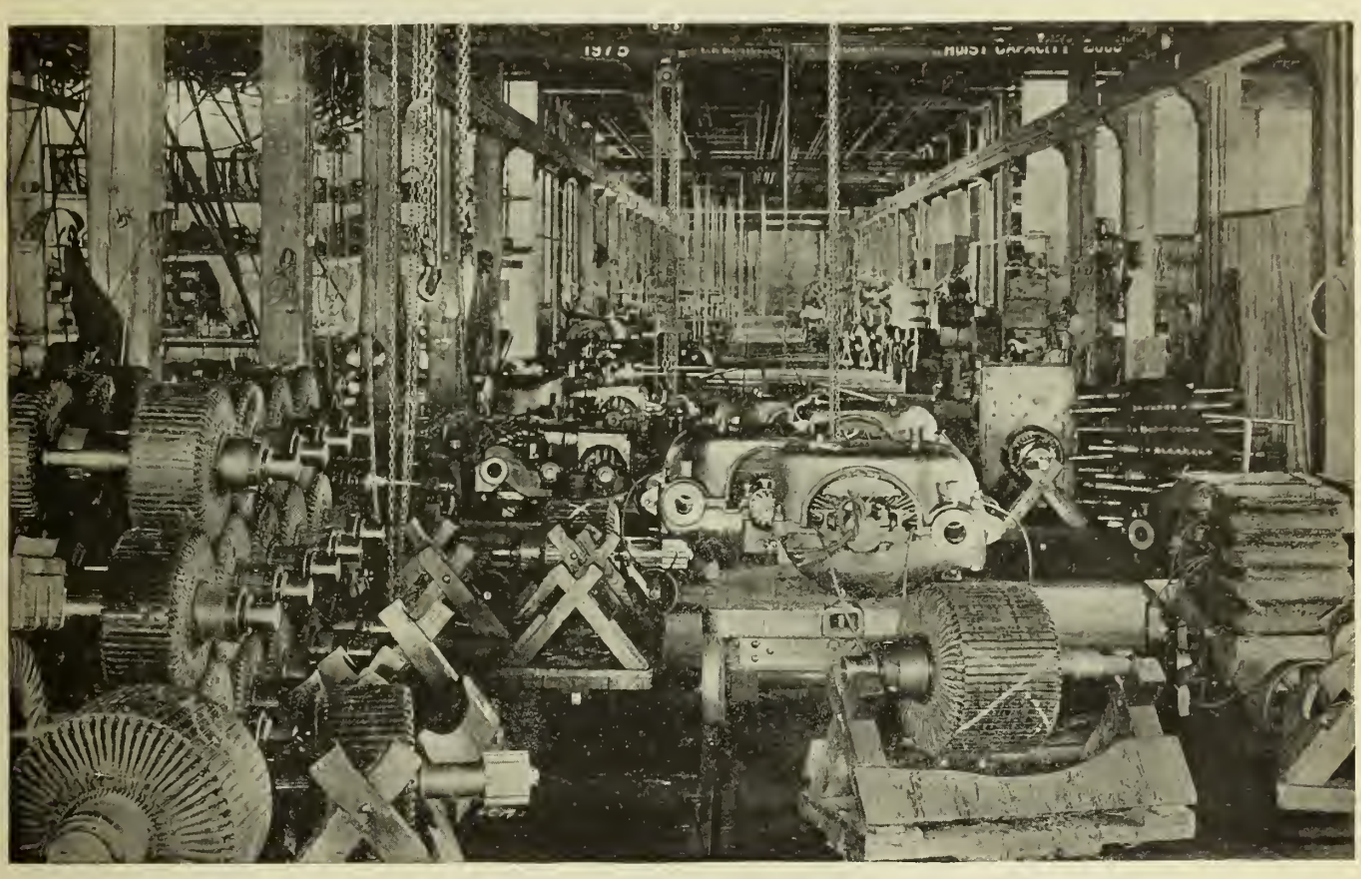


FIG. 10.—INTERIOR OF ASSEMBLING ROOM.

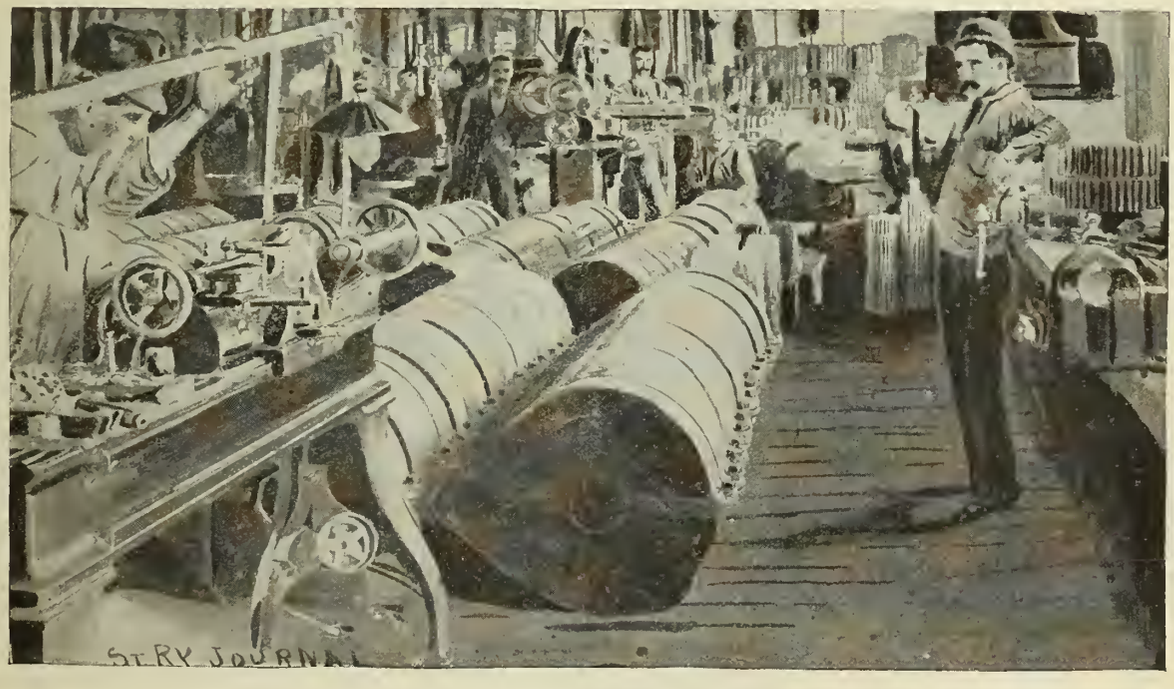


FIG. 11—FINISHING GEAR CASINGS.

Fig. 11, consist of a very thin shell of malleable iron, and are carefully fitted so that the joints are oil tight, and serve to exclude dust and provide for thoroughly lubricating the gears. A small hand hole on the top, with cover provides for inspection and the introduction of the lubricant. The parts of the motor, including the brushes and holders, being completed and having passed the inspectors, are assembled, and in Fig. 12 we witness the and held in place at the back by means of a flat hook which embraces the car axle—a very ingenious arrangement, for without it the lower field would fall to the ground whenever the frame was opened. Our machines are now boxed and made ready for shipping, and for this purpose freight cars are brought directly to the shop by means of sidings from the steam lines, which convey them to all parts of the country where they are put in

service and minister to the comfort of untold numbers of people, and at the same time serve as dividend earners to those who have invested in this popular means of transit.

The manufacture of electric railway apparatus is, however, only a small part of the product turned out from the Lynn shops, a birds-eye view of which is presented in Fig. 13, but it is not our purpose in this connection to describe in detail the work in each department; we can only name them and pass on to general equipment and management.

The lighting department is by far the largest in extent of product, and embraces the manufacture of generators, transformers, lamps, both arc and incandescent, together with switches and other auxiliary appliances. Both direct and alternating current generators are made for lighting purposes, and for incandescent purposes three sub types are manufactured. To show how an alternating current machine differs from a railway generator, the former is presented in Fig. 14. Five different types of transformers are also made.

In the mining department we note the manufacture of electric drills, coal cutters, hoisting motors and various apparatus for mining work. The welding department is set off in a separate building, and is devoted to the manufacture of generators and electric welding machines. This is a growing industry, and quite marvelous results are obtained by the use of welding machines, some of which are designed for railway work, such as welding rails, welding chairs to rails, and attaching the base to the new type of electric rails which are now being introduced.

The Thomson watt-meter has a department exclusively devoted to its manufacture, and very large numbers (about 100 per day) are turned out. This is a tiny but an exceedingly interesting machine, and is employed, the same as a gas meter, to measure the amount of current delivered to customers for operating stationary motors (Fig. 15). The armature of this meter, which is only about three inches in diameter, is mounted on a vertical shaft or spindle and is driven with fields consisting only of spools without cores. To the lower end of the spindle is attached a thin copper disk which revolves between the poles of three U magnets placed in a horizontal position and which exert a retarding force in proportion to the current

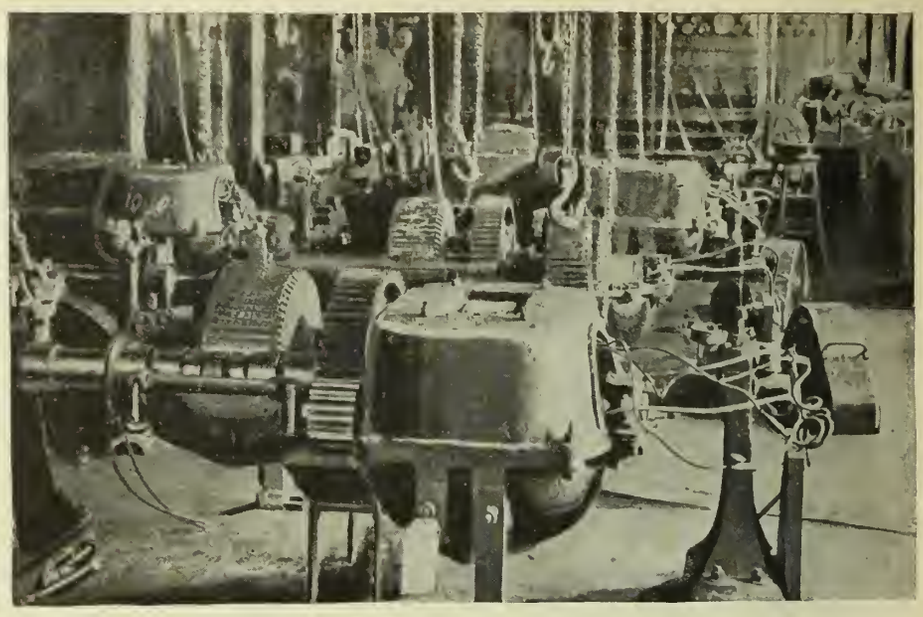


FIG. 12.—W. P. MOTORS COUPLED FOR TESTING.

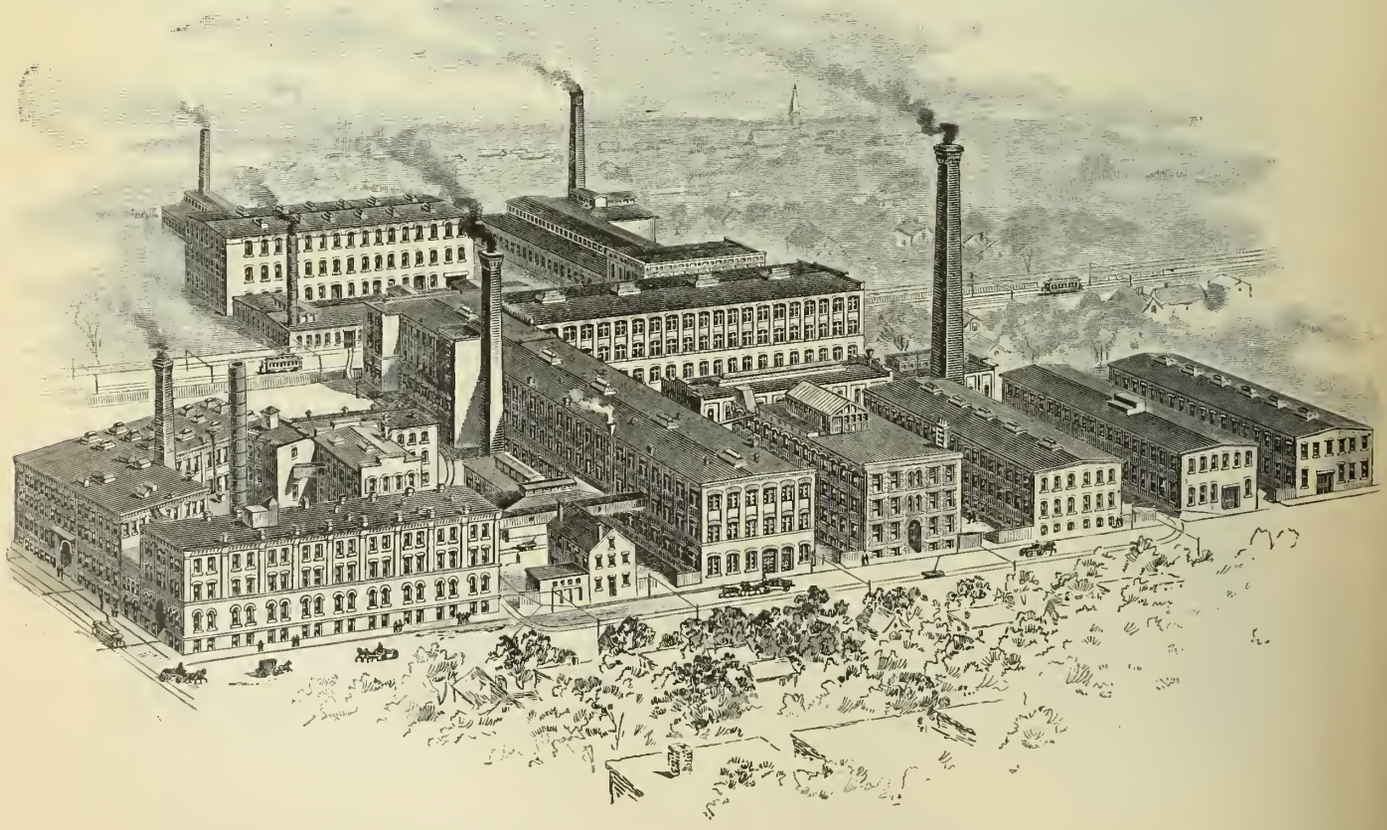


FIG. 13.—THOMSON-HOUSTON ELECTRICAL WORKS, LYNN, MASS.

employed. A revolving mechanism is attached to the frame above the armature, and the results are read from dials the same as in gas meters. In order to increase the output of these machines, a third story is being added to one of the buildings, which will be equipped with suitable tools for meter manufacture.

Electric locomotives are also receiving considerable attention, and the 400 H. P. machines for hauling steam cars through the Baltimore tunnel are now being designed.

Stationary motors are also manufactured in great numbers and in all

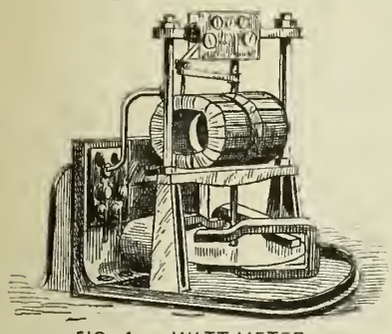


FIG. 15.—WATT-METER.

sizes from a one horse power machine up to 100 H. P., or any capacity required.

Not only do the Thomson-Houston company manufacture electrical apparatus for others to use, but they show their faith in their own products and in this subtle fluid as a mechanical agent adapted to a variety of purposes by employing it in nearly every possible way Stationary motors, Fig. 16, are brought into extensive use in nearly every department for driving the shafting from which the tools are operated, no less than forty-five machines being thus employed. The position of the motor with its rheostat, and the method of belting to the shaft, is clearly shown in the figure. Not only are the specially constructed motors thus employed, but in a few cases W. P. railway motors are utilized for shop power purposes. When thus employed they are usually suspended from the ceiling or mounted on a bracket at the side of the room. This use of railway

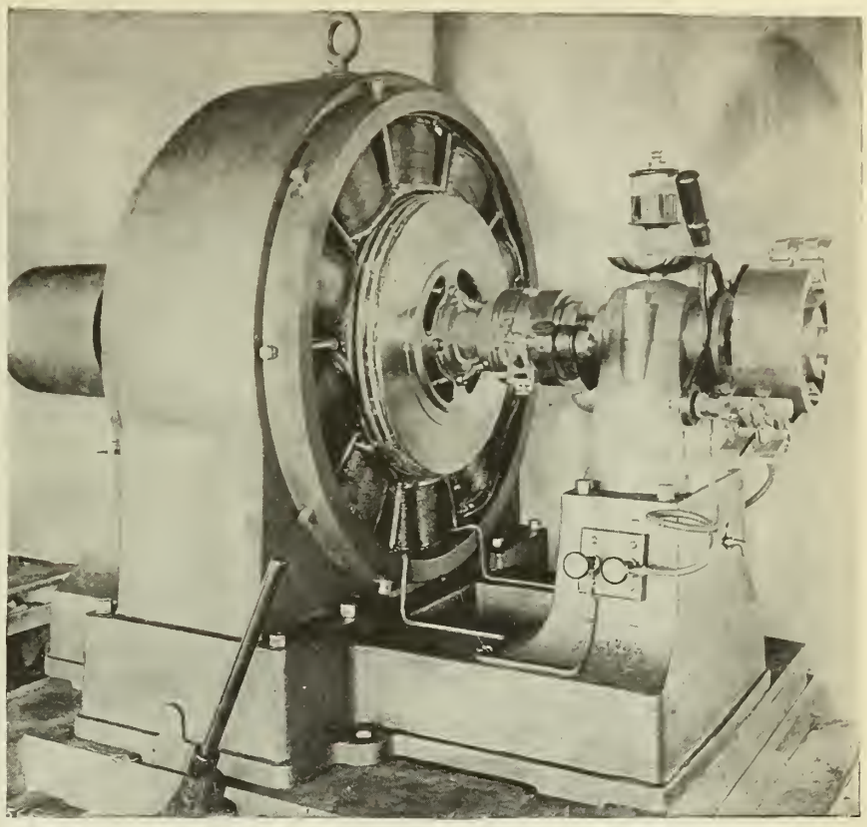


FIG. 14.—ALTERNATING CURRENT DYNAMO.

motors will suggest to street railway managers the possibility of employing old car motors for operating the repair shop tools. Not only are the W. P. motors employed for shop purposes, but, as previously noted, the traveling cranes are equipped with double reduction railway motors.

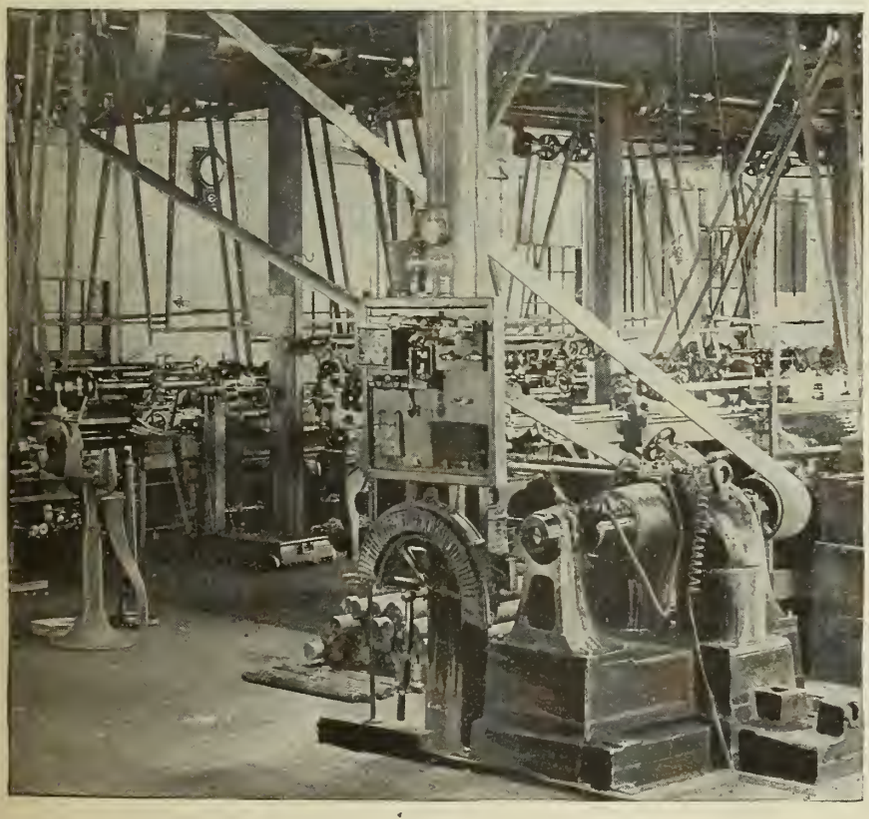


FIG. 16.—STATIONARY MOTOR DRIVING SHAFTING.

A very elaborate system of transfer tracks is provided in the yards, adjacent streets and through the buildings, upon which are operated, by means of electric motors, low trucks or flat tramway cars (Fig. 17) for the purpose of transmitting material about the works. This equipment consists of eight shop motors, and forty tow cars. The motor cars are provided with a folding trolley pole, as shown, which has two wheels, so that the cars can be run beneath the low ceiling of the basement floors or in the yard from a trolley at ordinary height. There is also an electric locomotive of forty horse power (Fig. 18) with which the freight cars from the steam lines are shifted about the shops. This machine will handle a train composed of a number of freight cars, and place the cars in convenient position for loading or unloading.

The electric current is also employed for lighting the shops, and for this purpose there are about 300 arc lights and more than 3,000 incandescent lamps. The current for power and lighting purposes is generated by a number of dynamos distributed about the works, with an elaborate system of switchboards so equipped that the current from the machines under test can also be utilized for lighting and power purposes.

The telephone system of the shops is also very com-

plete, there being a telephone in every main office, and in the offices of the shop foremen, with a complete telephone exchange having a switchboard containing seventy-one drops. There are also private lines to the head offices in Boston, and connections with the city and long distance services. There are also the usual fire alarm signals and the watchman recording disks.

Steam is, of course, the prime motive power for operating the shops, and for this purpose a number of engines have been installed in the different departments,

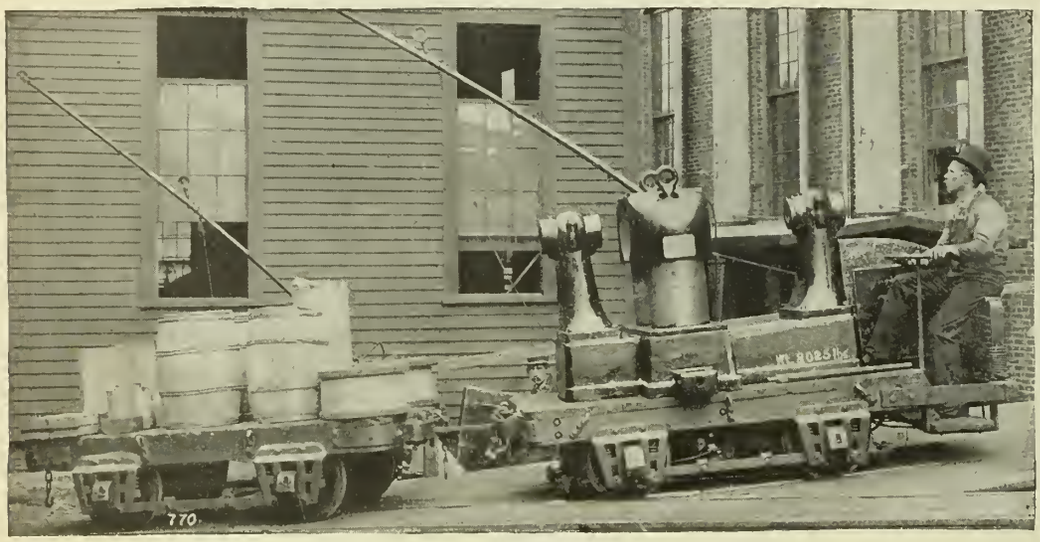


FIG. 17.—ELECTRIC YARD TRAMWAY.

aggregating in all about 2,500 H. P. The main power house adjoins the testing room, and here is located a 1,000 H. P., Greene, tandem, compound engine (non condensing), manufactured by the Providence (R. I.) Engine Co. The flywheel is eighteen feet in diameter, with a five foot face, from which two belts are driven. This engine is employed almost exclusively in testing the large M. P. generators, to which they are belted direct with suitable belt tighteners. The shaft of the flywheels is also extended and provides for coupling direct to the ten pole generators when these are being tested.

The engine room is equipped with a powerful fire pump made by the George F. Blake Manufacturing Co., of Boston, capable of throwing three streams aggregating 750 gals. per minute. A second Armington & Sims 400 H. P., high speed engine is also employed in the testing room. This drives three 100 H. P. shop generators, and is at times employed for testing. There are also three other engines in other departments, one being a 120 H. P. Corliss and one a double Greene of 500 H. P. The steam generating equipment of the principal power station consists of two batteries of longitudinal tubular boilers manufactured by Abendroth & Root and four vertical Manning boilers. The exhaust steam is utilized for warming the buildings, and for this purpose the rooms are provided with a direct overhead system of steam piping.

Steam is referred to above as the prime motive power of the works, and so it is in a physical sense, but every machine which has its origin in the brain of the inventor must be designed before it can be manufactured in the shops, so that the draughting room becomes the most important factor in keeping the wheels moving. A large room (Fig. 19) on the third floor of the office building is devoted to this purpose, and here nearly 100 draughtsmen are employed in completing the various designs. In connection with this department is a blue print and photograph room. There are also storage vaults and racks for holding the prints, any one of which can be easily found, as a very complete ready reference index system is employed.

Notwithstanding the extent of the works, which now have a floor space of 342,000 sq. ft., or about eight acres, as shown in the illustration (Fig. 13), the business has outgrown the capacity of the factories, and the company have already begun the erection of large buildings on the Saugus River, about one mile from the present plant. A part of the new plant will be employed as a foundry for making heavy castings, and here will be located the steam and electric power plant. Being near tide water, condensing engines can be employed, and the current for operating and lighting the present plant will be transmitted by suitable conductors.

EMPLOYES.

The organization and discipline of a shop force is not less interesting than the manufacturing details just described, and the effect of a wise administration is evidenced by the diligent and conscientious manner in which each individual of the nearly 4,000 operatives performs his tasks, and by the orderly manner in which they conduct themselves in public while going to or from their work or when off duty.

The employes enter the works through two main doors which lead from the street into a check room which is in charge of a timekeeper and assistant, and it is an interesting sight to see the hands gathering from every direction as the hour of work approaches. Upon the walls of this room are hung a number of check boards each containing 100 numbers with brass checks having corresponding numbers, attached by a hook to the numbers on the board. The men are known by numbers, and each man as he enters takes his check from the board and deposits it in a box as he passes from the check room into the yard. As soon as the hour for reporting is up, which is 6 : 30 A. M. and 1 P. M., the box containing the checks is removed, and another put in its place, which remains for half an hour, and all checks found in this are marked a half hour late. At the end of the half hour this

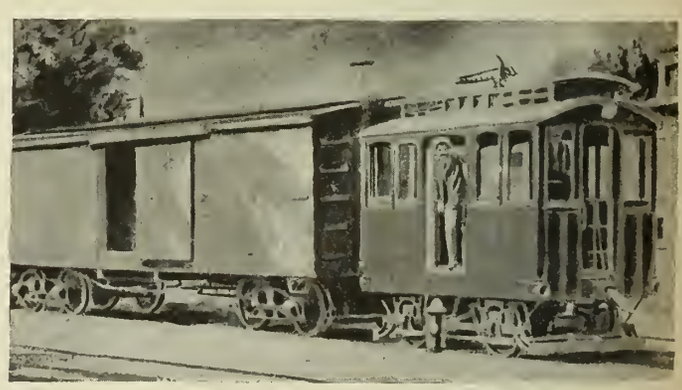


FIG. 18.—ELECTRIC SHIFTING LOCOMOTIVE.

is removed, and all checks deposited during the next half hour are marked one hour late, when the doors are locked and no one is allowed to enter.

All checks remaining upon the boards are marked absent, and the checks are then sorted by the attendant and replaced upon the boards. Should a man remain in the works during the noon hour, he is required to go and draw his check the same as those entering. In case an employe wishes to leave the works before the hour of closing, he secures a pass from the foreman of his department, which he deposits with the timekeeper at the check room, who notes the hour of leaving and turns the pass in with the owner's time card. The hours of work in summer are from 6 : 30 to 12 A. M., and from 1 to 6 P. M.

with a half holiday on Saturday. Each department is in charge of a foreman who keeps a record of all work, and reports to the production department daily the progress on each piece of work under his supervision. A mechanical record in the office of the production department indicates the condition of every machine and principal part that is progressing through the shops.

In addition to the regular shop force, the regulations provide for the employment of a certain number of "students" and "apprentices" who are under the supervision of the expert department. The organization of this department consists of a general manager and foreman. The manager is assisted by a clerk, stenographer and general expert, and the foreman by a clerk and office boy. Under these in the Lynn factory are eighty students and twenty-five apprentices, with two special experts for trouble work, the duties of the latter being to hunt for and remedy the trouble that may occur in the operation of any machine in the different departments.

The students take a regular course, covering a period of one year, and are assigned for a certain number of weeks to different kinds of work in each of the departments. The pay of the students is five cents per hour for the first three months, seven cents per hour for the second three months and ten and twelve cents for the successive periods; and should they remain after completing the course they receive fifteen cents per hour, unless they secure regular employment in the shops, when the pay is such an amount as may be agreed upon.

The regulations require that applicants for admission to the expert department must be twenty-one years of age and graduates from some technical school or college, either as mechanical, mining, civil or electrical engineers, or shall have had experience for two or more years in general electric construction work or machine shops. On completing the course in a satisfactory manner, the students are given a handsomely engraved certificate of graduation, signed by the manager and foreman of the expert department, stating that the holder is deemed competent to install and operate the particular apparatus named in his certificate.

Applicants for admission to the apprentice course are required to be not less than eighteen or more than nineteen years of age, and must have graduated from some public high school or its equivalent. The course covers a period of three years, and the pay is five, six and seven cents per hour for each year in order. On becoming twenty-one years of age, and having a satisfactory record, they are transferred to the student course, and receive eight cents per hour for the first six months, and then regular student rates. The employes in the expert department associate freely with the heads of the departments, and every facility is offered them for becoming acquainted with all the details of the works. The management are besieged with applications for entrance into these courses, and they are annually sending out a number of graduates who secure lucrative positions in all parts of the country.



FIG. 19.—DRAUGHTING ROOM—THOMSON-HOUSTON ELECTRICAL WORKS.

HISTORY.

The name of the company, Thomson-Houston, is derived from those of Prof. Elihu Thomson and Prof. E. J. Houston, founders of the industry. Professor Thomson was born in Manchester, Eng., in 1853, but at the age of five years came to this country with his parents who located in Philadelphia, where young Thomson was educated in the public schools. In 1870 he was appointed as Assistant Professor of Chemistry and Physics in the central high school, and in 1876 to the Chair of Chemistry and Mechanics in the same school. As early as 1874 he began work on a dynamo machine for lighting purposes, and afterwards associated with himself Prof. Edwin J. Houston who had before built an eight light dynamo in a small shop in Philadelphia, with whom several joint patents were taken out. Upon these patents the American Electric Co., was organized in 1880 under the laws of Connecticut, and Professor Thomson became its electrician when he resigned his position at the high school and removed to New Britain, Conn., where the works were first established. Professor Thomson still retains an active interest in the company, and is employed as expert in charge of the chemical and patent department. In 1882 the majority of the stock of the company having come into the hands of certain Lynn capitalists, headed by Mr. C. A. Coffin, who is still the executive head of company, the business was re-organized and the name of the company changed to that of Thomson-Houston. A building with a floor space of 26.962 sq. ft. having been erected in Lynn, the machinery was removed from New Britain 1883, and the factory facilities have naturally increased to their present magnitude, while the capital stock of the organization is now $18,400,000, reflecting creditably upon the financial ability of the general manager, Mr. C. A. Coffin. The Edison General Electric Co., was recently merged into this company, and they now constitute the General Electric Co., with a capital of $50,000,000.

PERSONAL.

The management of the Lynn factory is in the hands of Mr. E. W. Rice, Jr., who, in all problems relating to the factory and employes, consults with a "factory committee," consisting of the heads of some of the depart-

ments. The members of this committee, besides Mr. Rice, are Mr. D. M. Barton, manager of the production department, Mr. I. F. Baker, mechanical superintendent and Mr. G. E. Emmons, auditor.

Mr. W. H. Knight is chief engineer of the railway department, and he devotes all his time to railway work, being assisted by Mr. H. F. Parshall. Mr. Knight was engineer of the original Bentley-Knight company, and in that capacity built and operated the first commercial

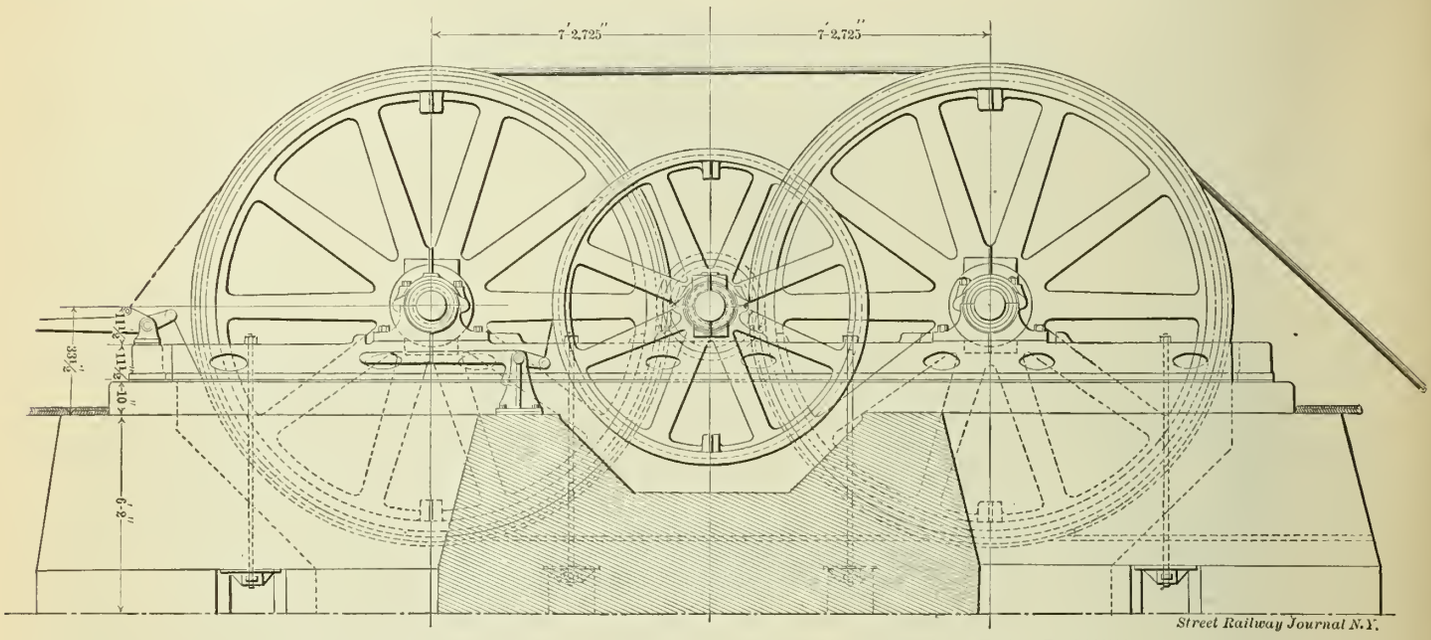


FIG. 2.—SIDE ELEVATION OF DRIVING MACHINERY—OTIS ELEVATING RAILWAY.

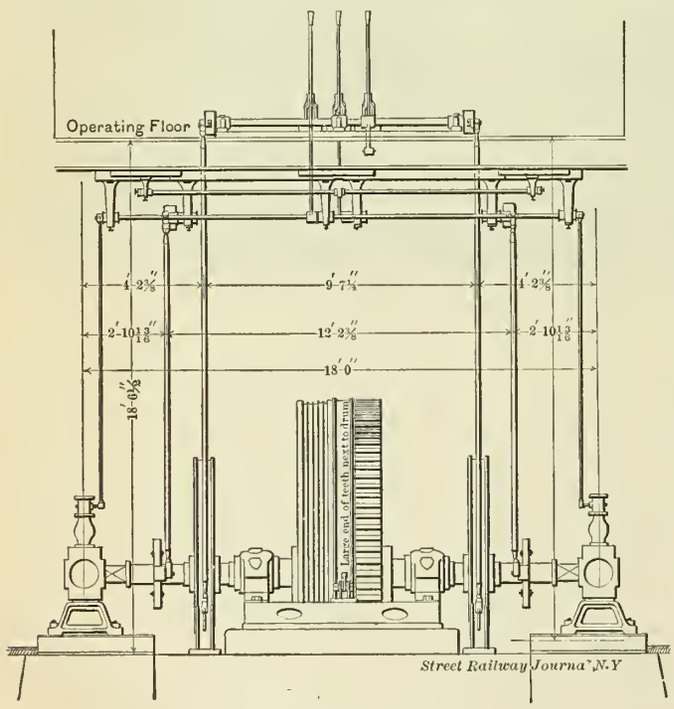


FIG. 1.—END ELEVATION, SHOWING CONTROLLING DEVICES—OTIS ELEVATING RAILWAY.

electric street railway in this country, and has since been closely identified with electric railway work.

The management of the expert department is in the hands of Lieut. J. B. Cahoon, who has supervised the organization of the forces in this and nearly all the departments, and his success in this direction reflects creditably upon his ability. Lieutenant Cahoon is a graduate of the U. S. Naval Academy, and spent fifteen years in active service, but having been injured at the torpedo station he was retired in June 1889 and since then has been identified in various capacities with the Thomson-Houston Electric Co. To him and to the managers of the other departments our thanks are tendered for courtesies shown.

The Otis Elevating Railway, Catskill Mountains.

During the last month the longest single lift cable incline railway in this country, and the second in the world, was put in operation on the eastern slope of the Catskill Mountains. The lower terminus of the road is at Otis, a station on the Catskill Mountain Railroad, and the upper terminus is about 200 yds. from the Catskill Mountain House. The total length of the incline is 7,000 ft. and the rise 1,630 ft. The grades vary from 4 to 34.4 per cent. The ascent is made in ten minutes or at the rate of about eight miles per hour. Only two incline railways in the world exceed this in length ; one at Mt. Vesuvius, Italy, which, however, is operated in two sections, neither of which is as long as that mentioned above, and one at Mt. Soperga, Italy, which has a rise of less than the Catskill incline.

The road was surveyed during the latter part of last year, but owing to certain delays, active construction was not begun until about the middle of last May. The incline is of the three-rail, gravity type, the middle rail being used by both the ascending and descending cars, and a turnout 100 ft. long being provided midway between the two termini. The two trestles on the line have a total length of 2,600 ft. and maximum height of seventy-two feet, are made of Georgia yellow pine and required in their construction nearly 1,250,000 ft., board measure. On the line of the road there are also four heavy rock cuts, one of which is forty-five feet in depth and from which about 70,000 cu. yds. was removed.

The gauge adopted is three feet, the same as that of the Catskill Mountain Railway with which it connects. Tee rails thirty-five pounds in weight are used, laid on 6 × 6 ins. × 8 ft. cross ties, spaced two feet between centres. These ties, with the exception of 1,000 ft. at the lower end where they are ballasted with broken stone, are laid on longitudinal stringers, 6 × 10 ins. and these, except at the trestles, are mounted on subsills six feet from centre to centre. The structure is made still more rigid by two longitudinal guard rails of wood, 6 × 8 ins., which are bolted to the cross ties and which also serve for safety rails, as will be described later.

The engine and boiler houses are at the summit terminus, the latter being located at the side of the track about fifty feet below the former, so that the fuel can be dumped from the railway cars directly in front of the door. The boilers are two in number, of the Manning upright tubular type, were manufactured by E. Hodge & Co. of East Boston, Mass., and were furnished by the Q. N. Evans Construction Co. Each boiler has a nominal capacity of 150 H. P., contains 152 tubes fifteen feet long and two and a half inches in diameter, and is run under

a pressure of 100 lbs. A Worthington pump is used. The hoisting machinery (see Figs. 2 and 3) consists of two 12×30 reversible Corliss engines, manufactured by Hooven, Owens & Rentschler of Hamilton, O., operating one shaft on which is a pinion geared to two Walker differential drums. Each drum is twelve feet in diameter and has six rings. The driving machinery is controlled from a lookout station above the engine room by an operator who, from his position on a clear day, can see the greater part of the line. This operator has before him three levers, shown in Fig. 1, one of which controls the throttle valve, another reverses the machinery, and the third sets two friction brakes operating drums seven feet ten inches in diameter mounted on the pinion shaft. The operator is also in electrical communication with each train; this is accomplished by the use of two conductors, one for each train, upon each of which runs a trolley attached to the forward car. The conductors are carried on bell insulators mounted on the ties, and the return circuit is made through the rails. A signal bell, operated by a relay circuit, is located in the lookout station, and one is carried on each car, so that signals can be given from either car to stop the machinery at any point. When such a signal is given from either car the operator in the lookout station, before stopping the machinery, answers by a return signal that the request is understood. As an additional safety precaution at the station, friction brakes are also being placed on the drums themselves which will be operated automatically when the speed of the cable exceeds twelve miles per hour.

The cables were manufactured by John A. Roebling's Sons Co., and are two in number. Each is of steel with a hemp centre, 7,250 ft. long, one and one-quarter inches in diameter, ten tons in weight, and with a tensile strength of fifty-two tons. The greatest strain that can come on either is ten tons, so that there is a very high factor of safety. The ends of the two cables are attached to the two forward cars of each train as described later. At the power station the cables from the right hand track take two wraps about each drum, and are then led over a tail sheave eight feet in diameter, in the rear of the building, from which they pass to a guiding sheave six feet in diameter and thence to the left hand side. The carrying sheaves on the straight portion of the track are fourteen inches in diameter with chilled rim, and are spaced thirty feet apart except near the lower terminus where they are spaced fifteen feet apart. The sheaves are mounted on self centering and self lubricating bearings. At the turnout the sheaves are twenty-four inches in diameter and inclined so that their axes are at right angles to the direction of strain. The weight of the cable has been found to be sufficient to keep it in place on the track without the aid of any depression sheaves.

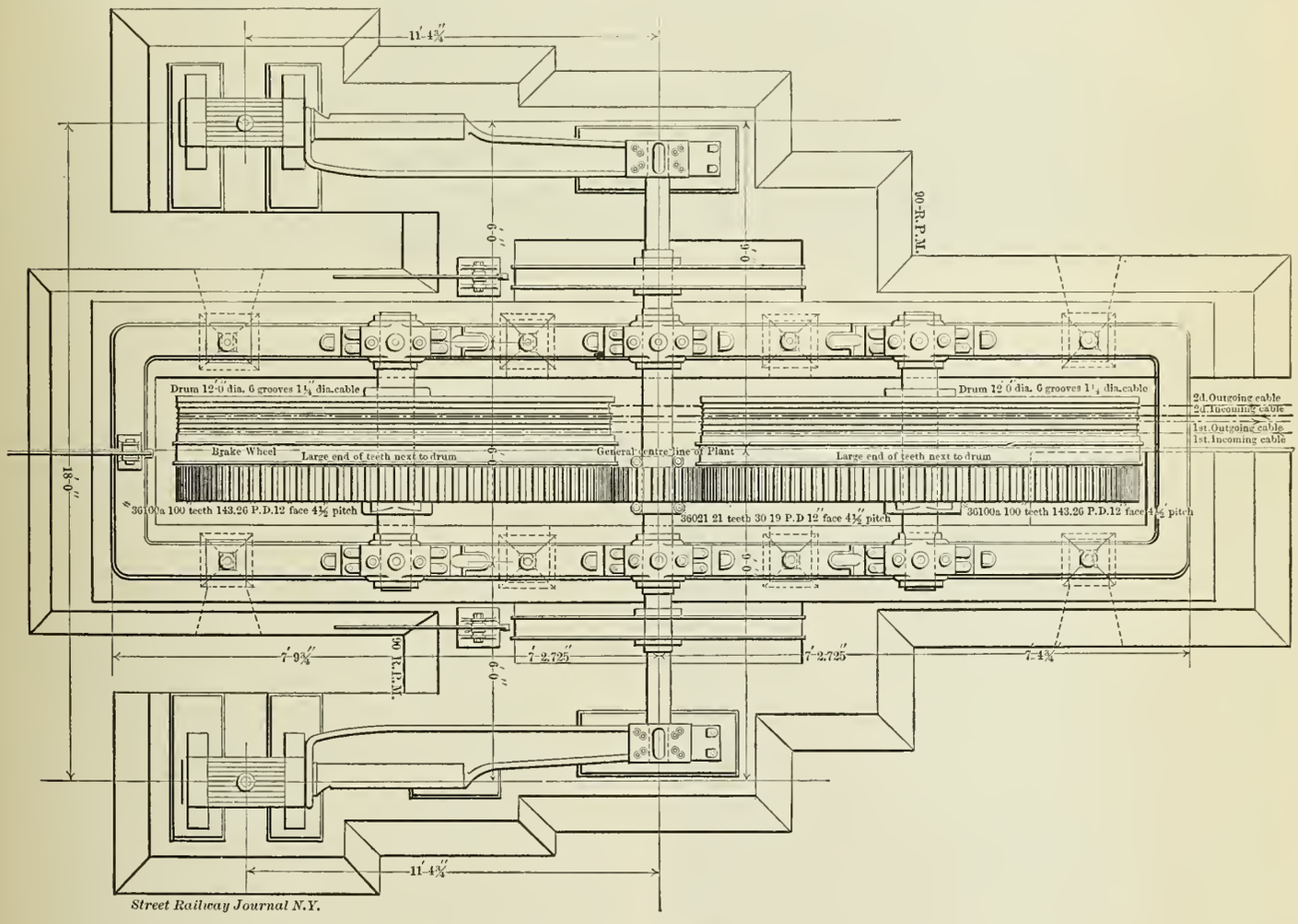


FIG 3.—PLAN OF DRIVING MACHINERY—OTIS ELEVATING RAILWAY.

The rolling stock consists of two passenger and two baggage cars, each train being made up of a car of each kind. The passenger cars, which are run ahead of the baggage cars, are open, forty-six feet long, and can seat comfortably seventy-five passengers each. The benches, which are fifteen in number, are arranged transversely to the car, with backs toward the front platform, and are similar to those in the elevators of the Eiffel Tower. The ends of the cars are glazed, and one of the sides has fixed horizontal iron rods, while the other, or entrance side, has wooden bars which are dropped in place when the passengers are seated. The ceilings are painted white, and the body of the car wine color. Each is mounted on two four wheel trucks. The baggage cars are of the ordinary platform type, and, with the passenger cars, were manufactured by Jackson & Sharp, of Wilmington, Del.

The safety grip used on these cars is especially ingenious, and is operated automatically when either or both of the cables break or become slack, or when the speed of the car exceeds twelve miles an hour. The ends of each of the cables are fastened to opposite sides of a pivoted metal disk, placed under each passenger car about in the centre. While both cables have the same tension, the disk

remains stationary, but should the tension on one relax beyond a certain amount, the displacement of the disk will throw the safety grip into action. This grip consists of two toothed surfaces and a toothed dog, which when actuated will engage with the wooden guard rail on three of its surfaces. The device for operating the safety grip automatically consists of a governor wheel which runs on the guard rail ahead of the grip, and contains two weights which are thrown out by centrifugal force when the speed is excessive, permitting the setting of the grip. These grips are similar to those used on the Weehawken elevator, have been thoroughly tested by the manufacturers, the Otis Brothers, of New York, and have been found to be perfectly reliable.



FIG. 4.—UPPER TRESTLE—OTIS ELEVATING RAILWAY, CATSKILL MOUNTAINS.



FIG. 5.—VIEW OF INCLINE FROM NEAR LOWER TERMINUS—OTIS ELEVATING RAILWAY.

An especially interesting and novel feature of the road is the grade line which is a combination of two tangents and several circular, compound and parabolic curves, so arranged as to compensate for the difference in weight between the long and the short ends of the cables. By this device the cars with equal loads will exactly balance each other at any point of the trip, making the load on the engine simply that required to overcome the frictional resistance of the plant, and with ordinary variations in loading, the work on the engines will be constant at all points of the incline. The credit for the application of this principle for the first time is due to the designing engineer of the road, Mr. Thos. E. Brown, Jr., to whom we are also indebted for the accompanying details of the railway.

The grade line in detail is as follows, all the distances being measured on a horizontal projection from a point directly in front of the summit station. From the top of the incline, which is about fifty feet beyond the point selected as a starting point, for a distance of 816 ft. from the starting point, the grade line is a uniform descent of 30.5 per cent. From 816 ft. to 1,390 ft. from the starting point the grade line is a vertical circular curve, convex upward, the maximum grade on the line, 34.6 per cent., being at the point 1,390 ft. From 1,390 ft. to 2,614 ft. there is a vertical circular curve, concave upward, of 62,985 ft. radius, thence to a point 3,861 ft. distant, a vertical circular curve, convex upward, of 21,515 ft. radius. From 3,861 ft. to a distance of 5,131 ft. there is a vertical circular curve, convex upward, of 14,572 ft. radius, and from 5,131 ft. to 6,596 ft. a parabola, convex upwards. For the remaining 404. ft. of the line there is a uniform grade of 4.04 per cent. The average grade is about 23.7 per cent.

The road was built by the Otis Elevating Railway Co., of New York, at a cost of $275,000. The assistant engineers were Gaylord Thompson, of New York, W. G. Howell, of Washington, and Charles F. Parker, of New York. The contractor for the entire line was Charles L. Bucki, of New York; sub-contractors for grading and track laying, Pennell, O'Hern & Co. of New York; for timber work Mairs & Lewis, of New York. The contractors for the machinery were Otis Bros. & Co. Figs. 4 and 5 are from photographs taken by J. W. Rusk.

World's Fair Passenger Cars.

The cars which the Illinois Central Co. are building for use in drawing crowds to the World's Fair ground are similar to an open street car. They are made of this special design in order that they may readily be converted into freight and platform cars after the Exposition is closed, for the company could not afford to build 600 passenger coaches for six months' service. The cars will be built with no centre aisle, and the fares, therefore, will be collected before the passengers enter. A lever at the top is connected with the doors so that all entrances can be closed at once.

THE Akron Street Railway Co. have been experimenting with a thirty horse power electric motor designed by Mr. John Seiberling of that company. The motor has given very good results in practice.

A Novel Combination Car.

Several weeks ago a new car, which is illustrated in the accompanying engravings, was put into service on the Euclid Avenue line of the East Cleveland Railroad Co. The officers of the road were at first doubtful if in actual use the changes introduced in the plan of the car named would prove successful, but after several weeks' trial they are emphatic in their endorsements. The Mehling car, which is twenty-one feet in length, is intended for both winter and summer use. The work incident to changing it from the one style to the other will not require over an hour or two at the outside. The engravings represent the car with the panels removed adapting it for summer use. The panels are of such construction and are so fitted into position that they cause no rattling when in place.

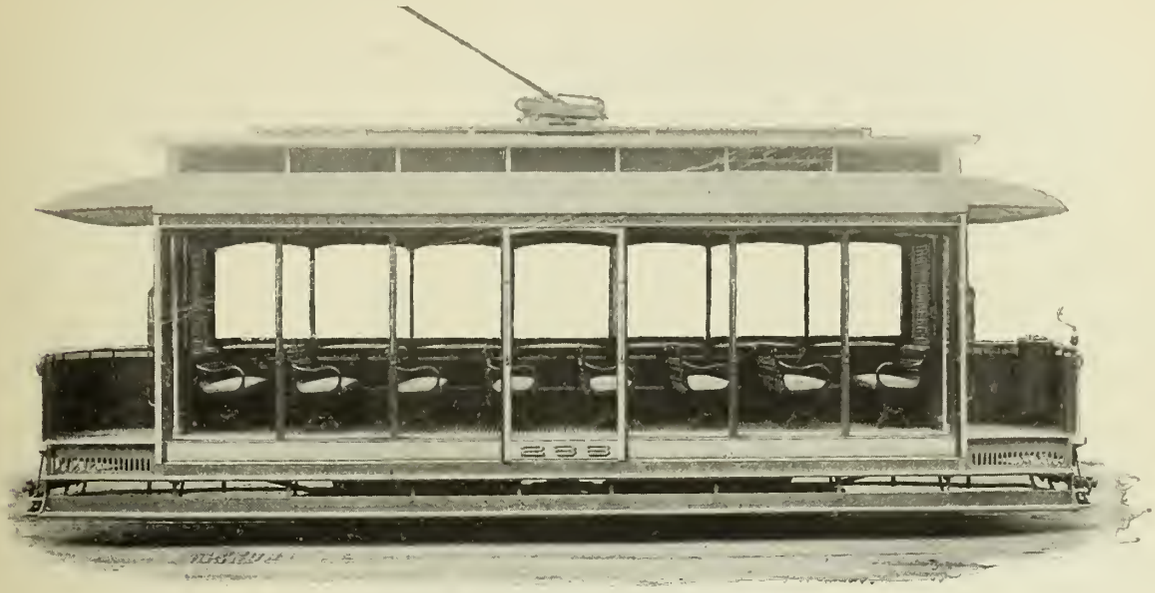


FIG. 1.—SIDE VIEW OF CLEVELAND COMBINATION CAR.



FIG. 2.—END VIEW OF CLEVELAND COMBINATION CAR.

The removable panels are a feature of one side only; the windows on the other side are so large and are built so low in the body that when lowered the air has full sweep.

It will be noticed that the car is constructed with a side aisle, which is narrower than that ordinarily allowed in a centre aisle car. No inconvenience results from the narrowness of the passage way, as the feet of passengers do not offer any obstruction. At the ends of the aisle ready exit is afforded by side doors opening on roomy platforms which have accommodated eighteen persons on special occasions.

When the car is closed by the panels a door is arranged at the side to facilitate entrance and exit, making three doors in all. Those interested in the car lay stress on the fact that the seats are arranged transversely. They state that one reason that open cars are so popular is because seats are arranged in this way.

The car is reached by a double step, which has not been found to cause any inconvenience even to those who board the car when it is in motion. The car has straight sides, and it is stated that the cost of construction is not high. The car used in Cleveland was built by the East Cleveland Railroad Co. The inventor is J. A. Mehling, who, with S. D. Dodge, of Cleveland, owns the patent.

One Company and Two Presidents.

The Atlanta Traction Co., at present presents the condition of a railway company with two presidents. The stock of the company, which controls a number of the most important lines in Atlanta, was divided among Messrs. Hoppie and Lanier who together owned 1,499 shares, Mountain and Woodward who owned the same number of shares, and A. T. Stewart who owned two shares. The first two mentioned gentlemen with Mr. Stewart held the control of the company until recently, when Mr. Lanier transferred his half interest of the 1,499 shares to a number of purchasers. These latter, soon after the purchase, proceeded with Messrs. Woodward and Mountain to elect a new board of directors by whom a new set of officers was chosen. Mr. Hoppie still claims to be president stating that the half interest held by himself and Mr. Lanier was owned jointly, and that, consequently, all sale of the stock was void. The courts will decide the matter.

A Long Lived Cable.

On July 2, the Los Angeles (Cal.) Cable Railway Co. took out of use the Grand Avenue cable which had been in use since September 11, 1889, lasting 1,026 days. It was 23,400 ft. long and was the only cable that has ever been on the line, and had run 163,944 miles. The cable is one and one-quarter inches in diameter and is composed of 114 steel wires in six strands of nineteen wires each, wound about a hemp coil. It was made by the Hazard Manufacturing Co. of Wilkesbarre, Pa.

The cable is not yet worn out. It would have lasted longer in the condition it was in on July 2, but the management feared to trust it to haul the heavy loads which had to be carried on July 4, and did not want stoppage of travel to occur on that day.

THE North Chicago Street Railway Co. have decided to adopt a new grip car made by the Brownell Car Co., St. Louis.

The Trenton, N. J., Electric System.

The Trenton Passenger Railway Co., of Trenton, N. J., has recently completed and has now in operation a well equipped electric railway system which is deservedly an object of pride to the citizens of that city as well as an evidence of the able and efficient management of the street railway company under whom the recent improvements have been made.

The Trenton Passenger Railway Co. was formed last year by the consolidation of the Trenton Horse Railway Co., the City Railway Co. the Hamilton Township Street Railway Co., and the South Clinton Avenue & Broad Street Railway Co., and now owns all the street railway lines in that city. Soon after the consolidation had been effected contracts were let for the station and electric equipment of the road, which was designed to be, and is, first class in every particular.



FIG. 1.—EXTERIOR OF POWER STATION—TRENTON PASSENGER RAILWAY CO.

THE POWER STATION

is of brick, one story in height and very substantial in appearance. A tablet on one of the walls shows that it was designed and erected by Lewis Lawton under the direction of Lewis Perrine, Jr., president of the company. The mechanical engineer employed in its construction was John B. Bates, and the electrical engineers the Field Engineering Co. The location was chosen with a special regard for its fuel and water facilities, and is at a point about midway between the termini of the line. A steam railway siding runs directly in the rear of the boiler room, so that coal is dumped almost at the doors of the furnaces. Water for condensing purposes is also near at hand, being supplied from a branch of the Delaware River flowing within a few feet of the boiler room.

The station is divided into two rooms by a fire wall. That portion occupied by the boilers is 94 × 44 ft., and contains at present four 200 H. P. return tubular boilers 18 ft. long, manufactured by the Kensington Engine Works of Philadelphia, and equipped with the McClave shaking grate. A Worthington pump and Watts-Campbell condenser also form part of the equipment of this department. The engine room, shown in Fig. 2, is 126 ft. long and 69 ft. wide in its widest, and 44 ft. in its narrowest part, and is well lighted and ventilated. The engine equipment consists of two 500 H. P. compound condensing Corliss engines, with cylinder dimensions 16 × 29 × 42, made by the Watts-Campbell company of Newark, N. J. The flywheel of each is 18 ft. in diameter, has a 54 in. face and weighs 28 tons. Each engine is belted directly to two 100 K. W., Short multipolar generators. Electric belting, manufactured by Chas. A. Schieren & Co., is employed to transmit the power. The station is designed to accommodate three additional engines and six additional generators or to have, in other words, a total ultimate engine capacity of 2,500 H. P. The piping between the present boilers and engines is arranged in duplicate so that either or both of the engines now installed can be supplied with steam from either set of pipes.

The permanent switchboard for the station has not yet been put in place, but will be a very handsome addition to the station equipment. The material selected for the board is slate, and all the appliances will be furnished by the Short Electric Railway Co., and will be installed by the electrical engineers of the station, the Field Engineering Co. One peculiarity of the board will be that the break switches will be of the single pole type with a positive leg. Each generator will also be supplied with a double pole switch, the intention being to break the circuit of the generators when necessary at the generator itself instead of at the switchboard. The equipment of the present switchboard includes four Cleveland circuit breakers and Short volt and ammeters. The lamp switches are of the Johnson type ; all other switches and all lightning arresters will be of the Van Nuis type. In the station wiring, Habirshaw wire has been employed, and all the connections and wiring are in full view, and all wires are mounted on porcelain insulators. The feeders when brought to the station are fastened to an outside bracket and are then brought through the wall, instead of being attached to the roof.

THE STACK

belonging to the station is the highest in that section of the state, and was completed August 1, 1892, when the last brick was laid by Mrs. Lewis Perrine, Jr. The dimensions of the stack are : Total height from bottom of foundation to top of cap, 168 ft., size of base at bottom, 26 ft. square, depth of foundation, 11 ft., distance of collar below cap 21 ft., diameter of shaft at base 14 ft., at collar 8.6 ft., across head 12.4 ft., diameter of flue 6.4 ft. The stack rests upon a bed of gravel. Upon this is a layer of concrete 3 ft. 6 ins. thick and 26 ft. square. There

were used in the construction of this foundation, 200 tons of broken stone, 250 barrels of German Portland cement and 500 barrels of sand. Upon this concrete base, large stones weighing from one to two and a half tons each were laid and grouted with best Portland cement.

The stack will be surmounted by an iron cap, not shown in the view, which will be 12 ft. 4 ins. in its largest dimension, and 6 ft. 6 ins. high. Iron bands are built in the stack every five feet of height.

THE MOTOR CARS

are fifteen in number and are equipped with Short single reduction electric motors. These motors, it is almost unnecessary to say, have given good satisfaction, and the managers of the company are so well pleased with the showing made by them that they have recently awarded the Short Electric Railway Co. an order for seven additional equipments. Three-fourths of the traffic occurs during the early morning and evening hours, and during this time every motor car draws a trail car, and often both are crowded, so that the work which the motors are required to do is by no means light. The cars themselves are from the works of the St. Louis Car Co. and are painted a yellow ochre with silver and gold lettering. The motor cars are thirty-two feet over all, are provided with extra large six foot platforms, and are mounted on Brill trucks. The open trail cars are sixteen in number, and twenty-five feet long.

THE ROADBED

is constructed with seventy-eight pound Johnson girder rails laid on seven inch oak or chestnut ties placed two feet six inches between centres. Chairs are used on part of the line and extra ties are placed at the joints. The rails are connected with galvanized iron bonds with cross connections.

Span wire construction is used on the overhead line, supported by Syracuse Tube Co.'s iron tubular poles for about half the line, and by painted octagonal wooden poles for the remainder. The overhead line is divided into four sections. The trolley wire is hard drawn copper No. 0 B. & S. The span wires are of twisted galvanized iron, and insulators are used between the span wire and side poles as well as at the trolley wire hanger. The feed wires are of Habirshaw No. 000, and all the overhead line material is of the Anderson type.

The most difficult piece of construction met with on the line was at a point where the road crossed a canal on a swing bridge. At this place the usual drawbridge connections had to be made without at the same time interfering with the use of the tow path on one side. In the construction adopted two poles with bracket arms, one fifty feet long, and one slightly shorter were placed on each side of the street about thirty feet from the bridge, and these bracket arms were made to support a cross bar to which the trolley wires are attached. The electric



FIG. 3.—STREET SCENE—TRENTON PASSENGER RAILWAY.

line in Trenton is giving good satisfaction to the citizens of that city, and there is a general call to extend the use of electric power over the other branches as rapidly as possible. It is interesting to note that with ten motor cars the company handle 56 per cent. more passengers than formerly with eighteen horse cars.

The officers of the company are: President and general manager, Lewis Perrine, Jr.; vice-president, S. K. Wilson; secretary, J. H. Solomon; treasurer, G. H. Parker; superintendent, P. E. Hurley.

THE first electric car of the Toronto Street Railway was run August 10, and the regular service on Church Street was put into regular operation August 15. The cars were built by the Toronto Railway Co. and are finished inside with oak and other light wood. The bodies are eighteen feet inside, and the cars are twenty-six feet over all, and equipped with twenty horse power, Edison, single reduction motors each. The overhead work was done by the Cleveland Construction Co. The rails are of English make, and the ties are of cedar and laid in concrete.

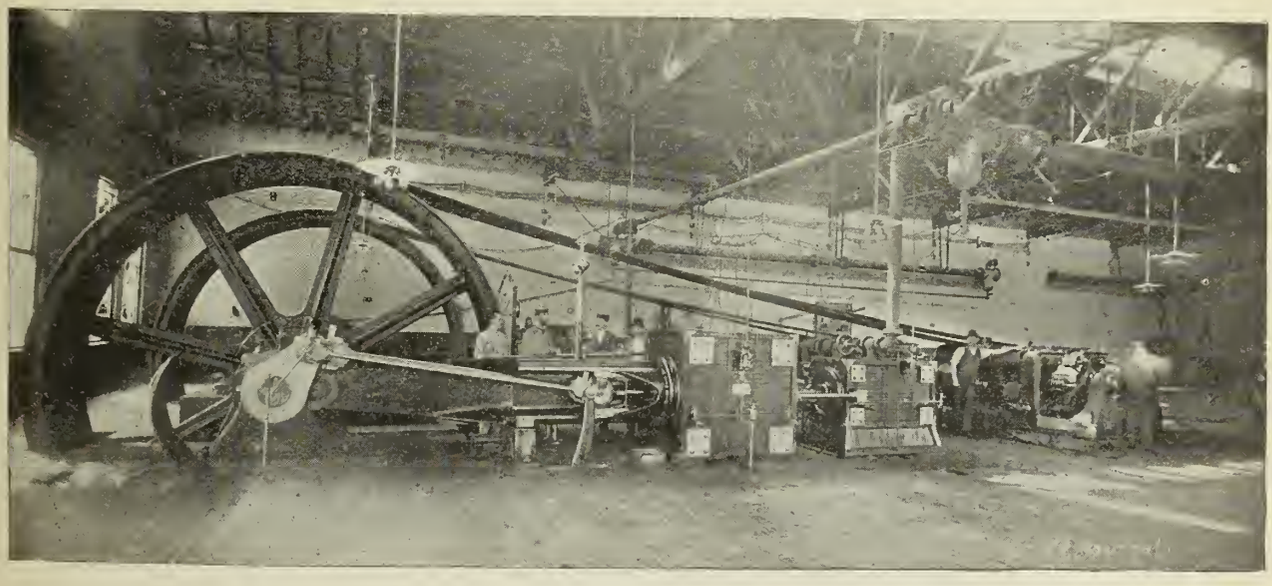


FIG. 2—INTERIOR OF STATION—TRENTON PASSENGER RAILWAY.

THE Sioux City & Morningside Street Railway, of Sioux City, has been opened for traffic.

The Broadway, New York, Cable Cars.

The accompanying engraving shows the type of car adopted for the Broadway Cable Railway in New York City. The car has a seating capacity for thirty persons, and the platforms are large and capacious. Special provision is made for convenient and quick ingress and exit as the doorways are larger than usual, and the approaches nearer the steps. Safety gates are provided which close the platforms on the left side, and quiet, ease and comfort are provided by the superspring running gear and bronze metal sashes.



CABLE CAR FOR THE BROADWAY, N. Y. LINE.

The interior finish is neat and tasteful, and is in wood of light shades, while the architecture, in style of the Bombay roof, is particularly pleasing, because of its lightness and tastefully curved lines. The 100 cars for this road are now being built by John Stephenson Co., Ltd., of New York City. Other particulars of the car were published on page 471 of our last issue.

VISITORS to the World's Fair will be enabled to pass from one end of Machinery Hall to the other at an elevation, and thus gain a birdseye view of the vast area of exhibits, and see many of the larger exhibits to much greater advantage than will be possible from the floor. To accomplish this three mammoth electric traveling cranes will be installed in Machinery Hall, each with a lifting and carrying capacity of 40,000 lbs. Contracts for their construction have been let to the Yale & Towne Manufacturing Co. of Stamford, Conn., the Morgan Engineering Co. of Alliance, O. and the Edge Moor Bridge Works of Wilmington, Del. Previous to the opening of the Exposition these cranes will be used for the moving of heavy exhibits; afterwards they will be covered with broad platforms capable of carrying several hundred people at each trip.

A COMPANY has been granted the privilege of carrying visitors by lake to and from the World's Fair grounds. It is the plan to run at least fourteen steamers. Between the "lake front" in Chicago and the grounds, four large boats, two of them whalebacks, and all having a capacity of 5,000 each, will make trips every half hour. The charge will be fifteen cents one way and twenty-five cents for the round trip.

Detroit Motor Hauling Four Trailers.

The cut accompanying this article shows a recent performance of a Detroit forty horse power motor equipment on the road of the Chattanooga Electric Street Railway Co., Chattanooga, Tenn. The car body on the motor truck is twenty-eight feet long, having been made out of two fourteen foot bodies joined. In addition to carrying this double car body, the motor equipment hauled four trailers, which, as will be seen by the cut, were fully loaded, the entire number of passengers on the motor and trail cars having been 355. This load is far beyond what any other motor equipment on this road is ever called upon to haul, but no trouble whatever was experienced by the motor car which still maintained the regular schedule time. The special event leading to the load shown was bringing passengers from a recent ball game at Chattanooga. This same motor equipment has often been timed on its regular trips when running without trailers, and has been found to run for a short distance at the rate of from twenty-five to twenty-eight miles per hour. This may be questioned by some, but Mr. Young, superintendent of the road, certifies to this fact. The Chattanooga Electric Street Railway Co. have, since putting on the Detroit motor shown in the cut, been investigating the different systems with a view to purchasing additional motors, with the result that they have now placed an order with the Detroit Electrical Works for three thirty horse power motor equipments, as they consider that motor to be the most economical in operation, and, having a great amount of traction, that it can draw more trailers than any other of the same capacity.



MOTOR CAR DRAWING FOUR TRAILERS.

A MEETING of the Massachusetts Street Railway Superintendents' Association was held August 24 at Lovell's Grove. The members were the guests of Superintendent Weeks, of the Quincy & Boston Street Railway Geo. A. Murch, of Worcester, presided.

THE Newton (Mass.) & Boston Electric Railway has commenced operations.

The Street Railways of New York.

PART II.

SECOND AVENUE RAILWAY CO.

A grant to build the Second Avenue line was secured from the city of New York in 1852, and the Second Avenue Railway Co. was chartered by the grantees January 21, 1853. Right to build on First Avenue was granted by an act of the legislature, passed May 6, 1884, and the consent of the city authorities was secured the same year. The company has a capital stock authorized by charter of $2,500,000, of which $1,862,000 has been issued, The funded debt of the company consists of $1,600,000 5 per cent., general consolidated mortgage bonds due 1909 and $1,500 5 per cent. debenture bonds due 1909.

The main line of the company extends from Fulton Ferry via Peck Slip, Pearl Street, Park Row, Bowery and other streets to the corner of Houston Street and Second Avenue, from whence it extends on Second Avenue to 129th Street. The Astor Place or First Avenue division has one terminus at Broadway and Astor Place, and extends thence by Stuyvesant Place, Second Avenue, 59th Street and First Avenue to 129th Street. There are also branches to Astoria Ferry at the foot of East 86th Street and to the corner of Worth Street and Broadway. The second division cars are painted blue, the others are of a yellow color. The total length of track owned by the company is twenty-eight miles. The company also leases one and one-eighth miles of track from the Bleecker Street & Fulton Ferry Street Railway Co. now controlled by the Houston Street, West Street & Pavonia Ferry Railway Co.

The line is laid with sixty pound stringer rail, and the number of cars owned by the company is 338, divided equally between box and open cars. Most of the cars are from the works of the John Stephenson Co. The cars make an average of about sixty miles daily each, or have a total car mileage of about 12,000. The main depot of the company extends from Second Avenue to First Avenue with sides on 96th and 97th Streets. There is also a depot at the foot of First Avenue. The officers of the company are: President, G. S. Hart; secretary, J. B. Underhill; treasurer, H. E. Doremus.

THIRD AVENUE RAILWAY CO.

The Third Avenue Railway Co. was chartered October 8, 1853, with a capital of $1,170,000. The company was organized to take over a street railway which had been built by a firm a short time previously, from Park Row through the Bowery and Third Avenue to 61st Street, and continued the construction of this road to the Harlem River. In 1870 the company leased a line on 125th Street from the East River to the Hudson River then operating twenty one-horse cars, and later, in 1880, acquired full control of the road. This line was changed to a cable road in 1885. In 1883 the Third Avenue Railway Co. commenced the construction of a cable line on Tenth Avenue from 125th Street to 186th Street, and this was put into operation in August, 1885. The company, as the readers of the STREET RAILWAY JOURNAL well know, is now cabling the main line of the road from Park Row to 129th Street. The authorized capital stock of the company consists of $5,000,000, of which $4,000,000 have been issued. The funded debt of the company consists of $5,000,000 5 per cent. mortgage bonds due in 1937, all of which have been issued.

The main line extends from City Hall to 130th Street a distance of eight and a quarter miles, which is double tracked. The power stations for operating the line by cable power will be two in number, one of 7,000 H. P. capacity at Third Avenue and 65th Street, the site of the present stables, and one of 2,500 H. P. capacity at Bayard Street and the Bowery. These stations are being installed by the Pennsylvania Iron Works Co. of Philadelphia, and a full description of the machinery was given in our issue of September, 1891. The road construction has been completed for the greater part of the distance between 130th Street and the City Hall, and the remaining portion is being rapidly finished by the contractor, Mr. T. E. Crimmins. Duplicate cables will be used. A full description of the system of cable construction adopted will be found in our issues of November, 1890, and May and July of the present year. The type of rail used is a seventy-nine pound, grooved, girder rail, part of which has been furnished by Wm. Wharton, Jr., & Co., and part by the Johnson Co. The cars for the main cable line are being built by the Laclede Car Co., and the open cars are thirty-eight feet eight inches over all, and the closed cars thirty feet over all, both having four-foot platforms at each end. These cars were illustrated and described in our February and March issues.

In the old track construction of the main line a sixty pound, stringer, centre bearing rail was used. The horse cars are of different styles, the open cars seating forty-two to fifty passengers, and the box cars being all of the ordinary sixteen foot type. These cars are painted vermilion, and some were furnished by Stephenson, while others were manufactured by the railway company themselves.

The 125th Street and Tenth Avenue branch, which is operated by cable power, is five and a quarter miles in length, all of which is double track, making with the main line an equivalent of twenty-eight and three-eighths miles of single track owned by the company. The power station for this division is at 128th Street and Tenth Avenue, and contains two 350 H P. Wright engines, and one 1,200 H. P. Dickson engine, which was installed recently. The rolling stock of this branch consists mainly of cross seat cars, seating thirty-two passengers, twenty-two feet body and thirty feet over all, which are used as open cars in summer and closed cars in winter. The company has also a number of regular closed cars with twenty-two feet body, twelve open grip cars and two long open cars forty feet over all and thirty-two feet body, seating forty-eight passengers. All the cars on this branch are painted carmine body, balance white, and were supplied by the J. G. Brill Co., Philadelphia, with the exception of the two forty foot open cars, which were supplied by the Laclede Car Co.

The company has two depots. The first built was erected in 1861 and enlarged in 1872, is located at the corner of 65th and 66th Streets and Third Avenue, and contains the offices of the company. The main cable station is now being erected in the rear of this building, and the latter will be reconstructed to fit it for the uses of the cable road. The company has also a very extensive depot occupying most of the block bounded by Third Avenue, 129th Street, Lexington Avenue and 128th Street. This depot is of brick, three stories in height, is fitted with all the latest car house appliances and was finished in the spring of 1891. Each of the three floors has a capacity for 110 of the forty foot cars, or 150 of the thirty foot box cars belonging to the company. The number of horses owned by the company is 1,750 and the number of horse cars 336. All these cars will be disposed of by the company when they commence operations by cable power.

The officers of the company are: President, A. J. Elias; vice-president, Henry Hart; secretary, Alfred Lazarus; treasurer, J. Beaver; superintendent, John H. Robertson; mechanical engineer of Tenth Avenue and 125 Street, C. G. Bliss; chief engineer of construction, A. H. Lighthall.

NEW YORK & HARLEM RAILROAD CO.

The New York & Harlem Railroad Co. has a capital stock authorized and issued of $10,000,000. The funded debt of the company consists of $12,000,000 7 per cent., consolidated mortgage bonds due in 1900, and $5,000 6 per cent., consolidated mortgage, sinking fund bonds due in 1893. This was the first street railroad ever built for carrying passengers, and was constructed in 1831–32. The line was laid with strap iron rails, first laid on stone and afterwards on wooden stringers, and originally extended on Fourth Avenue, from Prince Street to 14th Street. A statement of the early history of this railway was given in our February, 1891, issue. In 1873 the portion of the road which was then operated by steam was leased to the New York Central & Hudson River Railway Co. for 401

years. Under this lease the latter pays, as rental, an 8 per cent. dividend on the entire stock of the New York & Harlem Railroad Co., as well as the interest on the $12,000,000 consolidated mortgage bonds. The dividend paid last year by the New York & Harlem Railroad Co., from the earnings of the horse railway, was 2½ per cent., making a total of 10½ per cent.

This company attempted early in 1888 and subsequently to operate a number of storage battery cars, and has probably operated more cars of this kind at one time than any other street railway company. The system used was the Julien, and the electric company who supplied the electric apparatus the Julien Electric Traction Co., afterwards the United Electric Traction Co. These cars were withdrawn from service some time since.

The portion of the railway now operated by horse power consists of seventeen and three-quarters miles of track, extending from the Post Office, via the Bowery, Fourth Avenue and Madison Avenue to Mott Haven. There are also branches to East 34th Street Ferry, Broadway and Astor Place and East 86th Street Ferry. The line is divided into six divisions ; from the Post Office to 86th Street ; from 86th Street to 138th Street ; from the Post Office to 42d Street, and the three branches mentioned above. All the cars are painted yellow, with the exception of the Astor Place cars which are wine color on the body of the car.

The rolling stock consists of 185 box cars, which, with the exception of six ten foot cars in use on the 34th Street branch, are all sixteen feet in length. Most of the cars are from the works of the John Stephenson Co., though the railway company also owns some built by J. M. Jones' Sons Co., and some of their own manufacture. Most of the track is laid with a forty-seven pound stringer rail, but some recent portions have been laid with a Johnson girder rail and the Duplex Track rail.

The main depot of the company occupies a block bounded by Fourth Avenue, 32d Street, Lexington Avenue and 33d Street. The company also has a depot at the corner of Madison Avenue and 86th Street. The stock of the company includes 1,600 horses.

The average daily car mileage for the year ending June 30, 1892, was 8,508, an increase of about 580 car miles over the record for the preceding year. The company has no immediate plans for extensions or change of motive power. The officers are : President, C. Vanderbilt ; vice-president, C. C. Clarke ; secretary, and treasurer, Ed. V. W. Rossiter ; superintendent, Alfred Skitt ; purchasing agent, A. Bourne.

EIGHTH AVENUE RAILWAY CO.

The Eighth Avenue Railway Co. was chartered January 10, 1855, and the road was built by an association, and transferred to the Eighth Avenue Railway Co. for $762,500 in stock. The company have at present a capital stock authorized and issued of $1,000,000 and a funded debt of $1,000,000 in 6 per cent. bonds, due in 1914, and entitled "certificates of indebtedness." These certificates were issued to the stockholders as a special dividend and as representating earnings.

The line is twenty miles in length, all double track, and it extends from the corner of Broadway and Vesey Street to Eighth Avenue and 154th Street, with a branch to the corner of Broadway and Canal Street. For ease in operation, it is divided into two divisions, part of the cars running between the lower terminus and Central Park, the rest between Broadway and Canal Street and the upper terminus. The box cars belonging to the latter division are painted a canary color ; those on the first division are red, and all the open cars are painted canary color.

The rolling stock of the company consists of 176 cars, of which 125 are box and 51 open. The open cars were built by the Lewis & Fowler Manufacturing Co., are twenty-seven feet two inches in length, width six feet six inches, have seven seats, and a total seating capacity of thirty-five passengers. The box cars are of the sixteen foot type, and were built in the railway company's shops. A total car mileage of about 6,000 is made per day.

The weight of rail used per yard is sixty pounds, and it was supplied by the Pennsylvania Steel Co. The number of horses is 1,200 and the main depot is at the corner of Eighth Avenue and 50th Street. The officers of the company are : President, George Law ; vice-president, Jacob Hays ; secretary and treasurer, T. G. Affleck ; superintendent, E. R. Sherman, being the same, with the exception of superintendent, as with the Ninth Avenue Railway Co.

CENTRAL PARK, NORTH & EAST RIVER RAILWAY CO.

The date of the charter of the Central Park, North & East River Railway Co. is July 19, 1860. The present capital stock authorized and issued is $1,800,000, and the funded debt consists of $1,200,000 7 per cent. mortgage bonds due in 1902. This railway is commonly called the Belt Line, and extends from South Ferry on the West Side of the city, by the way of West Street and Tenth Avenue, and on the East Side by a number of streets including South Street, Avenue B, Avenue A and First Avenue. The cars cross the city on 59th Street.

The total length of all tracks and sidings owned by the company is twenty-six miles, all double track, and a side bearing tram rail weighing sixty pounds to the yard and manufactured by the Pennsylvania Steel Co. is in use on all tracks owned by the company. The depot of the company is a substantial brick building on the corner of Tenth Avenue and 53d Street, and is well constructed and appointed. A complete system of stable ventilation, which was described in our March, 1891, issue is employed and gives very satisfactory results.

The total number of cars owned by the company is 196, consisting of 136 sixteen foot box cars manufactured by Stephenson, Brill and Jones, and sixty twenty-six foot open cars manufactured by Stephenson. The cars run on a headway of from two to four minutes during the day, and twenty minutes during the night, and cover about sixty miles each per day with a total car mileage of 7,000 per day. All cars have bodies painted canary, except those which operate on 59th Street only, which are painted red and lettered instead of being numbered. The total number of horses owned by the company is 1,157, and each covers on an average twelve miles per day. For dealing with snow in the winter the company have four snow plows and three sweepers.

The officers of the company are : President, G. Hilton Scribner ; vice-president, C. Densmore Wyman ; secretary and treasurer, J. L. Valentine ; superintendent, J. H. Oakley.

DRY DOCK, EAST BROADWAY & BATTERY RAILROAD CO.

The Dry Dock, East Broadway & Battery Railroad Co. was chartered December 8, 1863, and has a capital stock authorized and issued of $1,200,000, and a funded debt of $840,000, 7 per cent., first mortgage bonds due in 1893, and $1,100,000, 6 per cent. certificates of indebtedness due in 1914, and issued to stockholders for surplus earnings undivided.

The length of line owned by the company is eighteen and a half miles, laid with a sixty pound, centre bearing, stringer rail, manufactured by the Pennsylvania Steel Co. The line is divided into four divisions, viz : The City Hall, Avenue B & 34th Street line which extends from the corner of Ann Street and Broadway, via Park Row, East Broadway, Avenue B and First Avenue to East 34th Ferry ; the Dry Dock & East Broadway line from the same lower terminus, via Park Row, East Broadway, Avenue D and Avenue A to 23d Street Ferry ; the Grand & Cortlandt Street line, which extends from Cortlandt Street Ferry to Grand Street Ferry by Greenwich, Canal and other streets ; and the Debrosses, Vestry & Grand Street line which extends from the foot of Desbrosses Street on the West Side by Washington, Vestry and other streets to Grand Street Ferry. The cars on the first and fourth divisions are painted blue, the second division cars are distinguished by their green color, and the third are painted yellow.

The total number of cars owned by the company is 181, of which 173 are box cars and eight open. The third

division uses twelve to fourteen foot box cars. All the other box cars are sixteen feet in length and all the open cars eighteen feet. The company manufacture their own cars. Each car in use covers on an average fifty miles per day. The total number of horses owned by the company is 943, and they have three snow plows and the same number of snow sweepers. The office and main depot of the company is at 605 Grand Street, and the uptown depot at the corner of 44th Street and Avenue B. An 8 per cent. dividend was declared last year on the capital stock. No important changes or extensions are contemplated by the company. The officers of the company are: President, William White; secretary and treasurer, Richard Kelly; auditor, E. T. Landon; superintendent, Fred. F. White.

CENTRAL CROSSTOWN RAILWAY CO.

The Central Crosstown Railway Co. received its charter March 28, 1873, and purchased its line and franchises from the original grantees during the same year. The present capital stock of the company, authorized and issued, is $600,000, and the funded debt consists of $250,000, 6 per cent. first mortgage bonds due in 1922. The company also operates the line of the Christopher & Tenth Street Railway Co. under a perpetual lease which went into operation, May 28, 1892.

The line is divided into four divisions; the main, or blue line which has one terminus at the foot of Christopher Street, North River, and which extends to the foot of East 23d Street, through West 11th Street, 14th Street, Broadway, 17th and other streets; the white line, formerly that of the Christopher Street & Tenth Street Railway Co., which has one terminus at the Christopher Street Ferry and which extends to the corner of East Tenth Street and Avenue A by way of Greenwich Avenue, 8th Street and Avenue A, the cars returning by a different route; the yellow line which extends from Christopher Street Ferry to the corner of Fourth Avenue and 14th Street, through Ninth Avenue; and the red line which extends from the 23d Street Ferry to West 14th Street. The daily car mileage on all of these lines averages 5,830, divided about as follows: blue line, 2,900; white, 1,625; yellow, 846; red, 460.

The length of line owned by the company is four and one-fifth miles, and leased by the company seven and a half miles, making a total of 11.7 miles. The track is laid with a forty-five to fifty-two pound, centre bearing, stringer rail. The number of cars owned by the company is 157, mostly from the works of the Stephenson company, though the Lewis & Fowler Manufacturing Co. is also represented. Both twelve and sixteen foot cars are used. The company has also two snow sweepers and two snow plows. The main depot of the company is at 170 Christopher Street, and the number of horses owned by the company is 846. The company pays an annual dividend on the stock of 7 per cent. The officers are: President, Geo. S. Hart; vice-president, A. Cammack; secretary, Milton I. Masson; treasurer, E. Burton Hart.

CHRISTOPHER & TENTH STREET RAILWAY CO.

The road of this company is operated by the Central Crosstown Railway Co. as described above. The officers are: President, J. Downey; vice-president, I. Hendrix; treasurer, Geo. W. Linch.

FORTY-SECOND STREET, MANHATTANVILLE & ST. NICHOLAS AVENUE RAILWAY CO.

The Forty-second Street, Manhattanville & St Nicholas Avenue Railway Co. received its original charter August 29, 1878, but before commencing operations in 1885 was granted important extensions of franchise. The capital stock of the company at present consists of $2,500,000 authorized and issued and a funded debt of $1,200,000 6 per cent. first mortgage bonds due in 1910, and $1,525,060 6 per cent. second mortgage bonds due in 1915.

The length of the road is 19.82 miles, all double track. The line is divided into four divisions: The main line which extends from the foot of West 42d Street to the foot of East 42d Street and by First Avenue to the foot of East 34th Street; the Tenth Avenue line, which extends from East 34th Street over the main line as far as Tenth Avenue, thence by the Boulevard and 86th Street to Riverside Drive; the Broadway & Boulevard line, which extends from East 34th Street over the main line to Seventh Avenue, thence by Broadway, the Boulevard and Manhattan Street to 129th Street and Fort Lee Ferry; and the Manhattan Street & 110th Street line, one terminus of which is at Fort Lee Ferry and the other at 110th Street and First Avenue, the cars running by way of 129th Street, Manhattan Street and St. Nicholas Avenue. The cars on the latter division are from twelve to fourteen feet in length. The other cars are of the standard sixteen foot type, and white, blue, green and orange are the colors employed to distinguish the different lines.

The track is laid with sixty pound, centre bearing, stringer rail, and the company have two depots, one on 42d Street between Lexington and Park Avenues, and one at 119th Street, just west of the Boulevard. The number of cars owned by the company is ninety-one, part of which were built by the John Stephenson Co. and part by the company themselves. The number of horses owned by the company is 838. For dealing with snow in winter the company have three snow plows requiring from four to eight horses, and two Lewis & Fowler, ten horse sweepers. They have also recently ordered a third sweeper. No extensions are contemplated at present. The officers of the company are: President, John S. Foster; secretary, C. F. Naething; treasurer, Jacob Fleischhauer; superintendent, S. M. Sisson.

FORTY-SECOND STREET & GRAND STREET FERRY RAILROAD CO.

The Forty-second Street & Grand Street Ferry Railroad Co. was incorporated on February 21, 1863, and was successor to the Grand Street Ferry Railroad Co. incorporated only a short time previous. The company has a capital stock authorized of $750,000, of which $748,000 has been issued. The funded debt consists of $236,000, 7 per cent., first mortgage bonds due in 1893.

One terminus of the line is at Grand Street Ferry on the East Side, and the other at 42d Street Ferry on the West Side, the route including Avenue A, 14th Street, Fourth Avenue, 23d Street, Broadway, 34th Street, Tenth Avenue and 42d Street. The entire length of the line owned by the company is ten and a quarter miles, all double track, laid with a fifty-six to sixty-four pound, centre bearing, stringer rail which has been down ever since the company commenced operations. The number of cars owned by the company is seventy-two of which fifty-two are box and twenty open. The car bodies are painted green, and they are from the shops of a number of car builders. The number of horses owned by the company is 480, and their only depot is at the 42d Street terminus of the line. The company contemplate no extensions or important improvements in the immediate future. The company paid a dividend of 16 per cent. last year. The officers of the company are: President, J. M. Calhoun; secretary, Chas P. Emmons; treasurer, R. J. Jacobs.

NORTH & EAST RIVER RAILROAD CO.

The North & East River Railroad Co. has a capital stock of $300,000, all issued, and a funded debt consisting of $250,000 6 per cent., twenty year bonds. The track of the company extends from Burling Slip near the corner of Water, by way of Water and Fulton Streets, to the Fulton and Barclay Street Ferries, on West Street. The distance is about one and a half miles, and for about one-half this distance the company uses the leased tracks of the Bleecker Street and Fulton Ferry Railway Co. and the Ninth Avenue Railway Co. The track owned by the North & East River Railway Co., is laid with a forty-five pound, side bearing, tram rail.

The depot of the company is on Front Street, near Fulton Street, and the number of horses owned is seventy-five. The cars, which are twelve in number, have a length of body of twelve feet, and are painted magenta.

The line was constructed in 1888, and at that time was intended as an electric conduit line, and the conduit, which is still in position, was laid by the Bentley-Knight

Electric Co., but it has never been used for electric cars. The road is now being operated by the contractor of the road, J. H. O'Rourke, of 40 Court Street, Brooklyn.

The officers of the company are: President, O. W. Child; vice-president, E. P. McLaughlin; secretary, F. C. Gaffney; treasurer, Thomas F. Carney; superintendent, W. Farrell.

THE UNION RAILWAY CO.

The Union Railway Co., as mentioned in our last issue, is the title of a company recently formed by the consolidation of the Harlem Bridge, Morrisania & Fordham Railroad Co., the North Third Avenue & Fleetwood Park Railroad Co. and the Melrose & West Morrisania Railroad Co. The company is authorized by charter to issue $2,000,000 capital stock, and has already issued one half of this amount. The authorized bonded indebtedness of this company is also $2,000,000, of which one half has been issued. The Harlem Bridge, Morrisania & Fordham Railroad Co., the principal road of the three consolidated under the name of the Union Railway Co., received its charter May 1, 1863, and had a capital stock of $350,000, and bonded indebtedness of $76,000.

The territory covered by the lines of the Union Railway Co., lies in that portion of New York City which is north of the Harlem River. The line is divided into four divisions which have a common terminus at 129th Street and Third Avenue. The first or Boston Avenue division crosses the Harlem River and runs by Third Avenue to Mott Haven and Melrose and then by Boston Avenue to West Farms. The second or Fordham division crosses the Harlem River and runs by Third Avenue through Mott Haven, Melrose, Morrisania, Tremont and Fordham to Fordham Avenue. The third or Port Morris division extends by Third Avenue to 138th Street and Port Morris. The fourth division crosses Harlem River and then extends through 133d Street and the Southern Boulevard to West Farms. The main depot of the company is at the corner of 170th Street and Third Avenue, and the offices are on Third Avenue near 128th Street.

The length of line owned by the company is about twenty miles, of which fifteen have been equipped with electric apparatus. The work of electrical construction has been conducted under the superintendence of L. H. McIntire, and the company expected to have the first electric car in operation by October 1.

The power station, is located at West Farms on the Bronx River at about the middle point of the entire electric system when completed. The station is of brick, 75×235 ft., was designed for a capacity of 5,000 H. P. and is similar in general arrangement and appearances to the power station of the Lynn & Boston Railway Co. at Lynn, Mass., which was also designed by Mr. McIntire. The location of the station on the Bronx River gives facilities for the receipt of coal by barges, and plenty of water for condensing purposes. The engines, of which three are at present installed, are of 350 rated H. P. capacity each, are tandem compound condensing and were built by C. & G. Cooper & Co. of Mt. Vernon, O. The generators are of the Thomson-Houston, 300 K. W., multipolar type, and four are at present in position. They are driven directly from the engines by means of belts furnished by the Charles Munson Belting Co. The boiler equipment consists of four boilers of 250 H. P. each, supplied by the Babcock & Wilcox Co. The stack is of brick, and is 176 ft. high.

The rolling stock belonging to the company consists of sixty new motor cars and forty-nine horse cars. The former are exceedingly tasteful in design and consist of thirty open cars and the same number of closed cars. The car bodies of both the open and closed cars were manufactured by the St. Louis Car Co. The car electric equipment consists of Thomson Houston motors, which are mounted upon Peckham trucks. The closed cars are eighteen feet long inside measurement, and the open cars are of the eight reversible seat pattern.

The track of the portion of the line equipped for electric cars is laid with a seventy pound girder rail six inches high, furnished by Wm. Wharton, Jr., & Co. The rail is mounted on a stringer which rests upon ties spaced three feet between centres. Tie rods are also used. The rails are connected with copper rail bonds. A part of the line extends under the structure of the Suburban Elevated Railroad Co., and here the trolley wires are supported on the cross girders of the elevated railway. Elsewhere iron lattice poles, supplied by Milliken Bros., are employed to support the wires.

The Union Railway Co. have recently secured the right to make important extensions in the northern part of New York City. These include lines on Jerome Avenue from McComb's Dam Bridge, on Morris Avenue to Fordham Landing road, on Willis, Melrose and Webster Avenues, on Tremont and Webster Avenues and Riverview Terrace, on Olin Avenue, on Boscobel Avenue, on Sedgewick Avenue and Kingsbridge Road. The company expect to commence construction promptly and the system when completed, will comprise forty-seven miles of track.

The officers of the company are: President and general manager, Edward A. Mahar; vice president, Charles A. Stadler; secretary and treasurer, Thomas W. Alcott; superintendent, James Carrigan.

THE TWENTY-EIGHTH & TWENTY-NINTH STREET RAILWAY CO.

The Twenty-eighth & Twenty-ninth Street Railway Co. has a capital stock of $500,000 and bonded indebtedness of the same amount. The company has considerable track in New York City, most of which was laid in the year 1890, but has not commenced to operate cars. The terminal points of the line on the East Side are at the 23d Street and the 34th Street Ferries, and on the West Side at the 14th Street, 23d Street and 42 Street Ferries. All the track of the company to be laid is in place, with the exception of two sections on 28th and 29th Streets between First and Second Avenues, and a section on Thirteenth Avenue between 23d and 14th Streets. The laying of the latter has been prevented by delay on the part of the municipal authorities in grading the street, and in Twenty-eighth and Twenty-ninth Streets, mentioned above, through a failure on the part of the railway company to reach an agreement with the Twenty-third Street Railway Co. who have exclusive right to the use of those streets for their tracks. The managers of the Twenty-eighth & Twenty-ninth Street Railway Co. hope to conclude negotiations with the latter company by which they can soon complete their system and put their cars in operation. The line is laid with a sixty pound grooved girder rail. The offices of the company are at 45 William Street, and the officers are: President, J. H. Crane; vice-president, D. D. Conover; secretary, D. J. Apgar.

The Electric Street Railway System of Little Rock, Ark.

On April 1, 1890, Mr. H. G. Allis, president of the First National Bank of Little Rock, Ark., to whom Little Rock is indebted for its electric street railway service, purchased a controlling interest in the Citizens' and Little Rock Street Railway companies, and organized the Capital Street Railway Co.

On July 22, 1890, this company secured authority from the City Council to propel their cars by electricity, and a short time later Mr. Allis secured control of the City Electric Street Railway Co. and the other lines were then leased to this company. The authority of the City Government to lease these grounds was passed on February 16, 1891, and on the same date, the Capital Street Railway Co. was granted additional rights.

In October 1891, the company closed a contract with the Thomson-Houston Electric Co. to equip the system with electricity. The local company built its own power house, track and roadbed. Mr. H. P. Bradford, general manager of the company, personally superintended the construction of the roadbed and track. The Thomson-Houston company's contract work, consisting of the overhead construction and the installation of the electrical machinery, was placed in charge of Mr. E. E. Downs, one of the constructing engineers of that company.

The engineering of the power station was placed in charge of Mr. B. J. Arnold, consulting engineer of the Chicago office of the Thomson-Houston Electric Co., who designed the plant and superintended its construction. Mr. Arnold was assisted by Messrs. Rickson & Thompson, architects of Little Rock, Ark., to whom should be given the credit of the artistic front and details of the upper stories of the building.

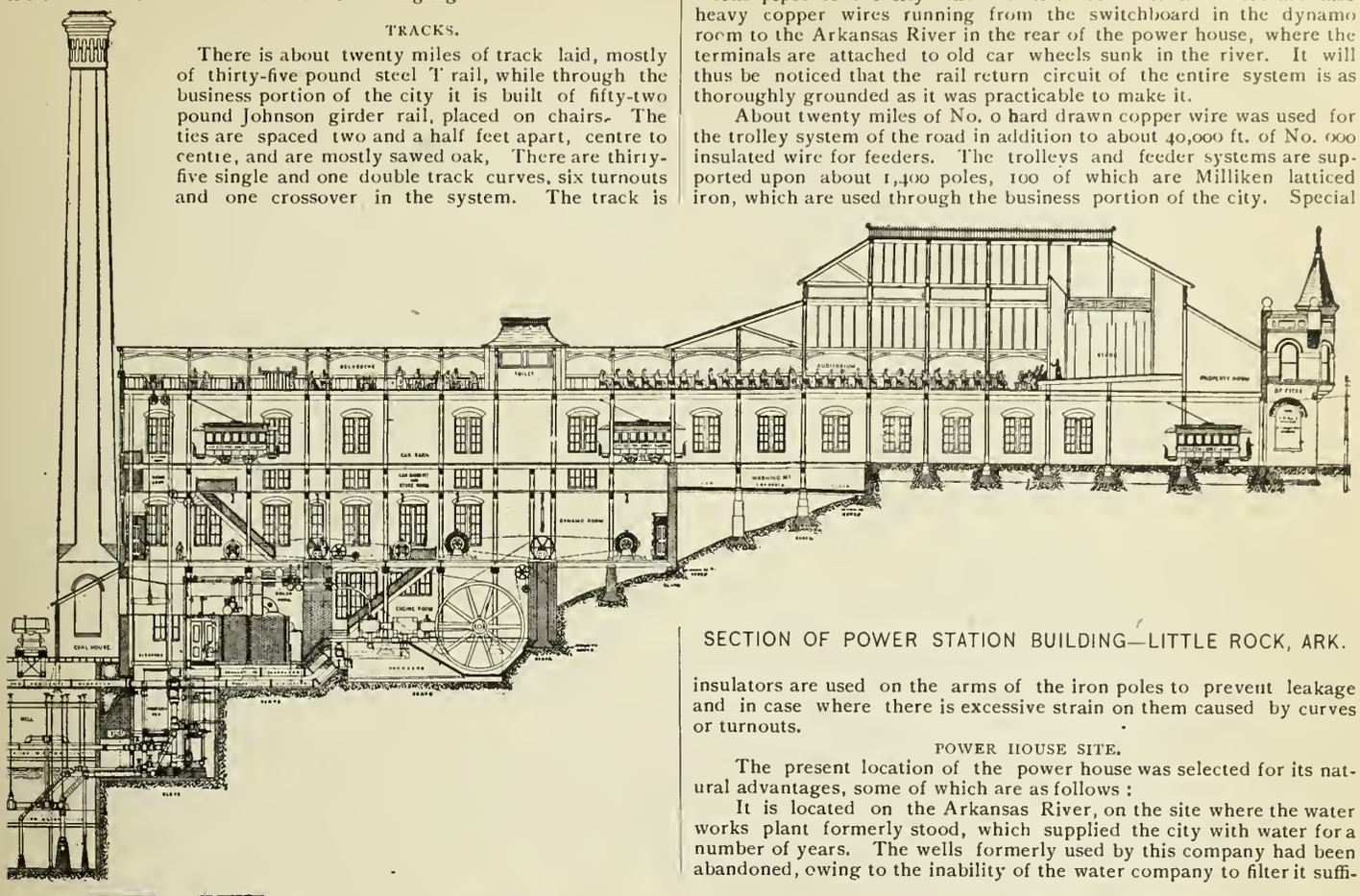
During this period of 131 days that elapsed, from the beginning of the construction to the opening of the road, thirty-two days were lost on account of Sundays and rainy weather, leaving but ninety-nine

actual working days. During this time the entire system, of about twenty miles of road, was either taken up and new rails and ties laid or the track narrowed from broad to standard gauge.

TRACKS.

There is about twenty miles of track laid, mostly of thirty-five pound steel T rail, while through the business portion of the city it is built of fifty-two pound Johnson girder rail, placed on chairs. The ties are spaced two and a half feet apart, centre to centre, and are mostly sawed oak. There are thirty-five single and one double track curves, six turnouts and one crossover in the system. The track is bonded throughout with No. 6 bond wire, joined to the rails with the Wheeler channel pins. These bond wires are attached to a No. 0 copper ground wire running the entire length of the track and returning to the power station. These ground wires are attached to old car wheels and other metal plates which are sunk in the old wells and ravines at suitable distances along the road so as to secure as perfect a ground as possible. The return wires are also attached to the water-works pipes of the city wherever it is convenient. There are also heavy copper wires running from the switchboard in the dynamo room to the Arkansas River in the rear of the power house, where the terminals are attached to old car wheels sunk in the river. It will thus be noticed that the rail return circuit of the entire system is as thoroughly grounded as it was practicable to make it.

About twenty miles of No. 0 hard drawn copper wire was used for the trolley system of the road in addition to about 40,000 ft. of No. 000 insulated wire for feeders. The trolleys and feeder systems are supported upon about 1,400 poles, 100 of which are Milliken latticed iron, which are used through the business portion of the city. Special insulators are used on the arms of the iron poles to prevent leakage and in case where there is excessive strain on them caused by curves or turnouts.

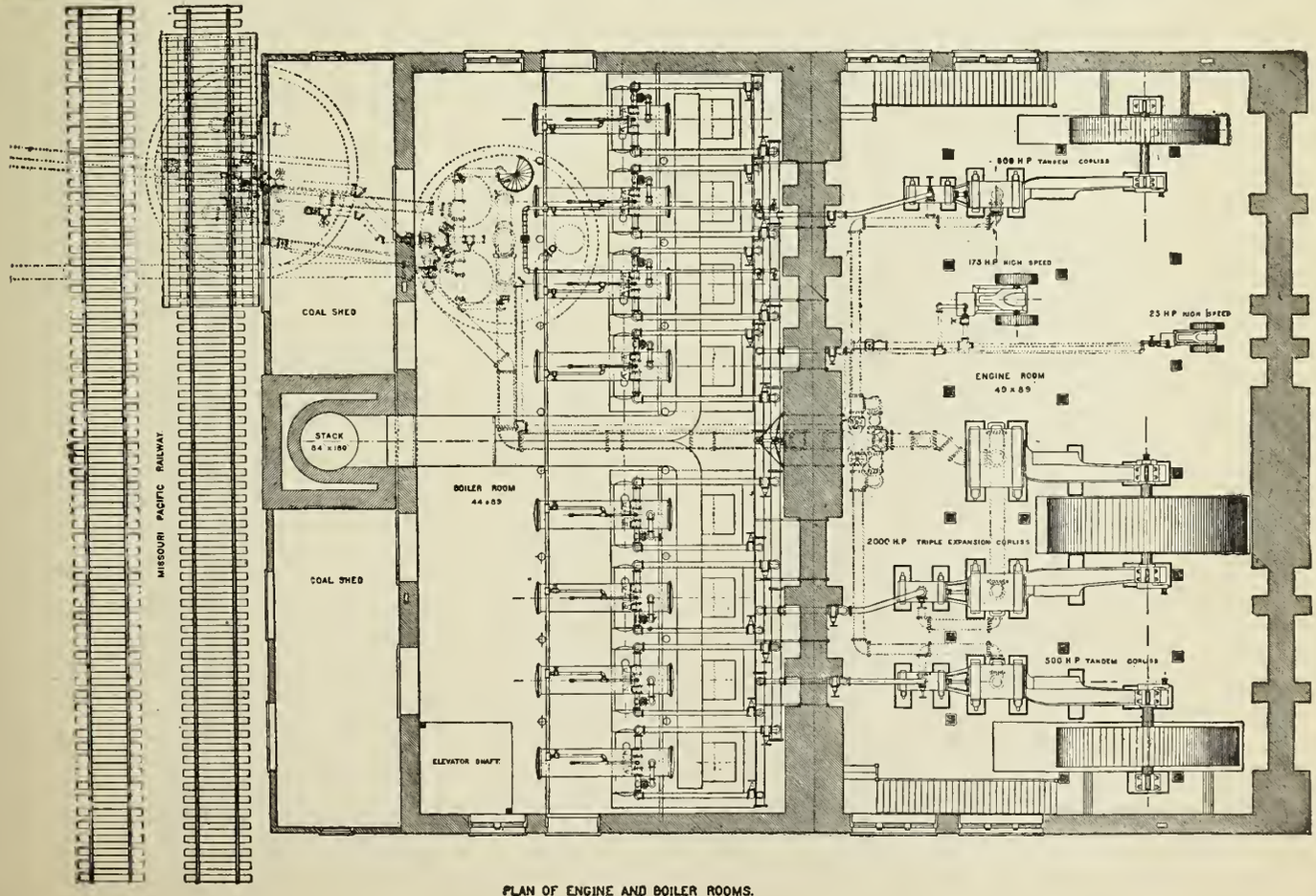


SECTION OF POWER STATION BUILDING—LITTLE ROCK, ARK.

POWER HOUSE SITE.

The present location of the power house was selected for its natural advantages, some of which are as follows :

It is located on the Arkansas River, on the site where the water works plant formerly stood, which supplied the city with water for a number of years. The wells formerly used by this company had been abandoned, owing to the inability of the water company to filter it sufficiently well for city use. The property that went with those wells consisted of a lot 100 ft. wide by 350 ft. deep, extending south to North Street, over which the principal line of the road extending from the depot to the city runs. This would bring most of the cars by the power station every trip if this site was selected. Again, there was a solid



PLAN OF ENGINE AND BOILER ROOMS.

SCALE IN FEET

slate substructure which would give a good foundation, and the profile of the lot was such that it enabled a building to be designed which brought the entire power station, car barn, repair shops, offices, etc., under one roof and on one set of foundations, making it thereby cheaper to construct than it would have been had two pieces of real estate been purchased and two distinct buildings been constructed. The main line of the St. Louis Iron Mountain & Southern Railway runs along the river bank in the rear of the building, enabling a side track to be built cheaply and fuel delivered directly into the coal house with but one handling. Again, being located upon the river at a point midway between Little Rock and Big Rock, overlooking the river for miles in either direction, and the Ozark Mountains on the north and west, it gives the most beautiful view that can be obtained in the city, which resulted in the designer providing for a summer theatre to be placed upon the roof. To those not familiar with the location of this plant, the idea of a theatre on the top of the power station may seem absurd, but when it is remembered that the roof of this building has an area of over six-tenths of an acre, and is located about 100 ft. above the river, entirely removed from the noise of the machinery and giving one of the most beautitul views that can be obtained in the Ozark Mountains, the idea may not seem so peculiar. Again, as the power station is located on the main line of the street railway, the theatre produces a source of revenue to the road that makes it quite an important factor.

On a level with the main track of the railroad formerly mentioned, is the side track shown on the longitudinal section. This track is carried across the outside well on trusses. Next to the side track comes the coal house which is twenty feet wide and extends the entire length of the building, and is capable of storing 300 tons of coal.

BOILER ROOM.

Passing through the coal house, we enter the boiler room which, as shown on the plan, is a room 44 ft. × 89 ft. × 25 ft. high ; in it will be placed, when the plant is completed, eight 250 H. P. water tube boilers, three of which are at present installed. Over the top of these boilers is a sheet iron breeching extending to the space between the centre row of columns where they join the main trunk breeching leading to the smokestack located outside the main building. The plant is at present operated from an iron stack five feet six inches in diameter, and 180 ft. high, set off to one side so that the permanent brick stack can be constructed in its proper position without interrupting the operation of the plant. The permanent stack will be built of brick and will be eighty-four inches in diameter and 180 ft. high.

Just south of the boiler room comes the engine room with its floor located six feet higher than that of the boiler room, thereby providing for the exhaust piping system to be located under the floor. This room is 49 × 89 ft. and will contain, when completed, 3,000 H. P. of engines ; three of these, aggregating 1,000 H. P., are at present installed.

The dynamo room is 133 ft. × 88 ft. 6 ins. wide. In this room will be located two distinct line shafts resting upon the tops of the partition walls of the building. From the north line shaft, which is at present installed, there will be belted eight 110 H. P. Thomson-Houston railway generators, five of which are now in use. There will also be an additional 110 H. P. railway generator, belted direct from a high speed engine, located below in the engine room, for the operation of the owl trains after the main railroad part of the plant is shut down. The other line shaft is located on the top of the wall at the south end of the engine room, and from it will be driven the lighting machinery. The two shafts will be cross connected at their centres with a fifty-four inch belt, thereby enabling any generator in the house to be driven from any engine in case of accident to any one of the engines. The railroad switchboard is located in the north end of the building as shown on the plan of the dynamo room, and the lighting switchboard in the south end, so that the the leads from the dynamo to the switchboard may be as short as possible, also keeping the railway and lighting plants distinctly separate. Over each row of generators and the line shafting extends an overhead single track railroad with the necessary differential pulleys, etc., for lifting out of an armature or box caps. This railway runs to the elevator shaft so that the heavy part may be delivered directly 'into the elevator and transferred to the machine shop above with but little labor.

On each side of the dynamo room are stairways extending up to the pit room above. This room was placed in the plant to provide for easy access to the motors and cars for making repairs at all times without necessitating the changing of location of the cars. In the rear of this room, on the river end, is a machine shop fifteen feet wide and eighty-eight feet long, a portion of which is partitioned off for a supply room. The heavy portions of the machinery can be dropped down into this pit room, placed on hand trucks and drawn to the machine shop for repairs with but very little physical exertion on the part of the mechanics. It also provides an easy means for wiping the cars.

Extending fifty feet south of the pit room is the washing pit, having a tar concrete floor sloping to the south, so the drainage will run into the sewer connected at that end, thereby preventing the water from flowing over the dynamo room. This washing pit extends the entire width of the building under all of the tracks, so the cars from either track can be run over the pit, washed, drained and run back to place without any transferring.

On each side the pit room extend stairs rising into the car barn. This room is 88 ft. 6 ins. × 297 ft., and cnotains eight tracks four feet and one half inch gauge and is capable of storing ninety-six motor cars. In the rear, on the river side, are located the small benches and stands for taking care of the headlights and other small repairs of the cars, giving a pleasant, airy room for the car barn employes.

The present electrical equipment consists of twenty-eight Thomson-Houston, double, fifteen horse power motor cars and five 100 H. P. multipolar railway generators with the switchboard. and overhead construction and appliances, with provisions made for the adding of four more generators and other cars without any additional expense except for the purchasing of the machinery. The plant is designed for the addition of an electric lighting plant, having a capacity of 10,000 sixteen candle power incandescent lamps and 1,000 2,000 C. P arcs, a portion of which will be added as soon as the necessary business arrangements can be made.

The present equipment of engines consists of Hamilton-Corliss tandem, compound, condensing engines, having cylinders 20×36×48 and 16×30×48 respectively. Also one 8×10 Ideal, high speed engine for driving eighteen arc lights, now in operation in the building. The engine room was designed for an additional 2,000 H. P., triple expansion Corliss engine, which willdrive the lighting plant when installed, and one 175 H. P., high speed engine for driving the railway generators to operate the owl trains, or those trains that run at night after the main plant is shut down.

There are now three 250 H. P. Heine boilers installed, and provision made in the boiler room for the addition of five similar boilers when the plant is extended.

There is at present one 1,000 H. P., Smith-Vaile, duplex condenser installed, and two Gordon steam pumps for the boiler feeders, each one of which is capable of supplying the entire plant. Provision is made for an additional 2,000 H. P. condenser.

The shafting now running consists of about eighty feet of six and a half inch hammered iron shaftings with 62×15 in. friction clutch pulleys, tighteners and clutches to receive the power from the two large engines now installed. The shaft is divided near the centre so that one portion of it can be kept going on in case of a hot journal in either part. The cap stones are set and the bolt holes made in the foundations ready to receive the other line shaft for driving the electric lighting machinery when the time comes for placing it.

CONTRACTORS.

The machinery was supplied by the following contractors :

Electrical equipment, Thomson-Houston Electric Co. ; engines, Hooven, Owens & Rentschler Co., Hamilton, O. ; boilers, Heine Safety Boiler Co., St. Louis, Mo. ; shafting, Hill Clutch Works, Cleveland, O. ; belting, Chicago Belting Co., Chicago ; condensers, Smith-Vaile Co., Dayton, O. ; boiler feed pumps, Gordon Steam Pump Co., Dayton, O. ; heaters, Wm. Baragwanath & Co., Chicago ; live steam purifiers, Hoppes Manufacturing Co., Springfield, O. ; steam piping, Nick, Peay & Co., Little Rock, Ark. ; steam pipe covering, Chicago Fire Proof Covering Co., Chicago ; smokestack, D. R. Wing & Co., Little Rock, Ark.

Success of Electric Traction in Binghamton, N. Y.

It is always a pleasure for us to record the success and prosperous condition of street railway lines, especially in cases where the success is due, not alone to natural causes, but is attained in spite of many adverse conditions, by the ingenuity and skill of the management. This applies fittingly to the Binghamton Street Railway Co., whose lines are under the management of G. T. Rogers, president, and J. P. E. Clark, manager, who have the hearty support of the press, the city officials and the general public.

The original line of this company extended from the State Hospital on the east through the city, a distance of about five miles, to Ross Park on the south, and this was one of the first roads in the country to be equipped for electric traction, the original motors being of the Van Depoele type. Two years ago, the line within the city limits was laid wih a heavy Johnson girder rail, and the cars were equipped with Edison No. 6 motors which have since been in continuous operation, and we are informed by the management that after a service of three years the electric equipment is in better condition for service than it was when bought, and that it has rendered more service during the last year than during any other equal period. The terminals of the line are laid with a thirty-five and forty pound T rail, which with slight repairs has stood up remarkably well under the traffic. The turnouts where the T rail is employed are entered by means of a Leary spring switch, which has proven in every way satisfactory.

Two other lines have recently been consolidated with this company's system, and they now control all except the Court Street and East & West End lines, which use the tracks of the Binghamton company for a considerable distance. The company are about to equip their entire system with electricity and are erecting a large power station on Lewis Island near the present car barn and will equip it with power sufficient to operate the entire twenty miles of road.

In relaying the track of the recently acquired lines, a seventy-one pound, half grooved, seven inch girder rail

is being employed on the paved streets, and a forty-eight pound T rail on the unpaved portion. The diamond turnouts for the new construction have been ordered from the Pennsylvania Steel Co. The overhead construction has already been begun on the Port Dickinson route, and it is expected that the line will be in operation by January 1. The cars are to be equipped with Thomson-Houston W. P. motors of fifty horse power.

As a means of promoting traffic, the company, some time since, leased Ross Park for the term of ten years, and have fitted it up with numerous attractions, and as a result of this and other enterprising strokes the lines carried during the month of July over 200,000 passengers. This park embraces about 100 acres, and has been laid out in one of the wildest mountain sections adjacent to the city, and consists of deep gorges and steep bluffs covered with a dense natural growth which has been preserved as far as possible in laying out the walks and drives through the park. Some of the attractions which the company have provided consist of a well assorted "Zoo," including a deer park and cages of bears, birds, monkeys, rabbits and many other animals. There is a long switchback railroad, an archery range, an electric gallery, swings and a dancing pavilion. A building is provided in which is a large dining room and kitchen with tables for picnic parties, and also soda water fountains, pony carriages and photograph galleries, and on the top of the mountain an observatory 120 ft. high, giving an extended view of the surrounding country. The company also employ a string band and orchestra which give concerts from a band stand every pleasant afternoon and evening

The park is lighted by rows of incandescent lamps and oil headlights, making it as attractive in the evening as in the day time. By an act of the legislature the sale of beer and liquor is prohibited within the park, and within one half mile therefrom, so that the premises are exceptionally free from disorderly characters, and the very best citizens patronize it almost daily. Frequently the families of business men go to the park in the afternoon, where they are joined by the husbands after business hours, and sup together at the park and spend the evening. Not only are the Binghamton citizens patrons of the park, but the street railway company are in communication with the church and other societies of the villages within a radius of 100 miles of the city, and by proper efforts succeed in bringing a large number of excursion parties to the cars who come on the steam lines and take the electrics to the park.

Binghamton is one of the most beautiful and attractive cities in the state, and doubtless this fact assists the company greatly in inducing excursion parties, but the efforts of the company in this direction may serve as a hint to other lines, as there are many other cities where street railway traffic could be greatly increased by the establishment of park attractions and the offering of sufficient inducements for people to patronize them.

The above will illustrate the foresight of the management as the gross earnings of the original line and two of the acquired short lines show that the gross earnings in two years have increased more than five times, and promise as good a showing this year, rendering the securities very valuable. The new bonds which the company intend to issue on the reconstructed lines are already in demand, as the earning capacity is at present in excess of the interest on the entire amount of bonds to be issued. Almost the entire stock is held by Binghamton people who are holding it as a permanent investment.

Meeting of the International Street Railway Association.

The seventh annual convention of the International Street Railway Association will take place at Buda-Pesth on September 8, 9 and 10, and will probably be largely attended. The speakers include representatives from street railway companies in Austria, Italy, Germany, France, Belgium and Holland.

The official programme of the meeting is as follows :

1.—Report on the condition of the Association.
2.—Auditing of accounts for the year 1891.
3.—Discussion of the following question :
In adopting the narrow gauge for a railway line, what are, according to your experience or in your opinion, the respective advantages of the three narrow gauges most in vogue, viz., 1 metre, 0.75 metre, 0.60 metre ?

Speaker:—Herr Ziffer, vice president of Kolomaer local roads, Vienna.

4.—Debate on the following question : What requirements are prescribed by the steam roads to the street railroads in connection with the putting in and working of crossings? The subject is subdivided as follows :

A.—*Arrangement.*

a. Describe the construction of crossings by reference to respective plans for (a) Horse railroads, (b) Steam railroads.

b. Give an account of what is needed in the way of flag stations, gates, side track switches, signals, etc., for street railway working.

B.—*Operation.*

What further duties (signal and flag service, etc.) are assigned to the street railroads in the operation of crossings ?

Speaker:—Signor Amoretti, manager of the steam tramways of the province of Turin, Turin, Italy.

5.—Debate on the following questions :

A. What proportions should be given to the repair shops for main and branch lines ?

B. What are the dimensions of your shops ?

C. Give, for the year 1891, the running expenses of the shops, the number of average working days, the number of kilometres run by cars, motors (or horses) and wheels.

Speaker:—Mr. Géron, manager of the Cologne Street Railroad Co., Cologne.

6.—Debate on the following question :
Give the merits and demerits of the different kinds of springs—rubber, flat, spiral and steel—as well as of combinations of these and other kinds of springs.

Speaker :—Mr. Thomas, manager of the Tramway company, Rheims.

7.—Debate on the following questions :

A. Have you made any study or trial of electric traction, and what are the results ?

B. In what respects does it appear to you that electric traction has any advantage over the (animal and mechanical) methods now in vogue ?

Speaker :—Herr T. Schmidt, engineer of the Great Berlin Horse Railroad Co., Berlin.

8.—Debate on the following question :
On what basis can rates be adjusted, or on what basis can they be reduced for stimulating traffic, under given circumstances, and assuming there is no competition ?

A. Is it expedient to establish different classes ?
To what degree is the increase of rates for higher classes desirable in order to obtain the most profitable business from the same ?
Adjustment of rates according to locality (lines running through poorer sections, industrial districts and lines through large traffic centres).
Adjustment of rates according to circumstances (market days, Sundays and holidays). Round trip tickets, mileage tickets, special rates, expenses of ticket agent.
Commutation : Ordinary rates, school and workmen's rates.

B. FREIGHT TRAFFIC.
Adjustment of rates according to the value of the goods ; according to the weight ; special rate by the car load ; rate on shipment at owner's risk.

Speaker :—M. Moyaux, of Brussels, manager of various steam and street railways in Italy.

9.—Debate on the following subject :
New methods of ticket selling and road inspection. Give the working length of the line, the number of miles run by cars and horses or engines, the number that each inspector has to examine on the average, including
1. Section inspectors (local and traveling inspectors).
2. Station inspectors (station masters, dispatchers, etc.).

Speaker :—Herr Roehl, manager of the Hamburg Street Railway Co.

10.—Debate on the following subject :
What lubricants have come into use for locomotives and cars ?
What practical results have been reached with them and what does their use cost per car kilometre.

Speaker :—Herr Billen, manager of the Hague Tramway Co.

11.—Expenditures for 1893.
12.—Election of Executive Committee.
13.—Miscellaneous business.
14.—Naming the place and date of the next convention.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

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It is Unfortunate that the date of the Cleveland Convention of the American Street Railway Association comes so near the Columbus inaugural services attending the opening of the World's Fair at Chicago. The date of the Convention having been fixed previous to the date for the ceremonies, the executive committee were unable to make a change when the fact was presented to them, as they could neither secure the hall for the place of meeting nor the hall for the exhibits at an earlier or a later date. We think, however, that most people who desire to be present at both occasions will be able to spend two days at the Convention and reach Chicago in time to participate in opening ceremonies.

The Recent Heated Term served to illustrate very forcibly the superiority of mechanical over animal traction in the operation of street cars. The high temperature caused almost a suspension of traffic on many lines, while the service on all lines operated by horses was more or less demoralized. Passengers thoroughly appreciated the benefits of rapid transit in localities where improved systems have been introduced, as during the heated term the open seats on the electric and cable cars proved to be almost the only available places where even a semblance of a cooling breath of air was to be found. Riding on the rapidly moving cars was a luxury of which all classes of people availed themselves in vast numbers.

The Coming Saratoga Convention of the New York State Street Railway Association, which is to be held on the twentieth of this month, should be attended by delegates from every street railway company in the state. This Association was organized at a time when it was necessary for united efforts at Albany to prevent legislation hostile to the street railway interests of the state. Although happily at the present time there is not so much need of watchfulness in this line, the organization should be kept in a vigorous condition that it may meet the exigencies that may arise. Not only should the Association meet with the hearty support by the small as well as the large lines for the above reasons, but the benefits to be derived from the proceedings will be of great value to the delegates and the interests they represent. Too strong an appeal cannot be made in behalf of the Convention, and it is hoped that the attendance will be larger than at any previous meeting in its history.

Public Parks are coming to be recognized as valuable agencies for the promotion of traffic by the managers of street railway companies in many of our medium sized cities and villages. The example set by a certain line mentioned in another column may serve as a valuable model for others. Of course the fact should be recognized that this matter could be overdone where rival lines are operating in the same territory, but where one company operates most of the lines, a judicious selection of parks, with a judicious equipment and management, may be made valuable adjuncts to increase a company's income. In the selection and laying out of parks for this purpose, it is not always best to select a tract that is level, and best suitable for building purposes; but usually the most wild and uninviting territory may be transformed into an attractive park. Care should also be exercised in providing attractions that will draw only a desirable class of patrons. These being provided, and changes and variations made at intervals, it will be found that the people never tire of patronizing them. Where objectionable features are introduced they drive away respectable people, and frequently attract a patronage that is unpleasant to handle as well as expensive in the way of accidents and repairs rendered necessary from damages wantonly committed by reckless patrons.

The Advent of Power Brakes and other safety devices in the street railway field is the natural sequence to the employment of mechanical power for traction, and doubtless they are destined to play an important part in this service as they already have done in steam railway practice. Safety or continuous brakes are of far greater necessity on heavy electric or cable cars or trains running at high speed than on light horse cars jogging along at only six miles an hour. Hence it is that the hue and cry which follows any accident on cable or electric roads is growing louder and louder, because the general public have come to expect with mechanically propelled cars greater safety with higher speed, as well as cleaner streets and better service. The credit for high speed in steam railway service is given to the air brake, for without it the speed attained could not be so readily controlled, and naturally many are looking to this element first as a reliable means of controlling street cars. Fortunately there is now a machine for utilizing air almost, if not quite, equal to those employed in steam practice, and from which railway managers are expecting a large measure of safety. This device, we understand, has been tested for more than a year, and is now being put in operation on several large cable and electric lines. In the way of fenders we are not making as satisfactory progress as with brakes, although there are many patterns in use. The field in this direction is an inviting one for inventors.

Emergency Cases are bound to occur in the practice of every street railway company, no matter how well the lines are managed, so that how to meet them is an important question. Particulars in this regard will be found in another column. Of course, it is wise policy to employ all possible means to prevent their occurrence, but where they do occur everything that experience teaches should be employed to avoid their recurrence. In some cases, however, the managers guard against a recurrence only when the cost of preventing the trouble does not exceed the damage which the trouble would cause. This is doubtless good policy from the company's standpoint, but the patrons of the line have rights in this respect, and for this reason the company may be called upon to expend in excess of the threatened damage. In this connection we call attention to a former editorial in which we cautioned street railway companies who were reconstructing their lines for mechanical traction not to allow their animals to run down, but to keep them in as good condition to the last day of service as though they were going to continue to operate by animal power. It is gratifying to know that some lines adopted this policy and we find their horses, which are now being replaced by mechanical power, in first class condition and selling rapidly at good prices, while on the other hand several lines having allowed their stock to deteriorate have lost heavily in horses during the recent heated term and have been confronted with a threatened paralysis of the business. These facts are striking commentaries on the rule that all possible emergencies should be carefully guarded against.

"The Increased Value of Property along the line of a street railway is the true fund on which to draw to pay for the plant." So says a local paper in announcing the failure of a certain street car line which failed, as stated, "because it depended alone upon fares for financial support and that properties rent or sell on a basis affected by the convenience of having a horse railroad." We have frequently stated that the service which a street railway rendered was a sufficient compensation to the municipality for the use of the streets, but this is the first time we remember to have met the suggestion of direct taxation of abutting property for the benefits of an operating company. A street railway may or may not enhance the value of property along its lines. If a road built in a small city that has completed its growth and depends for its patronage upon a few people who will ride only from necessity, we do not see where any benefit is conferred upon the adjacent property. A street railway to be of benefit to local property must create a traffic and induce people to settle in outlying districts, in other words, build up the town, and put the population in easy communication with the business centres. It is then that business as well as residence property is benefited and the street railway reaps its reward in increased patronage. The article further states that, "A street railway is a public function as much as a water or a sewer system." A little thought will show the fallacy of such a statement. The water system benefits every individual in the community, men women and children daily. It is operated by a few employes, and the rents are collected at stated intervals by a small clerical force. On the other hand the street railway is of direct service to only a portion of the people and to many of them only at intervals so that they have no interest in its management. Then it requires a large number of men constantly employed to operate and collect the revenues, who must be carefully watched and governed by experienced managers, a function in which muncipalities are proverbially inefficient.

Patent Royalties on street railway appliances are apt to be estimated from a different basis by the inventor and the purchaser. The latter usually considers them an unfortunate tax upon his income, and pays only when compelled to do so, with little thought of the benefit the appliance in question will confer upon him. The inventor, on the other hand, reasons somewhat as follows: "The life of an ordinary, well built car may be estimated at fifteen years. A royalty of $100 per car would then mean a little less than $7 per year, or less than two cents per day. Surely a great railway company could pay this insignificant sum per day for my device, for on special occasions the car could carry enough more people in one or two days to pay the entire amount, or would by its use avoid an accident or damage suit that would cost ten times the amount." The above reasoning is logical and fair, and would, no doubt, ordinarily be admitted by the purchaser, but when it is remembered that upon the same car there may be a large number of patented devices, and that some companies employ a very large number of cars, the amount of royalty demanded would prohibit their use. The same fact is emphasized in the practice of providing a duplicate electrical equipment for open and closed cars. Such lines as employ only a few cars could afford to equip both types of cars with independent motors, or could readily change trucks at the end of the season in case only one set of motors were employed, but where the number of cars run into the hundreds a duplicate equipment is out of the question, for the first cost and the interest on the idle motors would absorb the dividends, or the time consumed in making transfers with ordinary facilities, were only one set employed, would entail too large an expense. Hence, it is difficult to suggest a uniform basis for estimating royalties, as naturally the smaller lines could pay more proportionally than the larger lines with a large number of cars. In any event the disposition on the part of street railway companies to avoid the payment of royalties on valuable appliances is not altogether a commendable one. We have not too many patented appliances; we have not enough; there is still room for improvement in car construction and in safety appliances, and the more liberally inventors are compensated the more earnestly they will apply their genius to devising additional improvements. As a class, inventors deserve more considerate treatment in every way from street railway managers and the public generally.

Shocks From Electric Street Railway Circuits can never cause death or serious accident save under the most unusual circumstances and such as are never presented to passengers. Fatal accidents from the electric railway current are so rare that, for the first time since the electric railway has been in operation, we are called upon in this issue to record one clearly traceable to the railway current. The victim, at Port Huron, Mich., was a lineman, and, as the letter from our correspondent clearly shows, the unfortunate conditions under which he received the current provided a short path for the electricity through the most vital part of the body. On the other hand, the instances are almost numberless of the

full voltage having been received by linemen and others without injury, and there is no instance on record of a passenger on an electric car being seriously injured, still less killed, by the current of an electric railway circuit. But, in the face of all competent testimony, a belief in the great fatality of the electric railway current seems to obtain among a very respectable proportion of the people. Every few months this unwarranted belief finds official expression in the verdict of some coroner's jury, as witness the result of a recent inquest in Rochester, N. Y. The circumstances were such, however, that the case might be cited as an argument in favor of the selection of intelligent men on juries, for it is not difficult to see how this particular jury reached an entirely incorrect verdict. The fact, as subsequently ascertained, was simply this: The unfortunate man was killed by the current from a high potential lighting circuit. The connection was made through a broken fire alarm wire, dangling in the air, which was found to be crossed with the lighting circuit, and at the point of contact the insulation in the latter had been worn away. It so happened, however, that the broken wire crossed the trolley wire, and the jury, learning merely of the latter fact, deemed further investigation needless, and jumped to a conclusion. The case serves to illustrate in a striking way the truth of the general statement with which this paragraph opens, and it indicates that we cannot too frequently reiterate that assertion, for it is true beyond question that the public believe that death lurks in the trolley wire. The belief crops out whenever an electric railway franchise is sought. But the safe and successful operation of electric systems is tending to eradicate this erroneous belief, and the public at the same time are learning that railway companies by good construction are making the possibility of shocks from falling wires more and more remote. Perhaps it is not too much to hope that even coroners' juries may reach correct findings. Then indeed will the companies entering the field congratulate themselves, for one of the chief obstacles to a franchise will be removed. In leaving this subject we may state that while believing that electric railway wires can not cause fatal shock to passengers we are prepared to endorse heartily the following sentiments addressed to the public from a paper which states that its "free advice to its readers is not to trifle with trolley wires, or trolley poles, or any metallic thing connected with an electric road. These things may not kill you if you touch them, and they certainly won't kill you if you don't touch them."

The Rights of Labor are conceded by all fair minded men, but organized labor can have no rights that are not possessed by the individuals composing the organization, and whatever fancied rights they have that cannot be enforced under our laws are not right and must be abandoned unless our laws are changed, and who is there that can suggest laws under which the liberty of the individual and welfare of the state are more carefully guarded than those which prevail in our own country and to which she owes her greatness and from which we trust she is not destined soon to descend? If labor leaders can suggest freer and nobler institutions than those which we now have and reverence, then let them set themselves to the task and not exhaust their superior talents in conducting strikes and violating law. We concede the right of labor to organize, and believe that labor unions properly conducted will work to the advantage of employe and employer, that employers will be glad to deal with responsible organizations rather than with individuals, but organizations cannot become responsible unless the individuals composing them are faithful to their individual trusts. We take the liberty to suggest to labor leaders a plan of action that will, we think, surely bring increased pay and shorter hours, both desirable results, to that class of workmen who will not spend their increase of time and money in the saloons. There are few industries employing a number of men that could not be made very much more profitable were each individual perfectly reliable and faithful in the discharge of his duties. One has but to watch for a little period the employes of some of our large establishments, and especially the employes in public work, to have the fact emphasized that a good many men are apt to "soldier" unless they are continually under the eye of the foreman. Hence it is apparent that organized labor must be elevated, clarified within, and this is the first work to which the leaders should set themselves. Let them assemble the men engaged in special industries and say to them: Every one of us knows that we could materially increase the output of the material or income of our employer if every individual would pledge himself to do his work upon honor, be saving and work for the general good, as well as inform against those who would not come into this argument that they might be eliminated from the organization. Then we could go to our employer at the end of six months or a year and make the statement that such was the character of all the men in his employ, and that from the fact the income of the business had increased to such a per cent., they considered that had some claim upon a share of this If the request did not meet with a favorable response at the end of the first period, start in on another in the same way, and then another when an employer worthy of the name would be won to the cause. In any event a strike would not be justified, but the men could withdraw and seek employment with other firms, and such a class of men would have no trouble to secure work. Any leader could then retire from such a work without accusing himself of having been untrue either to the cause of civil liberty or to the cause of property and law, and could reflect with pleasure that he had borne a part in labor reforms that had corrected great abuses and removed just discontent, and that he had never in times of trouble incited his fellows to demand of employers miracles which it was well known could not be performed, nor ever sought the redress of grievances by any other than strictly legal means. Recent events are full of important lessons both to employer and to employes; and he learns only half the lesson they ought to teach who sees in them only a warning against tyranny on the one hand and anarchy on the other One lesson they teach is that our great industries have no more deadly enemy than the bigoted employer who refuses to adjust them in some measure to the new state of society and theclaims of honest labor. Nor do they teach less clearly that the sovereignty of the mob leads by no long path to the sovereignty of the sword. While we recognize in these events the signs of the prophetic "time of trouble," it does not argue that the remedy outlined above should not be undertaken.

A HIGH speed electric railway is proposed between Baltimore and Washington. Among others interested in the plan are D. N. Newbold, T. Edward Hambleton and Stephen Gambrell, all of Baltimore.

Legal.

INJURIES TO PASSENGER—BOARDING MOVING CAR—EVIDENCE. In an action for damages the only evidence to support plaintiff's claim of negligence which occasioned his injuries while attempting to board defendant's horse car, was his own testimony, as follows: "I signaled the driver to stop. He stopped the car. By the time it came to me it had a little speed, but was moving so slowly that it would not be noticed. I placed my left hand on the hand rail and my right foot on the step, when I heard the brake go off; and before I had a firm footing the car moved, pulled me along, and broke my arm. I was dragged a short distance."

Held, that the statement is insufficient to show negligence on the part of the defendant company. That the mere taking off of the brake of a slowly moving horse car would not give it such a jerk as to break a man's arm. It may be that a prudent man would attempt to board a moving car, but it ought to be understood that he does so at his own risk. The mere fact of the conductor being inside at the time of the occurrence does not signify negligence upon the part of the company. He cannot be on the platform at all times. A passenger who attempts to get on board a car, especially if it is in motion and the conductor inside, must be held to a reasonable degree of care. It would seriously inconvenience the traveling public to hold that a car should come to a dead stop until every passenger who gets on is seated. Judgment in nonsuit affirmed.

Picard v. *Ridge Ave. Pass. Ry. Co.*, Penna. S. C., Jan. 25, 1892.

ACTION FOR INJURIES—EVIDENCE—RIDING ON PLATFORM—INTOXICATION. Where plaintiff, a passenger riding on the platform of defendant's car, the latter having stopped near plaintiff's destination to let two ladies off, and where, according to plaintiff's testimony, he followed them down the car steps, intending to alight, when the driver suddenly started up the horses, throwing him to the earth and injuring him. Defendant's witnesses testified that plaintiff was "pretty full," and got off the car while it was in motion, which plaintiff denied.

1. *Held*, that the testimony presented a mere question of credibility between said witness and plaintiff, and that the trial court erred in instructing the jury that if plaintiff's intoxication contributed to his injury he could not recover.

2. *Held*, that the court also erred in instructing that, as plaintiff stood on the platform, it was his duty to alight immediately when the car stopped; and that, if the car stopped a reasonable length of time for passengers to alight, and plaintiff, without the knowledge of the driver, delayed alighting beyond that time, he was guilty of contributory negligence and could not recover. Passengers have a right to assume that the car will not be started without ascertaining whether any passenger is alighting.

3. Error also, to instruct that no recovery could be had if "the driver of the car was conducting his business in the usual and ordinary way," in view of the testimony that the horses were started violently and suddenly with a whip. Judgment reversed and remanded.

Britton v. *Street Ry. Co.* of Grand Rapids, Mich., S. C., February 5, 1892.

ORDINANCE CONSTRUED—ADDITIONAL RIGHTS. Where one section of an ordinance authorizes a street railway company to lay tracks of its own on a certain street, and another provides that it shall be lawful for it to use the tracks of other companies, so far as the council has power to grant the right to their use, and that where the council has no such power, and the company is unable to agree with the other companies for the use of their tracks, then it "shall be lawful" for it to lay its rail inside and outside the said track, the latter section cannot be construed as revoking by implication the right of the said company to lay tracks of its own, but only as conferring additional rights.

MUNICIPAL AUTHORITY—USE OF ELECTRICITY—SERVITUDE. Where the law (Act 1870, c. 370) confers upon the council of Baltimore full power to authorize the use of electricity for propelling street cars, and since this use does not impose a new servitude upon the streets so as to entitle abutting owners to additional compensation, an injunction will not lie to restrain the said use.

ELEVATED ROAD—WHAT CONSTITUTES—STATUTE. A street railroad built upon vertical iron pillars at an elevation of twenty feet above the street, and extending a distance of three-quarters of a mile is an elevated road, within the meaning of art. 23, sec. 186, of the Code, declaring that no such road shall be constructed except under a special charter, and the fact that the road was elevated only for the purpose of avoiding the tracks of a steam railroad on the surface of the street, and that a descent was made as soon as said tracks were out of the way, will not be sufficient to enable it to escape the operation of the statute. *Kotch et al* v. *North Ave. Ry. Co. of Baltimore*, Md. S. C., January 28, 1892.

STREET RAILROADS—GRANT OF EXCLUSIVE RIGHT. Suit to enjoin the defendant company from laying tracks on a certain bridge. Relief being refused, the plaintiff appeals.

Held, that an ordinance which grants to a street railroad company the right to use the tracks of another company on a certain street, but which declares that nothing therein shall be construed to grant any right to lay additional tracks on a certain bridge, owned by the city and a part of the said street, is not intended to secure to the company whose tracks are already on the bridge a monopoly of the right of way, but only to avoid incumbering the bridge with unnecessary tracks; and the fact that a temporary bridge is to be erected, while the other is being replaced, and that only those companies that are entitled to occupy the permanent bridge are licensed to lay tracks upon the temporary bridge, does not prevent a similar license from afterwards being given to the other companies.

North Baltimore Pass. Ry. Co. v. *Mayor City of Baltimore*, Md. S. C., January 28, 1892.

A Schedule Time of Forty Miles Per Hour.

The Hampton & Old Point Railway is the title of an electric railway now in operation between the two points mentioned above, and being extended to Newport News. The road extends a distance of seven and a half miles, passing Fortress Monroe, the National Soldiers' Home and the Hampton Normal School. The track is laid throughout with a sixty-five pound T rail, and a special feature of the road is the fact that the schedule time is to be forty miles an hour. The motors are of the thirty horse power, Edison, single reduction type, wound especially for this speed, and mounted on Brill's No. 13 trucks with sixteen foot cars. The work is being done by J. B. Crankshaw.

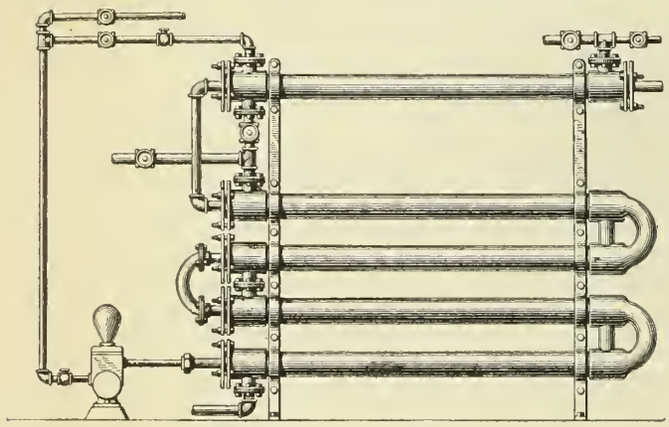
New Equipment at Cleveland.

The plans for the electrical equipment for Woodlawn Avenue & West Side Street Railway have been completed. The contractors are as follows: Cars and trucks: J. G. Brill Co. Motors: Westinghouse Electric & Manufacturing Co. Rails: Johnson Co. Overhead construction: Railway Equipment Co. Engines and boilers: Globe Iron Works. Trolley and feeder wires: McIntosh-Huntington Co., and by them assigned to the Western Electric Co.

THE complete Directory of Street Railways, revised to date, will be found in its usual place. We have found that our readers make such constant use of this directory that upon urgent request, we have decided to continue its publication monthly instead of quarterly, as stated in our July issue.

A Compact Condenser.

A condenser of compact arrangement and designed especially for tug boats, has recently been invented by Elihu Nelson of New York, to be used in connection with the feed water heater illustrated in our last issue. The different sections are made up of what Mr. Nelson calls a double chambered pipe, that is, one pipe is arranged



TUG BOAT CONDENSER.

within another, forming a central circular chamber and outside annular chamber. Either chamber may be used for the induction water, the other carrying the steam which is to be condensed. Ordinarily the two fluids will pass in opposite directions, but this is a matter of detail. It will be seen at once that the space occupied by this new condenser may be made very small, and yet a great deal of surface may be exposed in the successive sections. Another point in favor of this condenser is the reduced weight. The first sections may be made larger than the rest, each succeeding section being graduated to a smaller size from beginning to end, or all the sections may have the same capacity as indicated in the cut.

Improvement in Steam Separators.

With the constant and growing demand among engineers for dry steam in connection with all power plants, the inventive genius of the engineer has kept pace in providing separators of various designs and merit that may be connected into the main steam pipe to the engine for the purpose of separating the water, oil or dirt from the steam, that dry steam free from foreign substance may be delivered to the cylinder.

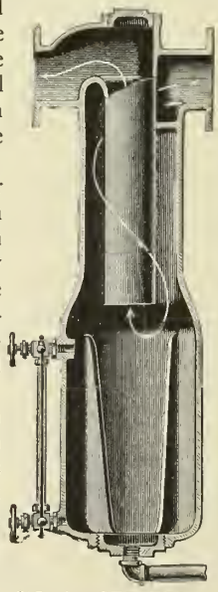


FIG. 1.—STRATTON SEPARATOR.

Among the various appliances for the purpose stated above, the steam separator manufactured by the Stratton Separator Co., 32 Cortlandt Street, New York, has won for itself a high place in the estimation of engineers throughout the country, that could only be obtained by the real and undoubted merit of the apparatus.

The Stratton separator is based on the principle that if a rotative motion is imparted to the steam as it enters the separator, all the liquid particles it may contain, being heavier than the steam, acquire centrifugal force and are projected to the outside of the current.

Practical results have proven this theory to be correct, but in some cases where high pressures of steam are used, it was found that the water gauge on the side of the separator would show full of water, while steam would blow out of the drain pipe at the bottom. While this proves the centrifugal principle of the separator, the force was so great as to hold about the interior walls of the chamber a volume of water whirling so rapidly as to be hollow in the centre, allowing steam to blow out of the drain pipe.

To meet this slight objection the Stratton company have patented an improvement as shown in the accompanying cuts, and briefly described as being a centrifugal steam separator provided with wings or plates projecting from the interior surface of the well chamber at an acute angle therewith and to the course of steam or water, thus breaking the whirling body of water and allowing it to settle quietly in the bottom of the separator chamber, from whence it can be drained.

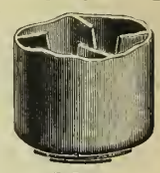


FIG. 2.

Fig. 1 of the above illustrations shows a view of the separator in vertical section, and Fig. 2 a cross section of the water chamber, showing wings or plates placed at an acute angle to the current of the water as described.

Combined Switch and Fuse Box for Railway Lighting Circuits.

In the accompanying view is shown a very neat combination switch and fuse box for use on the lamp circuits of electric street railway cars.

Fig. 1 shows the body of the box with the rotating ratchet switch in the lower compartment, and Fig. 2 the reverse side of the cover with the terminals and thumb screws for the metal fuse.

This box, it is claimed, possesses many advantages over anything heretofore in use for railway lighting service. It

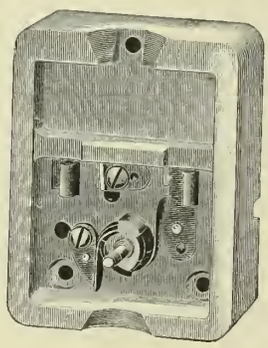


FIG. 1.

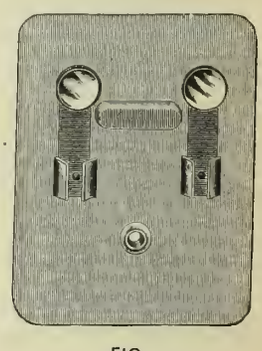


FIG. 2.

is very compact and neat, and as it is made entirely of porcelain it is perfectly incombustible. The switch is of the latest improved type of rotating ratchet switch manufactured by the General Electric Co., and possesses the essential point of good contact and sudden break. The fuse is placed on the inside of the cover, so that in replacing a blown out fuse the fuse terminals are taken completely out of the circuit, and it is utterly impossible to receive a shock in any way. The brass clips on the cover fit over the two contact posts in the box, and serve the double purpose of holding the cover in place and forming part of the circuit.

As will be seen in Fig. 2, the box is divided into two parts, the lower holding the switch and the terminals for the wire, and the upper part consisting of a shallow recess into which the thumb screws on the inside of the cover project. In the back of the box behind this upper recess, is a magnetic blow-out, which breaks the arc formed when the fuse is blown. In general appearance the box is quite ornamental, and with the great superiority over other and older devices for the same purposes it should commend itself strongly to all street railway men.

THE Collins Park & Belt Railroad Co., of Atlanta, Ga., is now in successful operation with two 150 H. P. generators, and ten Brill cars, equipped with twenty H. P., single reduction motors, all of which apparatus was furnished by the Short Electric Railway Co., of Cleveland, O. The railway company are operating the two ends of their system, not having as yet been able to complete the line through a part of the city. The road has had unusual success from the start, and both ends are very much more than paying expenses.

New Track Switch.

A track switch, which can be operated from the front platform of a cable or electric car while the car is in motion, is manufactured by the Reliable Manufacturing Co. of Boston, and is shown herewith. The mechanical device is very simple, with nothing to get out of order. The switch plate is about twenty inches square and placed in the centre of the track with one corner extending to the rail. The whole is laid on a heavy wooden frame and can be placed in position very quickly. The pedals in

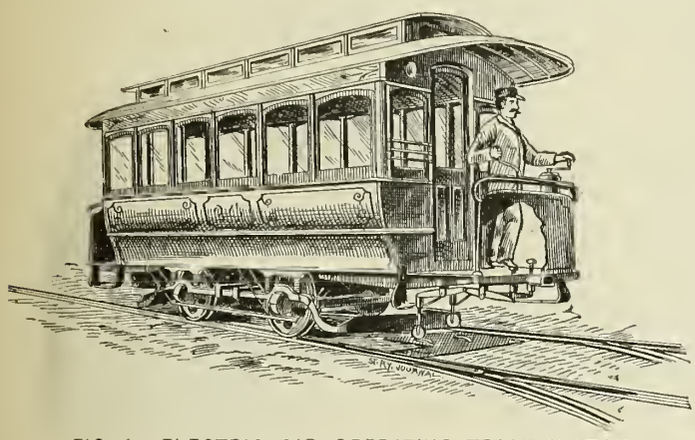


FIG. 1.—ELECTRIC CAR OPERATING TRACK SWITCH.

the plate are about seven inches long, two inches wide and half an inch high, are nearly water tight and with very little care can be kept from freezing in the winter. It is no obstruction to carriages or heavy teams ; both can go over them without difficulty or injury to the switch. The plungers to be applied to the car are made in two ways. In one the plunger has a direct motion, going down straight to the pavement. The action is very simple, and the plunger requires little power from the motorman ; the other style of plunger is worked by a wire cable over two pulleys, and when the foot is pressed the plunger is moved into position. When released, a spring carries it back into the car.

The switch can be operated in the darkest night as easily as in the day time. If the driver or motorman

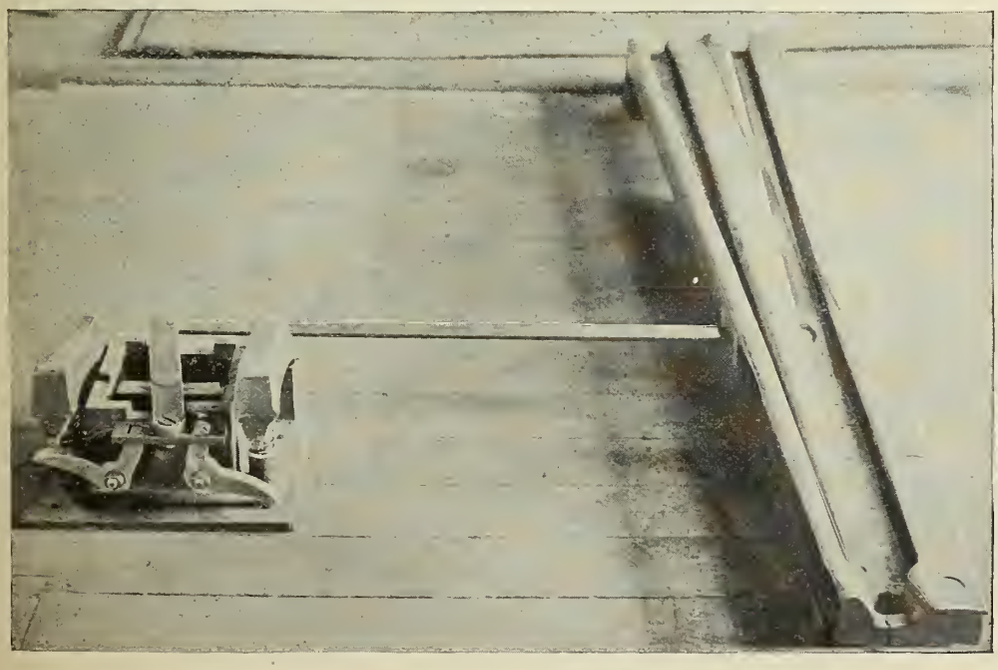
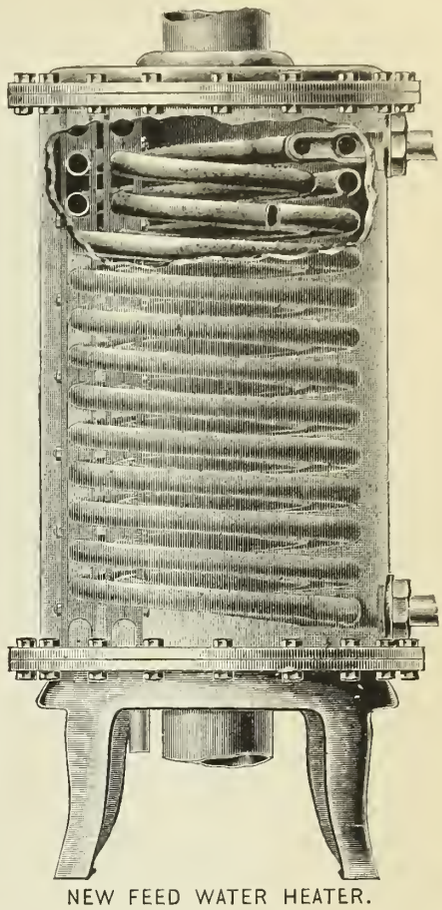


FIG. 2.—DETAILS OF TRACK SWITCH.

wishes a car to go to the right, he places his foot on the right plunger, if to the left, on the left plunger. He can force the plunger down a considerable time before reaching the switch plate if desired, the wheel running on the pavements until the switch pedal is reached.

A New Feed Water Heater.

The American feed water heater, shown in the accompanying illustration, is manufactured by the Whitlock Coil Pipe Co. of Elmwood, Conn., and possesses several very valuable features. The coils are made of the best seamless copper tubing, and are joined together and are also connected to properly designed gun metal fittings by brazing, which makes them virtually jointless. The fitting, which passes through the shell, is tapped for connecting the feed pipes, thereby doing away with all joints inside of the shell.



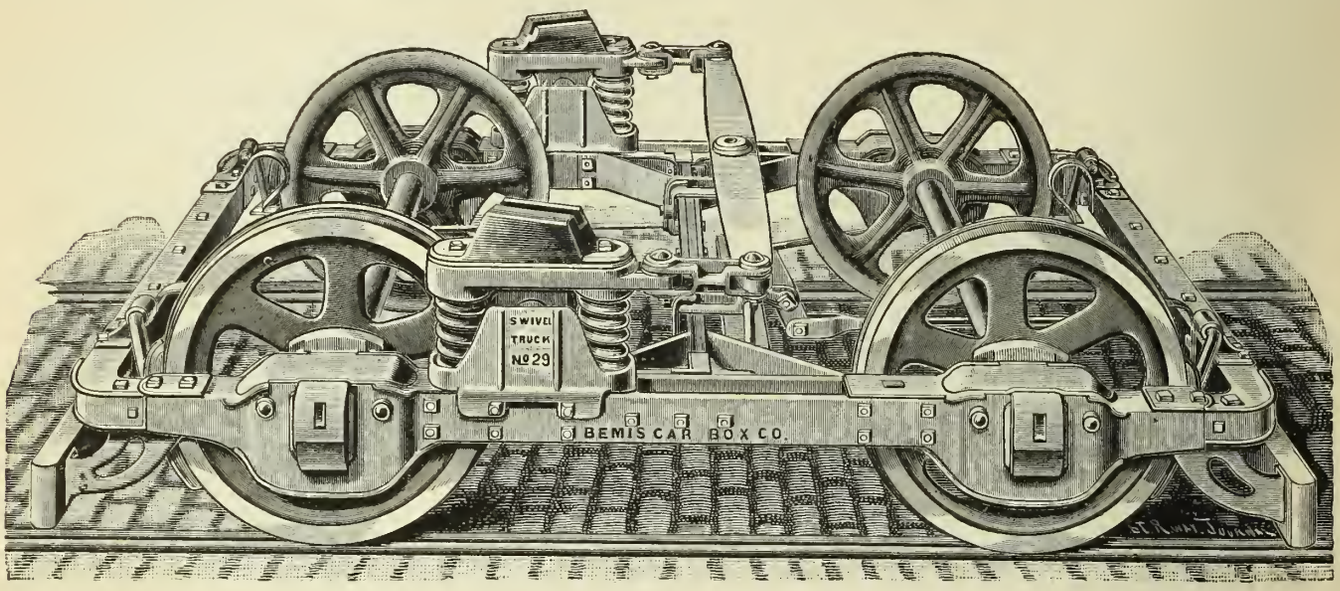
NEW FEED WATER HEATER.

As the circular coil is perfectly smooth, with no couplings or obstructions of any kind from beginning to end, the friction is very little more, if any, than through the same length of straight pipe, and the trouble caused in straight tube heaters by expansion and contraction is wholly obviated by the use of this spiral coil. The increased area of the shell above that of the exhaust wholly obviates any chance of causing back pressure on the engine; instead it causes a slight vacuum, thereby giving immediate relief to the engine. In fact, it is not necesary to pass all of the exhaust through the heater under circumstances where it is easier to set up the heater without. The exhaust pipe may be tapped by means of a tee placed therein and a branch run from there to the heater, and the vacuum formed by the condensation of the steam when coming in contact with the coil containing the cold water, will draw steam enough from the main exhaust pipe to heat the water above 200 degs. Fah. In setting up a heater in this manner, of course the exhaust hole in the top of the heater should be stopped up, and the heater should always be dripped from the shell as provided for. Dripping the exhaust pipe does not answer the purpose. The coils are thoroughly stayed and tested to 300 lbs. hydraulic pressure before leaving the factory.

This heater is particularly adapted to be used in connection with compound engines as it occupies a small space, increases the vacuum and will deliver the feed water up to the maximum degree. By using the auxiliary heater and utilizing the exhaust from the feed or air pumps, the water is supplied to the boiler at near the boiling point.

New Swivel Truck, No. 29.

The accompanying engraving illustrates a new swivel truck, No. 29, for eight wheel cars, designed and built by the Bemis Car Box Co. of Springfield, Mass. The truck has a short wheel base and swivels from its centre, but carries a large per cent. of the weight of the car on the motor axles, and while giving increased traction on the motor wheels, has standard sized wheels on both axles. This gives light draught and good braking qualities without increasing the height of the car above the track. Another important feature is the fact that there is no part of the truck over the motor, permitting of easy access to the latter for inspection, dismounting or making repairs.



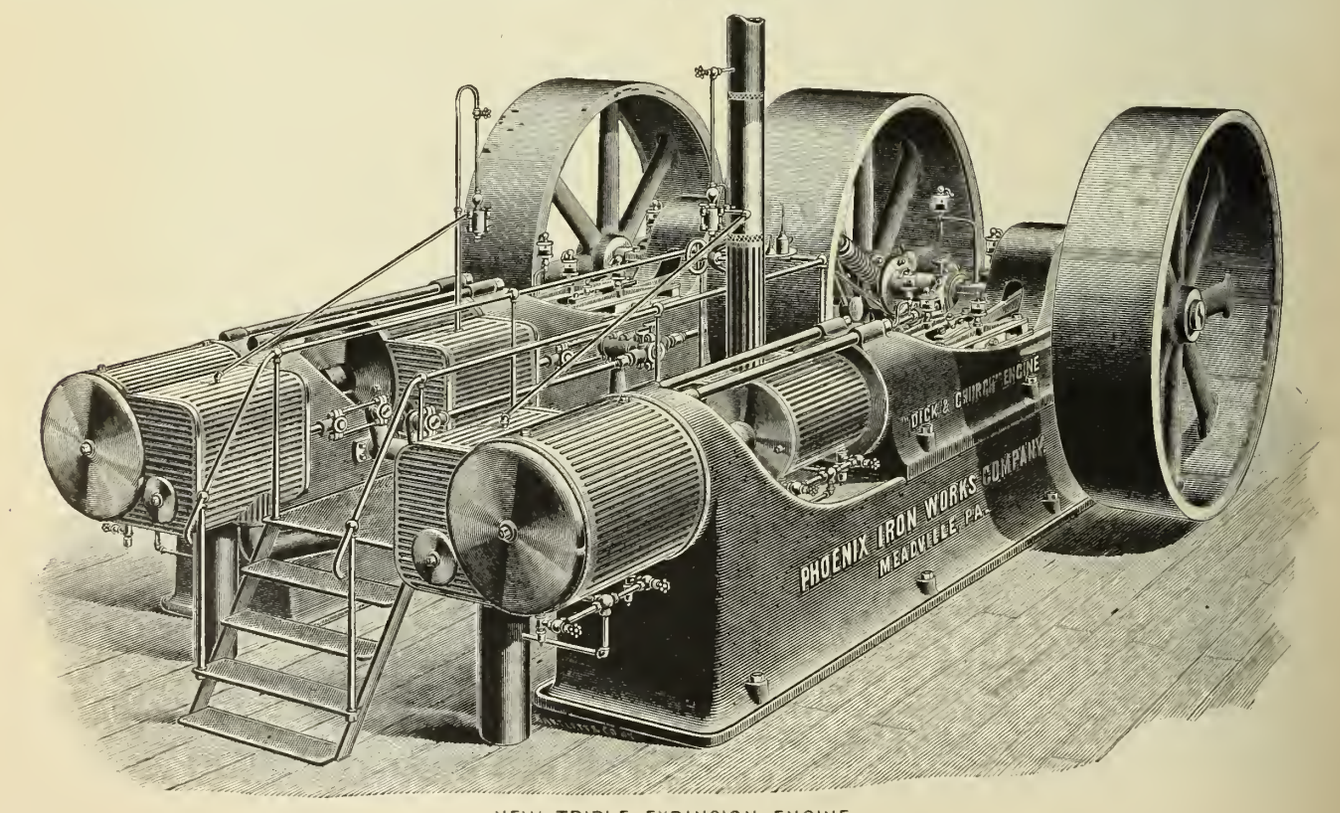
NEW BEMIS STREET RAILWAY TRUCK.

The well-known Bemis box, which has given such excellent results in the past is, of course, used, and the material and workmanship of the truck are of the best.

THE Passaic (N. J.) Elevated Transit Co. was recently ncorporated.

New Triple Expansion Engine.

The accompanying engraving shows a view of a 500 H. P., triple expansion engine recently put on the market by the Phœnix Iron Works Co., of Meadville, Pa. This engine, as will be seen, is very similar in design to the Tandem Compound, manufactured by the same company and described in our October, 1891, issue, except that it is a double engine carrying one high pressure, one intermediate and two low pressure cylinders. The centre wheel is the governor wheel, and, as with the compound engine, the valves to both high and low pressure cylinders are automatically controlled by one governing device. A double governor controlling all four valves is used, actuating the valves of the high and low pressure cylinders on one side, and the intermediate and low pressure cylinders on the other side, and securing, it is claimed, a more equal distribution of loads and temperatures between all cylinders than has thus far been brought out. The crank shafts of the two engines are bolted together mak-



NEW TRIPLE EXPANSION ENGINE.

ing, practically, a continuous shaft. The valve gear is all on the inside, but is so arranged that it is easily accessible for adjustment. Belts can be run from any or all of the wheels.

The proportions of this engine throughout are very large to insure durability, and particular care has been taken to make the working parts of the engine accessible for adjustment, and the oiling devices are such that all parts of the engine can be thoroughly lubricated while in motion. The machine is very heavy, of very rigid construction, and is particularly adapted for driving large railway generators. It may be run either as a condensing or non-condensing engine.

Standard Car Heater.

Street railway companies and car builders often find fault with the ordinary type of stove for street cars because, when it is used, it is necessary to cut the car seat. They also object to its location upon the car floor because it interferes with the flushing of the floor, as dirt and water collect in the stove box.



STANDARD CAR HEATER.

With the new stove recently put on the market by the Standard Railway Supply Co. of Chicago, these objections are entirely obviated. It is designed to rest upon the car seat instead of upon the floor, and it occupies only the seating space of one passenger.

The sides of the case are designed to be cut to conform to the shape of the seat, and are so made that they may be used over plain wood, cushioned or upholstered seats. Linings of asbestos and sheet zinc are contained within the case so that passengers sitting next to the heater experience no discomfort because of excessive heat.

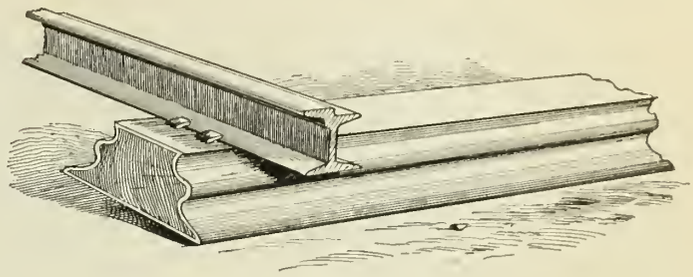
The stove presents a handsome appearance. It is substantially constructed of cast iron with nickled top and front plates. It occupies a space fifteen inches high by twelve inches in width, but its capacity is said to be fully as great as heaters of much larger size. As shown in the illustration, the coal box is lowered under the car seat.

The fuel is fed in at the top of the stove, and tests made thus far go to show that in its consumption of coal the heater is extremely economical. The ash box is made sufficiently large to contain all the ashes accumulating in twenty-four hours.

As the engraving shows, the pipe is straight, and extends through the lower deck, an arrangement considered far more sightly than when an elbow is used. The company have already received a considerable number of orders although the stove has been on the market only a short time.

Elastic Metal Railway Tie.

The accompanying engraving shows a type of metal tie recently invented by Charles O. Newton, of Homer, N. Y. It is made of sheet or plate steel, one-fourth to three-eighths of an inch thick, bent into shape, with the ends coming nearly together on the bottom. It has corrugated or fluted sides, and a wooden plug two and a half feet long fitted to shape and inserted in the ends. On the top of the tie where the rails are fastened are holes through which spikes are driven. If deemed preferable, the rail can be mounted on plates and bolted to the tie in place of employing spikes.

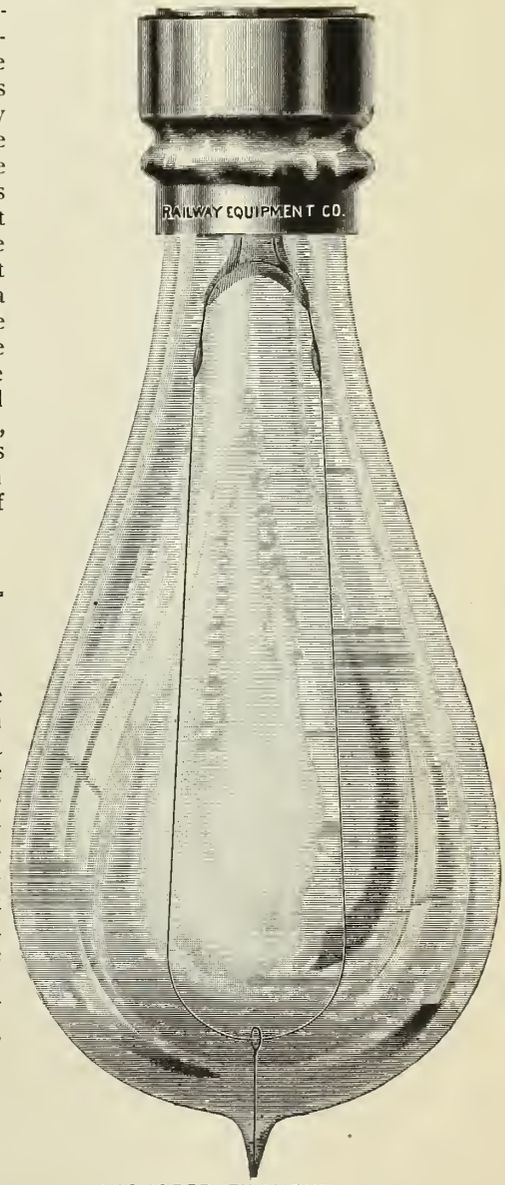


ELASTIC METAL RAILWAY TIE.

The advantages claimed by the inventor for the device are durability and elasticity. The latter quality is secured both by the shape of the tie and the wooden plugs which act not only to hold the tie in shape, but also serve as a cushion. The form of the tie enables it to be easily tamped in place, while, of course, its life is much longer than if made of wood.

New Anchored Filament Lamp.

The service required of an incandescent lamp on electric cars is necessarily very severe, and ordinarily conducive to short life through a breakage of the lamp filament.

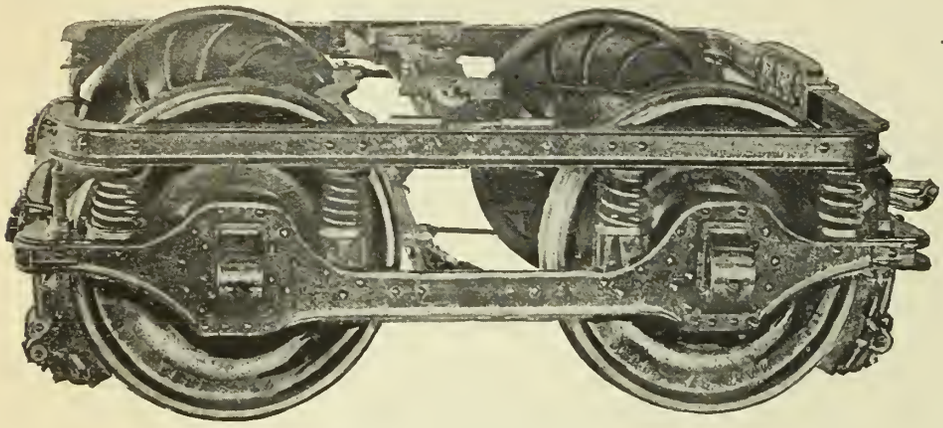


ANCHORED FILAMENT LAMP.

The Railway Equipment Co., of Chicago, noting the need of an anchored filament lamp, have lately placed one on the market, which, they claim, will meet the requirements. Severe tests of this lamp have been made during the last six months, and the company state they are prepared to guarantee it for life, efficiency and reliability of candle power. The lamp is called the Mansfield lamp.

Elevated Railway Truck.

The type of truck adopted on the elevated railway of the Interstate Consolidated Railway Co., of Kansas City, Mo., is shown herewith. The motive power on this line is being changed from steam to electricity, and the truck is the heaviest ever built for an electric railway.



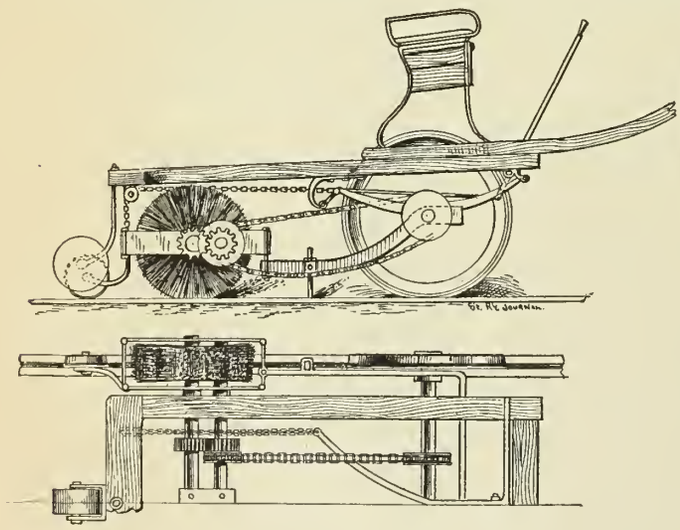
ELEVATED RAILWAY TRUCK.

The weight of the truck complete is 6,000 lbs., and the wheel base is six feet six inches. The wheels are thirty-six inches in diameter and weigh 600 lbs. each. The car bodies are thirty-five feet in length, and the motive power will be furnished by Westinghouse thirty horse power single reduction motors. The manufacturers of the truck are the McGuire Manufacturing Co., who have recently placed seventy trucks similar in design, but lighter in weight, on the San Francisco & San Mateo Railway in San Francisco. These trucks have given good satisfaction.

Track Cleaner at Lille, France.

By C. R. King.

In the accompanying drawing is shown a simple form of track cleaner employed at Lille, France, that has probably been in use since the earliest days of street railways in that city. The operation of the sweeper is very simple



ELEVATION AND PLAN OF TRACK CLEANER AT LILLE, FRANCE.

and apparently effectual in a city like Lille, where sand and gravel are never thrown on the track in greasy weather.

The sweeper frame is of iron, and is mounted on two forward and two small rear wheels. Each brush is about twenty inches in diameter by five inches wide and is mounted on a pinion shaft which has bearings at either side of each brush, and is driven by an intermediate shaft carrying two fixed pinions of the same diameter as those on the brush shaft. The intermediate shaft is driven by chain gearing from two larger pulleys keyed on the main axle. The object of the intermediate shaft is to make the brushes sweep forward. The driver's seat is placed over the main driving axle, thereby increasing the adhesion of the driving wheels on the rails. The seat is bolted to an upper wooden frame carried on plate springs sleeved on the axle. To relieve the shafts of strain, there is an iron standard pivoted in the middle of the rear of this frame and fitted at its lower end with a thick wooden block wheel or roller. The iron frame can be lifted so that the brushes are two or three inches clear of the ground, by a single pull on a lever at the driver's hand. This lever is worked beneath, and each brush is connected with chains passing over the grooved runners placed at either corner of the wooden frame down to the iron frame to which they are hooked. As the Lille lines are largely single track, the flanges of the tires of the sweeper wheels are made very shallow to facilitate derailment. Once off the rails, the weight of the sweeper is carried on the two front wheels and the wooden trailing wheel. On the iron frame directly behind the front wheels are two steel spuds or scrapers for cleaning the rail groove in advance of the brushes. The points which require the particular attention of the driver are, of course, the switches and "closed rails," that is to say, the rails of the double or jointless type which were formerly employed extensively at Lille, and which have the drawback of sometimes closing like a pair of scissors under the weight of the general street traffic. To pass such places, the flanges of the car tires manage to plow their way, but the scraper of this machine cannot. Such rails are, however, being rapidly replaced by the double or twin rail of the Marsillon's system, or by the grooved Broca rail.

The brush frame can be raised by a lever near the seat of the operator, and the sweeper can be turned from the track readily as the flanges on the wheels are shallow.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Death From a Trolley Wire.

Port Huron Electric Railway Co.

Port Huron, Mich., August 16, 1892.

Editors Street Railway Journal:

In reference to your letter of recent date concerning the death of Newton Talbot we would say: Newton Talbot was one of a gang of linemen at work putting up the overhead construction for the reconstruction of our road. The gang was straightening a pair of iron poles preparatory to putting on the cross wire that will support the trolley wires for a double track. Talbot was on top of the carry and happened to be astride of our live trolley wire. He told the driver to go ahead to enable a street car to pass, and failing to get from astride of the trolley wire, he grasped the wire the men of the gang were using in straightening up the poles, or rather threw his left arm over it, forming a circuit through his body. Before the unfortunate man could be released the current had done its work, as he expired very soon after being taken down.

We tested our current twice during the same day and found that it was running at 500 volts, and a little under at times. There was no *post mortem* examination made, the man to all appearance being strong and healthy. The current, you will notice, passed directly through the left side, and may thus have caused a fatality that under other circumstances would not have happened.

Yours truly, F. J. Dixon, Secretary.

Lancaster Street Railroad Co.

Lancaster, O., August 20, 1892.

Editors Street Railway Journal:

On June 1, the roadbed of the Lancaster Street Railroad was completed, and the line has at present three and three-quarters miles of track. Of this two miles, including turnouts, are laid with fifty and a half pound girder rails and curves with ninety pound grooved girder rails all mounted on chairs, and the streets are paved with vitrified brick. The remaining one and three-quarters miles of track are laid with from thirty-five to fifty pound flat rails on stringers. All the track, except that using stringer rails, is bonded ready for electric traction. The local electric light plant already has the steam plant and will install the power house equipment and furnish power for four cars. All that is required to convert the line into an electric road is the overhead construction and four motor cars.

The road at present with horse power has paid all running expenses and repairs, and if once equipped as an electric line would be a good investment. The city of Lancaster has plenty of natural gas. Columbus is supplied from the Lancaster gas field, and Zanesville will soon receive natural gas from here through a pipe forty miles in length, so that fuel is cheap.

The undersigned will be glad to correspond with parties seeking a safe and profitable investment by the purchase of the line outright or of sufficient stock to complete the electrical equipment. A. Bauman, Manager.

How to Meet Emergency Cases.

In order to give our readers the benefit of the experience of others, we recently addressed a letter to a number of street railway superintendents asking them to give in detail the methods employed by them to prevent or raise a blockade, should one occur, and how they meet the many exigencies that arise in street railway practice. The following are a few of the replies received which will be found interesting. There are doubtless others who can give valuable suggestions in this line, and we shall be pleased to hear from them.

Chicago City Railway Co.

Chicago, Ill.

Gentlemen:—We operate 150 miles of road, thirty-six miles of which are cable, and the balance are horse lines.

Most of our blockades and delays are caused by the breaking down of wagons in turning out of tracks, principally coal wagons and heavy loaded trucks. We have wrecking wagons located at different points in the city from which such blockades can be reached quickly. These wagons are drawn by a team of fast horses as are the fire department wagons, and are always ready to start on a telephone call.

The driver and one man are sufficient to remove the heaviest wagon from the track. The jack screw raises the wagon, so that our extra wheel, which fits any wagon or carriage, can be placed on the axle, and the obstruction is ready for moving. For this class of breakdowns the extra wheel and jack screw are the only tools required. Where the wheel cannot be used, a "skid" takes its place. These wrecking wagons also carry tools for use in all cases of damage to grips and cables, such as cutting out grip plates, etc., etc.

In case of breaking of cable, failure of power, or stopping of cable from any cause, horses and men are taken from stables at once and used until the cable is ready to resume work. A wagon loaded with whiffletrees for such an emergency always stands ready waiting for a team, and I am pleased to say that its service has not been required but once during past year. We endeavor to make blockades by civil or military parades as short as possible, by anticipating the line of march and having tow men and horses ready for switching back when possible.

In case of epidemic among horses, such as glanders, farcy, etc., we destroy those seriously affected, isolate those liable to be affected by contagion, and apply the usual remedies and disinfectants. Since the "Epizoötic", which stopped us ten days, we have not been troubled with any delay from this cause.

For city use I consider a wrecking wagon with a good team and driver, the most essential outfit required. The driver should be a man not afraid to make the necessary pace with his team, and at same time avoid all injury to persons and property. His mate should be an active man accustomed to handling tools, a repairer of car trucks preferred. Others can be added from depot men if required.

With the exception of jack screw and wagon wheel to fit any vehicle, the balance of tools should be selected according to the requirements.

M. K. Bowen, Superintendent.

The Cleveland City Cable Railway Co.

Cleveland, O.

Gentlemen:—In reply to yours of the 14th in regard to emergencies arising on our road, we would say we have never had a strike on our road since we commenced running the cable, nor have we had any failure for want of power. In regard to blockades caused by fire, we simply wait until the fire is over and the hose taken off the street. In regard to processions, civil or military, we have had but little trouble. In passing through crowds we put a man on the front of each grip car, run slowly and have him do the best he can to get the crowd out of the way. In this way we generally keep our cars moving, sometimes quite slowly.

In regard to cables breaking, our system is, first to notify the roadmaster as soon as possible, and have him and his men run along the street and try to find the place where the cable is broken. In the meantime we order teams sent from our horse car line for pulling the cable together. Our express wagon is ordered from the barn to the power house as quickly as possible, and the splicers' tools and all the implements necessary are placed in that. In the meantime, while waiting for the horse and wagon to reach the spot, our splicer and his men are getting the tension carriage in shape so that it can be drawn up close to the drums, and in all cases we try to save as much time as possible in getting our rope together, spliced and started up. M. S. Robison, Manager.

The Denver Tramway Co.

Denver, Colo.

Gentlemen:—In regard to blockades on our roads, we have a wrecking wagon equipped with all necessary tools, which we send out as occasion requires. There is a man constantly on watch, and we have a very complete signal and telephone system.

We find the wrecking wagon an almost indispensable adjunct to our business. C. K. Durbin,
General Superintendent.

Houston City Street Railway Co.

Houston, Tex.

Gentlemen:—The plan of our railway system prevents in most instances a total suspension of traffic. We operate a belt system, and it is rarely that both streets are obstructed, so that partial service by transfer can generally be given. The greatest delays come from fires and civil parades, through an indisposition shown on the part of the fire department and city authorities to give the necessary co-operation.

Duplicate station equipment is provided to prevent failure of power, and the overhead construction is divided in sections so that only one section is stopped by a short circuit. A variety of tools to make minor repairs and to replace derailed cars on track are kept at the office which is centrally located. We have not found obstructions frequent enough to have a special emergency force, but issue a general instruction book to employes, which is intended to cover most cases. It is not perfect as it has

not been revised under the light of experience with electric power, and special training to fit local conditions is always necessary, so that every case cannot be covered by a book of general instructions.

F. MUNDES, Superintendent.

NAUMKEAG STREET RAILWAY CO.

SALEM, MASS.

GENTLEMEN :—So far as the overhead lines are concerned we have two regular linemen who do nothing but attend to this part of the equipment. These men are hired with the understanding that they are to report any time in the twenty-four hours and any day in the week if called upon out of regular hours. As these men are not employed on any other part of the work, they are always ready at a moment's notice to respond to a call for accident. The line foreman is never allowed to leave the city without notifying the company, so that some one can be provided in his place ; this rule holds good in and out of regular hours. We have also one of Davis & Son's latest improved tower wagons, with a few attachments of my own upon it, which enables us to repair any trouble in the shortest possible time.

To give an instance of their work, we had a case a few weeks ago when the trolley wire separated at a sectional insulator and fell to the ground. Although it was during the night, the linemen were on the spot in eighteen minutes after the accident occurred, and inside of forty minutes all repairs were made. The linemen live close to the car barn, and at night are called by the man in charge of the barn.

During the regular hours the line foreman calls at the receiving office of the company at frequent intervals and keeps the office informed of his whereabouts at all times. Our road not being large enough to warrant keeping an emergency force of men stationed at one place continually, we have adopted the plan outlined above and find it very satisfactory.

We have never had any serious shutdown from fire or from the elements. In case of a heavy thunder storm we have a standing order to shut down until the heaviest part passes, as we find it cheaper to lose an hour's business and then be able to proceed as before, than to be obliged to lose several hours by the station being damaged and the street blockaded by disabled cars. In such cases the trolley poles are tied down several feet from the line.

In regard to tools and appliances, we believe that a suitable tower wagon, built light but strong, and equipped with all necessary line tools should be kept ready at all times to respond to a call. On small roads the same wagon can be used in every day work, provided some similar plan to ours is adopted.

So far as the cars and station are concerned, we have a chief inspector who has full charge of both, and whose duty it is to ascertain and immediately remove the cause of any trouble to either. This man has no other duties than to see that all cars are fully examined several times a day, and that all the electrical appliances at the station are in good working condition. In this way much trouble is prevented by taking small troubles in season and making repairs before larger ones happen. Such a man is of great service to a road of any size.

In conclusion, let me say that I believe in hiring men for a specific purpose and not for all kinds of work. If I have a mechanical job to be done, I hire a mechanic, and if a line job a lineman, and if an armature or field job, an experienced winder ; I do not believe in a "jack-of-all-trades" man.

JOHN H. BICKFORD,
Electrical Superintendent.

SEATTLE CONSOLIDATED STREET RAILWAY CO.

SEATTLE, WASH.

GENTLEMEN :—In reply to your favor of the 14th inst., we have been singularly free from blockades since we started as an electric railway, viz., April 7, 1889.

We keep a wrecking car with the necessary tools and appliances in case of accident, either to cars, overhead construction or any other emergency, with the following tools, etc. : One hydraulic jack ; two screw jacks ; one pair wrecking frogs ; two large plates of iron, 4 ins. × 4 ft. ; two pieces of flat rail, each ten feet long ; block and tackle ; two long hook chains ; two steel bars and a large quantity of blocks, besides the usual smaller tools.

We have never shut down the road for more than thirty-five minutes from any cause whatever, except on one occasion. This was early in the morning of December 25, 1890, when, in an exceedingly heavy gale of wind, we had our smokestack blown down, and several fir trees fell across our boulevard bridge (two and a quarter miles in length) which caused a shut-down of five hours. The trees were considerably over four feet in diameter, and drove the piles down several feet with the weight of their fall. In this case we had to transfer for two days. This accident could not occur again, as we have had all trees cut down in the vicinity of our tracks. This was the worst wind storm in the memory of the oldest resident, and caused much damage besides that mentioned.

A. DUNN, Auditor.

UTICA BELT LINE STREET RAILWAY CO.

UTICA, N. Y.

GENTLEMEN :—In order to explain intelligently our methods of raising blockades, etc., it will be necessary to first describe the system by which our gangs are divided and governed.

There is, first, an assistant superintendent who has entire charge of motormen, conductors and transportation. It is his duty in all cases of obstruction to traffic, such as fires, wires down or derailed cars, by which travel will be delayed for any interval, to go immediately to the place of trouble ; and should the obstruction occur on a single track line, he sends orders to the nearest turnouts for the cars to meet at the point obstructed and the passengers to be transferred from car to car.

If a car is delayed in returning to the car house by the accident, the starter at that point starts an extra crew with a car on the time of the car overdue, the extra crew changing with the regular and bringing their car to the house when the two meet. By this method the cars are on time when the blockade is raised.

If the trouble occurs on a double track, a man is placed at the nearest crossover from the point obstructed, and a given number of cars are allowed to pass, first down one track and then down the other, returning by the same track to the crossover. The transfer of passengers occurs the same as on a single track, the double tracks only serving to facilitate matters.

Second. There is a foreman of a gang on car repairs, who, in case of a derailed or disabled car, will have an extra car run out with his men and necessary tools, and get the car in shape to return to the car house. If convenient the disabled car is derailed entirely, so that it offers no obstruction to travel, or is side tracked at the nearest switch, and the repairs made at such times as not to interfere with regular travel.

Third. There is a foreman of linemen who lives in close proximity to the car house, and is subject to a "call out" at all hours. A man from the line gang is also on duty at all times. Should word be received of trouble on the line, the line gang with an emergency wagon is ready to start for the break with the utmost dispatch, and make the necessary repairs.

Fourth. There is a small track gang kept constantly employed on adjustment and light repairs of curves, switches and low joints. These men have a horse and wagon always with them, and they can be quickly called in case of spread rails, washouts, or other trouble with the track, and are also called in case of a derailed car.

All foremen of gangs make a report each morning at the office where they will work during the day, so that in case of trouble they can be quickly called.

In case of "heart failure" at the power house, when the power has again returned each conductor has instructions to allow the car immediately preceding one minute's start before giving the bell to start his own car, and the starter sends out extra cars to meet the regulars

and get them again on schedule time. On the single track when, for instance, cars are running on half hour time, and two cars meet at a given switch, the inward bound car will be on the outward bound car's time; the crews merely transfer cars.

I would suggest that all motormen serve at least one week on motor repairs in the shop before running on the cars. All motormen should be equipped with a neat and compact canvas or leather bag, containing a twelve inch monkey wrench, a six inch screw driver, a pair of side cutting pliers and six or eight feet of insulated No. 0 wire, for a ground wire. These tools are all that are necessary for any ordinary repairs to lamp circuits, hot boxes or to cut out a motor. Any repairs that would require any length of time should never be undertaken on the street by the motormen, but the car should be pushed home.

The conductor should at all times telephone to the starter at the car house, at the first place to which he has access, any disablement of his car.

A pair of rerailing frogs and jacks should be kept in a convenient place in the shop at all times.

WM. W. COLE, Superintendent.

UNION RAILWAY CO.

CHESTER, PA.

GENTLEMEN:—I have not time at present to reply fully to yours of the 13th, but would make a suggestion that street railway companies should endeavor to get all fire companies to carry two sets of jumpers to protect their hose in case of fire. In my opinion it would save a great deal of time and unnecessary delay to the traveling public.

JOHN MACFAYDEN,
Superintendent.

A Stranger's Impression of Our Street Railway Systems.

Mr. George Flett, managing director of the firm of Messrs. Dick, Kerr & Co., engineers and contractors, London, Eng., having recently made a tour of our principal cities gives us his impressions regarding our street railways, in substance as follows: He was exceedingly surprised and gratified to see the crowded three and five car trains, following each other at short intervals on the Chicago cable lines, and the same thing on electric lines in other localities, and says he can now understand how that electricity is a success in this country while it has not thus far proved a success in the old country.

He criticizes our method of track construction and thinks we will have to improve our methods before our tracks will compare with those of English construction. But he infers that we will in time make an equally substantial roadbed, but that we are now going on the principle of putting down a road that will pay in the first instance, with a view of improving it later on. He thinks it may be a sensible course to pursue, but that it is a policy that the English people cannot be trained to adopt. He further says that we will not regret the adoption of the girder rail that is now being extensively used, and states that it has been universally adopted on the other side and in the colonies, and where laid on a proper roadbed and with heavy fishplates very satisfactory results have been obtained. The rail, however, differs somewhat from our type of girder rail as only the grooved girder rail is allowed, and they are usually rolled with a very wide base.

Again, he is surprised at the enormous strides that electric traction has made in all parts of this country, and especially in cities of the size of Toronto where they are constructing a system that will embrace seventy miles of track, for in cities of the old country, with no larger population, twenty-five or thirty miles of street railway would suffice. Mr. Flett is not only surprised at the magnitude of the business, but seems to think that the concessions granted to the street railway companies by the municipal authorities are much more liberal than are usually allowed in his country, and were the same concessions granted to them, he thinks it would cheapen considerably the cost of construction in the first instance and would lessen a great deal of the irritation which now usually attends street railway construction.

Mr. Flett secured an order for 10,000 tons of grooved girder rail from the Toronto syndicate, and after this is put in service we will have an opportunity of studying the relative merits of this construction as compared with the American type of rail.

Street Railway News.

General.

Allentown, Pa.—The Briggs Carriage Co., of Amesbury, Mass., have shipped ten open cars to the Allentown & Bethlehem Rapid Transit Railroad. They have several closed cars to build for the company.

Asheville, N. C.—The Asheville Street Railway Co. carried 23,000 passengers during the four days of the firemen's tournament.

THE Asheville Street Railway Co. and the Asheville Light & Power Co., two corporations intimately connected, have bought the Reems-Creek Falls and water power, six miles north of the city, and will bring their power and light by cable from that point instead of running their dynamos by steam engines here. It is estimated the saving in coal alone will be nearly $12,000 yearly.

Buffalo, N. Y.—The contract for the construction of the Buffalo, North Main Street & Tonawanda Electric Railroad has been let to the Field Engineering Co. of New York.

Chester, Pa.—The contract for ten twenty-five horse power motors for the Chester & Media Electric Railroad has been awarded to the Westinghouse Electric & Manufacturing Co. The motors will be attached to cars thirty-one feet in length.

Cleveland, O.—The Woodlawn Avenue & West Side Street Railroad Co. recently purchased three acres of land on which the car houses and shops will be erected when the road is equipped with electricity.

Dubuque, Ia.—It is reported that the bondholders who recently bought the Eighth Street motor line for $25,000 will offer it for sale at auction. In all probability a company will be formed here to operate it.

Durham, N. C.—The Durham street railway has suspended operations for the reason that it did not pay expenses.

Easton, Pa.—The stockholders of the Centre Square & Delaware Bridge Passenger Railway Co. recently voted to merge with the Easton, South Easton & West End Passenger Railway Co. under the title of the Easton Transit Co. This completes the merging of the horse car lines in Easton. The officers of the new company are: President, Warren A. Wilbur; secretary and treasurer, A. D. Chidsey.

THE Easton Transit Co. have adopted the Westinghouse system, and have ordered ten closed cars of the Westinghouse Manufacturing Co., of Pittsburgh. Each car is to be equipped with two twenty horse power motors, the cars to be delivered by November 1. Next spring the Westinghouse company will furnish the road with ten or twelve open cars of the same equipment. Pepper & Register, of Philadelphia, have secured the contract for the construction of the road.

Fort Wayne, Ind.—The contract for the power house for the new electric railway plant of the Fort Wayne & Belle Isle Railway has been let. It is to be finished by October 1. A Chapoton, Jr., will do the mason work, Golden & Teakle the carpenter work, and the Wrought Iron Bridge Co. of Canton, O., the roof.

Gainesville, Tex.—The street car line was sold, August 3, for $855, to satisfy judgment in favor of the Merchants' National Bank of Fort Worth.

Galveston, Tex.—The Galveston City Railway has been sued in the United States Circuit Court here by the Detroit Electrical Works. On March 12, 1891, the Galveston City Railway Co. contracted with the Detroit Electrical Works for a full car equipment. The electrical company claim that they have complied with all the requirements of the contract, while the railway company allege that the plant and equipment put in by the electrical works did not meet the requirements of the contract.

Honeoye Falls, N. Y.—The projectors of the Lima & Honeoye Falls Motor Railway have begun operations.

Halifax, N. S.—The Nova Scotia Power Co. propose constructing an electric street railway to extend from the deepwater terminus of the Intercolonial railway along Water Street to the South End.

THE Halifax Carette Co. started business here about two months ago with $15,000 outfit. During the first month the company lost over $1,500 on running expenses, and the directors then discontinued the experiment.

Independence, Mo.—The tracks of the Citizens' Street Railway Co. were taken up by order of a resolution adopted by the City Council declaring the franchise void. The cause alleged was poor service and non-compliance with the franchise.

Johnstown, N. Y.—Frank Hart of Amsterdam has been awarded the contract to build the power house for the Cayadutta Electric Railway Co.

Kansas City, Mo.—The Eighth Street line from the Union Depot to Delaware Street has been equipped as an electric road by the Consolidated company.

THE transfer has been completed of the Interstate Consolidated Rapid Transit Railway to the Kansas City Elevated Railway Co.

AN ordinance has been passed by the City Council declaring forfeited $10,000 deposited by the Union Cable Co. on May 10, 1892, as a guarantee to complete their road, in accordance with their franchise, before August 1, 1892. The amount was placed to the credit of the City Hall fund.

Lansing, Mich.—As a result of the suit which has been pending in the United States Circuit Court, between the Continental Trust Co. and the Lansing Street Railway, Judge Swan has ordered the foreclosure of the mortgage which the trust company hold, and the sale of the line, including the franchise and equipments. It is said, however, that this new phase of affairs will not affect the proposed extensions of the lines nor the operations of the road. If the trust company bid in the road the improvements which are being carried out will be completed.

Lynchburg, Va.—The street railway companies are to be consolidated.

Memphis, Tenn.—The Memphis & Raleigh Springs Railway is complete and in full operation.

Montreal, Can.—Work on the electric street railway is progressing rapidly. The directors lately granted a 25 per cent. increase of wages to the conductors and drivers. It was also agreed to limit the working hours of the men to ten per day.

New York, N. Y.—The Belt Line railroad is likely soon to pass into the control of Metropolitan Traction Co., owners of the Broadway & Seventh Avenue, the Sixth Avenue and a number of other surface roads. The official name of the Belt Line road was the Central Park, North & East River Railroad. Another road which the Metropolitan Traction Co. are understood to be negotiating for is the Forty-second Street, Manhattanville & St. Nicholas Avenue. Negotiations were in progress some time ago for the sale or lease of the Eighth Avenue Road to the Metropolitan Traction Co., but they were interrupted.

North Vernon, Ind.—The North Vernon & Vernon Street Railway was put in operation August 9.

Ottawa, Ont.—The endeavor to get the old street car line converted into electricity has resulted in a proposition from the company to the Corporation to allow both lines to amalgamate under a thirty year charter, in place of the twenty year charter now owned by the electric line, and to give a twenty year charter to the Passenger Railway Co., with power to go back to their perpetual horse car charter at the end of that time. By this proposal both roads would be controlled by the Corporation.

THE electrical machinery is being placed in the Ottawa Electric Street Railway Co.'s new power station. The chief novelty of the station is that it will be the first building in America heated by electricity. The method is by water heated by electrical apparatus patented by Mr. Ahearn, the general manager. The 400 H. P. generator, weighing nearly 33,000 lbs., is made by the Westinghouse Electric & Mannfacturing Co., of Pittsburgh, Pa.

Paducah, Ky.—The Sinker-Davis company have shipped a high speed, 150 H. P., engine and boilers to run the electric plant which the Paducah Street Railway Co. are putting in.

Pawtucket, R. I.—A bill of equity has been filed in the Supreme Court by the New York, New Haven & Hartford Railroad Co., against the Interstate Railway Co., and also a petition for an injunction enjoining them to take up their tracks and the plate at the point where their roads cross the tracks of the railroad company on Broadway.

Peoria, Ill.—Eighteen conductors on the Central Electric line were discharged recently as a result of the discovery of wholesale robbery of the company. The plan of operation was to secure at a low figure, from the janitor, tickets which had been returned to the office, sell them over again and pocket the proceeds. The sum thus obtained is not known, but will amount to several thousand dollars.

Philadelphia, Pa.—John A. Rigg, who for eighteen years has been manager of the City passenger Railway of Reading, has assumed general management of the People's Passenger Railway Co. His brother, Samuel E. Rigg, will succeed to the superintendency of the City Passenger Railway of Reading.

Pittsburgh, Pa.—The arrangements for the consolidation of the Pittsburgh, Allegheny & Manchester and the Pleasant Valley street car lines, have been practically completed. Negotiations for a consolidation have been in progress for several months.

Pittsfield, Mass.—The directors of the old Pittsfield Street Railway Co. have authorized the treasurer to apply to the Supreme Court for the dissolution of the corporation. The franchise and road were sold last year to the Pittsfield Electric Street Railway Co.

Portland, Ore.—The Metropolitan and Multnomah companies recently caused the arrest of forty conductors for stealing. G. B. Markle, president of both companies, says that the company have been losing on an average of $4,600 a month.

Racine, Wis.—The City Council a year ago passed an ordinance granting to the Belle City Street Railway Co. the privilege of rebuilding fifteen miles of track and installing an electric system. The company have laid T rails and the Council have adopted resolutions notifying the company that there is serious opposition to their use as they interfere with traffic.

Rock Island, Ill.—The street railway syndicate has inaugurated a system of making a monthly award of prizes to the conductors and motormen presenting the neatest appearance personally, and who keep their cars in best order.

Rockland, Me.—The Rockland, Thomaston & Camden Electric Street Railway is finished and in full running. The road is very popular and the cars are crowded all the time. 30,000 passengers were carried the first week of operation.

Salem, Mass.—The great street railway deal, about which so much has been said and written lately, has been consummated. The syndicate is composed of Philadelphia capitalists, at the head of which is the banking house of E. W. Clark & Co.; they have secured the control of the Lynn & Boston, the Belt Line, the Naumkeag Street Railway and the Essex railway, and will operate a continuous electric system from Boston. The road will be known as the North Shore Traction Co. The property secured by the combination embraces fully 120 miles of track, about one-half of which is equipped with electricity.

St. Paul, Minn.—A fall of almost eight inches of rain during July 26 and 27 caused a suspension of the service on the electric railway lines Rain collected on the roof of the Hill Street power station more rapidly than the pipes could drain it away. The roof finally collapsed, and rested on the machinery. The company had an enormous amount of repair work to do after the rain had ceased. The Concord Street line was three feet under sand. The interurban line was kept in operation by current from Minneapolis. The street car company sustained considerable damage in Minneapolis, though it was by no means as serious as in St. Paul.

San Diego, Cal.—The San Diego Electric Railway Co. have ten miles of electric road under construction and expect to be in operation about October of this year.

San Francisco, Cal.—The Geary Street, Park & Ocean Railroad Co. have almost completed the reconstruction of their cable line, nine miles in length, and have changed the gauge to four feet eight and a half inches and will add ten cars.

THE City Railway Co. have a three mile cable line under construction.

Springfield, Mass.—A new car for the street railway company arrived recently from the factory of J. M. Jones's Sons, West Troy, N. Y.

Springfield, O.—W. B. Kinley, of Champaign, Ill., and S. L. Nelson, of Defiance, O., own and are now operating the Springfield Street Railway. The price paid for the system is over $500,000. Messrs. McKinley and Nelson are practical electric road men and will equip their new purchase with the best machinery obtainable.

Uniontown, Pa.—The Union Street Railway Co. are building from three to four miles of electric road.

Urbana, Ill.—B. F. Harris, Jr., has purchased the street railway system of Champaign & Urbana and the electric lighting and power plants connected with it, assuming management thereof. New and improved machinery will be added to the plant.

Velasco, Tex.—Messrs. Perry and Guy M. Bryan and others have begun construction on the street car line from Velasco to Bryan Heights, an elevation in the prairie three miles distant.

Victoria, B. C.—The Electric Lighting & Tramway Co. lately suffered a loss by fire of $80,000, of which only $45,000 was insured.

Victoria, Tex.—The Victoria Street Railway stopped their cars recently. Lack of patronage is the cause. It is expected that the suspension will be only temporary.

Wilkesbarre, Pa.—J. H. Gibson has been appointed general superintendent of the Traction company's lines.

Woburn, Mass.—Dr. George P. Bartlett, a physician and surgeon of this place, has invented a fender for electric street railway cars, which was successfully tested on the East Middlesex Street Railway lately. Dummies of a man and boy were placed on the tracks and roadbed in different positions, and the car run against them at various rates of speed. They were pushed off the tracks most effectively. In no instance was a dummy carried over twenty-two feet, and in most cases a much shorter distance before, being thrown aside. Stones were also placed upon the tracks and between them, and the fender worked equally well with these.

Yarmouth, N. S.—The Yarmouth Electric Street Railway was obened last month.

York, Neb.—The franchise of the street railway company was declared forfeited for the reason that their company had failed to comply with the provisions of the franchise in constructing and operating street railway lines, and owing to the fact that the materials composing the road were sold under attachment proceedings.

Extensions and Improvements.

Akron, O.—John F. Seiberling has received an ordinance to build and maintain a street railroad on North Hill.

Alameda, Cal.—The Alameda street railway line with its franchises has been sold to a company which will at once rebuild it as an electric line. It is likely that other franchises in the town will be applied for, and a complete system built that will supply all demands of travel. The officers of the company which purchased the road are: W. H. Bailey, president; F. H. Meyers, vice-president; W. M. Rank, treasurer.

Albany, Ga.—The Artesian City Railway Co. will extend their line for a quarter of a mile and will add two cars this year.

Allentown, Pa.—The Allentown & Bethlehem Railway Co. are extending their line this year.

Ashland, Wis.—The Ashland Lighting & Street Railway Co. have let the contract for changing the present horse car system into an electric line to the Thomson-Houston Electric Co. of St. Paul, Minn.; all work to be completed within four months.

Attleboro, Mass.—The Attleboro, North Attleboro & Wrentham Street Railway Co. have applied for a location from Park Street crossing to the town line of Seekonk.

Beaumont, Tex.—The Beaumont Street Railway Co. will make a slight extension this year.

Boone, Ia.—Engineer C. H. Hart, who is the projector of the scheme to electrically equip the Oskaloosa line, proposes to buy the present street car line, make some four miles of extensions and operate it by electricity.

Bowling Green, Ky.—The Park City Railway Co. have in contemplation some important improvements.

Bridgeport, Conn.—The East End Railway Co. have decided to discard horses for electricity.

Cairo, Ill.—E. W. Halliday, C. O. Patier and others of Cairo have purchased the interest of the St. Louis stock and bond holders, also Capt. W. P. Halliday's interest, and thus secured control of the road. They will proceed at once to extend the road and improve it.

Carthage, Mo.—J. Guinney, proprietor of the Carthage street railway, and other wealthy gentlemen of this city are interested in a scheme to run a belt line round Carthage, thence to Carterville to connect with the electric line which is being built from Joplin to the Troup mines.

Chicago, Ill.—The Chicago City Railway Co. are building and are to build a number of miles of street railway tracks on the South Side. Permits have been issued to build two loops to use in World's Fair transportation.

Cincinnati, O.—John Kilgour, of the Consolidated company, has asked Council to be allowed to relay the tracks on Eighth Street, from Central Avenue to the foot of Price Hill incline, with heavier rails, as the Consolidated want to operate the line with electricity at an early date, if permission is granted. He also wants permission to change the motive power of the Storrs and Sedamsville route to electricity.

Cleveland, O.—The East Cleveland Railroad Co. and the Sheriff Street Market & Storage Co. are working to get the right of way on Huron Street from Prospect Street to the market house for carrying farm products from the district east of Lake View to the market. The company's charter gives them the right to carry freight as well as passengers.

APPLICATION has been made to the Council to grant the Cleveland City Cable Railway Co. the right to equip and maintain an electric street railway on St. Clair Street from Water Street to the city limits.

Columbus, Miss.—The Columbus Street Railway & Power Co. have received an extension of their franchise.

Columbus, O.—The Columbus Consolidated Street Railway Co. have received a franchise on Kelton Avenue from Main Street to Livingston Avenue, for a single track railway.

AN ordinance has passed the City Council granting the Columbus Street Railway Co. right to extend their tracks on Goodale Street.

Corpus Christi, Tex.—The street railway system is to be extended.

Corvallis, Ore.—The Corvallis Street Railway will extend their horse lines two miles this year.

Covington, Ky.—The running of an electric street railway to Fort Thomas by way of Bellevue is being considered by the South Covington & Cincinnati directors.

Dalton, Mass.—There is a project on foot to extend the Pittsfield electric road to this place.

Decatur, Ill.—The street railway company have received a twenty year franchise to make further improvements.

Denver, Colo.—It was lately stated that the City Cable Railway Co. would abandon their Platte Street horse car line, and in this event the Tramway company will extend their Agate Avenue line over the horse car line and down Fifteenth Street to Lawrence. It is also said that the company will run electric cars through from Lawrence to both Elitch's and Manhattan.

Easton, Pa.—Permission has been granted to the Easton, South Easton & West End Passenger Railway Co. to operate their roads and proposed extensions by electrical power.

El Paso, Tex.—The El Paso Street Railroad Co. and the Santa Fe Street Railroad Co. have been granted the right to change their lines now in actual operation from horse power to electric.

Elizabeth, N. J.—Council lately received a petition from the Elizabeth Street Railway Co. for consent to use electricity for motive power instead of horses.

Flatbush, N. Y.—Application has been made to the Board of Improvement for a franchise to build a surface railroad on Nostrand Avenue from the city line to Vernon Avenue and from thence to Flatbush Avenue, by J. C. Cameron, representing the Brooklyn City Railroad Co.

Fond du Lac, Wis.—On August 9 a deal was closed whereby the Fond du Lac street railway passes into the hands of W. G. DeCille, St. Paul, Western agent of the Westinghouse Electric Co. The line will be equipped for operation by electricity, and an incandescent electric light plant will be put in.

Fort Wayne, Ind.—The Centlivre line is being extended to the race track.

Frewsburg, N. Y.—Frewsburg people want the Jamestown electric road extended to their town.

Glens Falls, N. Y.—The Glens Falls, Sandy Hill & Fort Edward Electric Railway Co. have commenced extending the road from East Street to a point in front of the post office.

Glenshaw, Pa.—The Manchester Electric Street Railway Co. having obtained the rights of way in Sharpsburg, Etna and Millvale, the people of Glenshaw have requested the company to put down a branch line from Etna to Glenshaw.

Harrisburg, Pa.—Right of way has been granted to the Citizens' Passenger Railway Co. to lay tracks on Fourth to Maclay Street, providing the company will not lay tracks on Fifth Street as granted by a previous ordinance.

THE East Harrisburg Passenger Railway Co. have asked the Council for rights to occupy certain streets.

Johnson City, Tenn.—The Johnson City & Carnegie Street Railway Co. have built a half mile of road during the present season.

Joplin, Mo.—A deal is on foot looking to the consolidation of the street railways of Joplin, Webb City and Carterville, and the building of an electric line between Joplin and Webb City. The necessary capital is said to be pledged.

Kansas City, Mo.—Negotiations are under consideration for the consolidation of the Northeast electric street railway line and the Tenth Street cable line, known as the People's Cable Railway Co., and the construction of a connecting line between the two on Lydia Avenue from Independence Avenue to Tenth Street. If successful the cable line will be converted into an electric line, the power to be obtained from the Tenth Street plant. The two downtown terminals will be continued. The Burge Park and Brooklyn terminals will also be continued.

THE Metropolitan Street Railway Co. have been granted a franchise to extend their line to the west end of Argentine.

A MAJORITY of property owners on Wyandotte Avenue, from Second Street south, have signed a petition for an electric line.

Key West, Fla.—It is said that the Key West Street Car Co. have sold out to a Northern company, who will relay the track and employ electricity.

Lancaster, Pa.—The West End Street Railway Co. are going to extend their lines from South Queen to Prince Street, on Conestoga, thus forming a belt line by erecting a line on South Prince Street to West King.

Laredo, Tex.—The Laredo Electric Street Railway Co. contemplate the extension of their road and the addition of six cars.

Lincoln, R. I.—The Pawtucket Street Railway Co. have asked the Town Council for rights to lay tracks in High Street.

Lynn, Mass.—The Thomson-Houston Electric Co. have been granted a hearing for September 6, on their petition to extend electric car tracks over Western Avenue from Federal to Fairchild Street.

Macon, Ga.—The Macon Consolidated Street Railroad Co. have been authorized to make various extensions.

Melrose, Mass.—The selectmen have granted the petition of the East Middlesex Railroad Co. to locate tracks from the junction of Main and Green Streets, Highlands to Wakefield line and from Howard Street easterly to Saugus line, and to maintain electric power over said tracks.

Methuen, Mass.—The Lowell, Lawrence & Haverhill Street Railway Co. have been granted a location in Methuen by the Selectmen.

Milwaukee, Wis.—The Milwaukee & Wauwatosa electric line is being extended.

A MOVEMENT is on foot by the Cudahy Bros. and other parties interested at Cudahy, St. Francis and along the route, to induce the Milwaukee Street Railway Co. to extend their line to Cudahy early next spring.

Mobile, Ala.—The Mobile Electric Railway Co. have asked authority to build a street railway, to be operated by electricity, on Jackson and other streets.

New Orleans, La.—It is reported that R. T. McDonald, general manager of the Fort Wayne Electric Works, has purchased and consolidated the street car lines and will operate them with electricity.

OFFICIALS of the Crescent City company state that an electric line, fully equipped, will be in operation in six months, the power to be supplied by the Louisiana Electric Light Co.

New York, N. Y.—John F. Foster, president of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railroad Co. has registered plans for the erection of a four-story brick depot and car stables, 125 × 182 ft., on the north side of Manhattan Street, and the south side of 113th Street.

Newburgh, N. Y.—The Newburgh Street Railway Co., will equip their line for electricity, provided they can get permission for further use of the streets.

Newport, Ky.—Colonel Shipherd and other members of the new street car syndicate have agreed to extend the electric car system out the Alexandria pike to the Evergreen Cemetery.

Niagara Falls, N. Y.—The Niagara Falls & Suspension Bridge Railway Co. have applied for a franchise on Ontario Avenue from Lewiston Avenue to Spring Avenue.

Oakland, Cal.—The Town Trustees have granted a franchise to the Oakland Consolidated Street Railway Co., giving them permission to construct their northern loop.

THE Oakland, San Leandro & Haywards Electric Railway Co. have been granted a franchise to maintain an electric road from Clay and Thirteenth Streets, down Clay to Eighth and thence to Franklin. This company has made an agreement with the Oakland Consolidated to run cars from East Oakland over Twelfth Street to Oak, to Thirteenth, and thence to Clay. The loop will be made by running up Franklin Street to Thirteenth.

Paterson, N. J.—The ordinance granting the right of way through Clay and other streets to the People's Park Railway Co. has been passed.

Petersburg, Va.—The street railway is to be extended this year.

Providence, R. I.—The Union railroad have asked the City Council of Providence for electric trolley rights on the Elmwood route.

Rockford, Ill.—Two miles of electric road and five cars will be added by the Rockford City Railway Co.

San Antonio, Tex.—The San Antonio Street Railway Co. advise us that they contemplate building a pavilion or summer theatre at the end of one of their lines, and that they desire to open correspondence with architects with a view to secure plans.

Saugus, Mass.—The Lynn & Boston Railroad Co. have asked for a location for their tracks from Saugus Centre to Melrose Highlands. It is understood to be for an electric system.

Seattle, Wash.—The Rainier Power & Railway Co. expect to complete seven miles of electric road before long.

Sioux City, Ia.—Rights to make several extensions have been conceded by the City Council to the cable railway company.

Stoneham, Mass.—The Wakefield & Stoneham Street Railway Co. have asked for a location for their tracks.

St. Paul, Minn.—President Lowry has proposed to the City Council to extend his lines to Como Park and Lake Phelan, on certain considerations.

Terre Haute, Ind.—The Terre Haute Street Railway Co. have filed a petition with the County Commissioners, asking to be granted the same franchise as was given to the Suburban Street Railway Co. They ask the right of way for a period of thirty years.

Trinidad, Colo.—The transfer of the Trinidad street railway to an Eastern syndicate has taken place. The present horse car lines will be taken up and an electric line of five miles laid.

Uniontown, Pa.—The Uniontown Street Railway Co. are extending their line three miles south to the Redstone Coke Co.'s works. The company also talk of extending to Oliver Bros. new plant, two miles north.

West Chester, Pa.—It has been decided to extend the line of the West Chester Street Railway Co. from Lenape to Birmingham Park. A new roadbed will be built separate from the railroad track.

Wilkesbarre, Pa.—The Wilkesbarre & Suburban Street Railway Co. by an amended ordinance have received permission to operate new lines over certain streets.

Yonkers, N. Y.—The Yonkers Railway Co. have petitioned the city to allow them to extend their line along Palisade, Ashburton and Park Avenues.

New Roads.

Abington, Mass.—The Abington & Rockland Electric Railroad Co. have accepted all the franchises granted by the towns along the proposed line, and contracts for the construction of the road will be made as soon as possible, and a call has been made to stockholders for the first 10 per cent. on their stock.

Atlanta, Ga.—A franchise has been granted to James Mell, W. J. Zachrey and A. S. Seals to build an electric street railroad on Loyd, Ivy, Gilmer, Fort, Erwin and Turnpike Streets to the city limits. Under the grant the road must be completed within one year's time.

A CHARTER has been granted to the Associated Loan & Investment Co., with a capital stock of $100,000. Some of the charter members of the company are: T. S. Boyd, D. G. Wylie, A. W. Hill and M. Harralson. The principal office of the company will be in Atlanta, and they have the right to construct railroads, canals, tramways and street railroads, to be operated by any authorized corporation, with steam or electricity.

THE proposed new dummy line between this city and Decatur is to be built at once, the permission requiring it to be in operation within one year under penalty of forfeiture of the franchise.

Aurora, Ill.—The Aurora & Chicago Interurban Railway Co. were given a franchise lately to build and operate their lines in Aurora. The company expect to build an elevated electric road between the cities to cover the distance in less than half an hour. The projectors hope to have the line completed by December, 1893.

Baraboo, Wis.—A movement is on foot to build an electric road from Devil's Lake to the Dells, via Baraboo. A scheme of this kind was contemplated some time ago, but it fell through.

Bartow, Fla.—R. W. Price of Dayton, Ala., has entered into obligations to have the new street railway in operation by June 25, 1893. It will run from the South Florida to the Florida Southern depots by way of the public square, and is to use either horse, steam or electric power.

Bedford, Pa.—A charter has been issued to the Bedford Electric Railway Co. with a capital stock of $15,000. The proposed road will be about two and a half miles in length, running from the Pennsylvania Railroad depot to the springs, and will run through the principal streets of Bedford. Three of the directors are: John B. Robinson, Media; James B. Oliver, Pittsburgh, and John Neeb, Pittsburgh.

Bridgeton, N. J.—A party of capitalists have formed a company, with ex-Senator Cattell, of Camden, at its head, to put in a line of horse cars.

Buffalo, N. Y.—Contracts have been let by the Buffalo, Kenmore & Tonawanda Electric Railroad for the construction of that long-contemplated line. The Field Engineering Co., of New York, will do the work. The officers of the road are: D, F. Callahan, president; William F. Strasmer, secretary; John L. Donovan, treasurer; George H. Frost, attorney.

Chattanooga, Tenn.—The Chattanooga, Mission Ridge & Alton Park Railway Co. have been incorporated by F. J. Bennet, C. E. James and others.

Chicago, Ill.—Residents of Oaklawn are organizing a company to build an electric road to Western Avenue. D. R. Niver and Geo. W. Warr are amongst those actively interested.

THE Evanston City Railway Co. have been organized at Evanston, a suburb of Chicago. The capital stock is $150,000, and the incorporators are: Henry Delany, Richard A. Paddock and J. P. Cody.

THE Chicago Carette Co. have been incorporated, capital stock, $100,000; incorporators: Thomas Salor, John Pender and James J. O'Connor.

THE Calumet Electric Railway Co. have recently been given the right to operate an overhead trolley line on 75th Street. The Council has amended the franchise so that the company may be compelled to use an underground system at the discretion of the authorities.

Chillicothe, O.—The Chillicothe Electric Street Railway & Light Co. have asked for the right of way and necessary franchise and privileges for operating an electric street car line, and arc and incandescent lights in the city.

Chippewa Falls, Wis.—C. W. Riely and F. J. Jersey, of St. Paul, are in the city, trying to secure a franchise from the Common Council to put in an electric street car line.

Cincinnati, O.—The citizens of Linwood and Red Bank, after having asked the Consolidated company to give them rapid transit, have raised a bonus of $10,000 which they have offered to the Cleveland company, now operating in the city, to build a line.

Cleveland, O.—A. Whitebeck and associates are making efforts for a crosstown street railway franchise. The proposed road is to run from Woodland Hills Avenue to the lake by the way of Doan Street.

Columbia, Pa.—Surveying has been begun for the proposed Columbia & Marietta Electric Railway.

Columbus, O.—Two new corporations, the Leonard Avenue and the Westerville street railway companies have received twenty-five year franchises to construct lines.

Easton, Pa.—The Easton & South Easton Railway Co., in which J. Davis Brodhead and W. A. Wilbur, of South Bethlehem, are interested, have been chartered; capital $1,000,000.

East St. Louis, Ill.—W. E. Gunn has asked the City Council for a right of way for a street car track from a point on Broadway and Eighth Street along Walnut and Fisk Avenues and on out through Denverside. The road will be propelled by cable.

Eddystone, Pa.—The Darby & Chester Electric Railway Co. have applied for permission to erect and operate a system of electric cars through the borough.

Erie, Pa.—The indications are that the project to build a line from here to Wesleyville and thence to Four Mile Creek is about to be revived by the Erie Transit Co.

Flint, Mich.—The Common Council has granted a franchise for the construction and maintenance of a system of street railway in this city to David Joy and Chas. A. Stockton, of Findlay, O.

Fort Wayne, Ind.—The Fort Wayne Electric Railway Co. have filed articles of association. The capital stock is $1,000,000.

Galion, O.—A company is being organized to construct an electric line between this place and Crestline.

Grand Forks, N. Dak.—The street railway ordinance has been passed by the Grand Forks City Council, and $5,000 bonds have been given by the company, and one mile is to be completed within sixty days.

Greenville, S. C.—The Street Railway Co. of the City of Greenville have been authorized by ordinance to build an electric railway and operate the same for a period of thirty-seven years.

Hoboken, N. J.—The Palisade Rapid Transit Association of West Hoboken are pushing the project of an elevated road to North Hudson.

Hollidaysburg, Pa.—It is understood that the directory of the Hollidaysburg Electric Light & Power Co. are considering the advisability of running an electric car line between this place and Duncansville.

Homestead, Pa.—Civil Engineer J. H. McRoberts has just completed a survey of the route of the proposed street car line from the South Side, Pittsburgh, to Homestead. The project is being engineered by Dr. J. M. Duff of Carson Street, Pittsburgh, and a number of well known capitalists.

Houston, Tex.—The Houston Heights Street Railroad Co. of Houston, with a capital stock of $100,000, have been incorporated by D. D. Cooley, H. F. McGregor and G. B. Hengen.

Hyde Park, Mass.—The selectmen have granted to the Suburban Street Railway Co. the right of way through the town. This is the same company that was granted a franchise at Dedham. The road will be at once built from Dedham to Mattapan, through Hyde Park, and if favorable action is taken in Boston, a line will be built on Hyde Park Avenue to Forest Hills.

Indianapolis, Ind.—The taking of subscriptions to secure an electric street car line to Brightwood is being successfully pushed. On the committee are: Captain D. D. Negley, Jacob Caskey and Aaron Clem.

Jamestown, N. Y.—President A. N. Broadhead, of the Jamestown Electric Street Railway Co., is organizing a company to build an electric road along the northern shore of Chautauqua Lake from this city to Mayville. Fast double decked cars will be run, and freight hauled by 250 H. P. motors. The road is to be completed by next spring.

Kansas City, Mo.—B. T. Whipple and others have applied to the City Council of the suburb of Westport for a franchise to construct an electric railway on Summit Street from Thirty-first Street to Westport Avenue. The line will connect with the Kansas City Cable Railway Co.'s line.

Lawrence, Kan.—Lawrence people want $10,000 from the state to build an electric street car line to the university.

Leavenworth, Kan.—The Leavenworth Electric Transit Co., capital stock $500,000, have filed articles of incorporation. The company are incorporated for the purpose of building an electric road from Leavenworth to the Soldiers' Home. The directors are C. F. Brotherton and L. M. Erb of Kansas City, and S. M. Neely, C. S. Hartrough and William C. Hook of Leavenworth.

McKeesport, Pa.—Application has been made for a charter for an electric street railway between McKeesport and Wilmerding. The name of the corporation is the "McKeesport & Wilmerding Railway Co." The officers are: A. W. Smith, president: B. W. Karskaddon, vice-president; John C. Devenny, secretary; Dr. C. B. Stucslager, treasurer. The capital stock will be $200,000.

Manchester, N. H.—The American Elevated Railway Construction Co. of Manchester, capital stock $1,000, have filed articles of incorporation, to construct elevated railways in all parts of the country. The incorporators are: A. J. Hodden and C. S. Daniels of Boston, E. Farrand of New York City, and F. C. Twombly and John Gay of Manchester.

Marquette, Mich.—Right of way has been secured for a motor line between this city and Nagaunee, thirteen miles distant. The right of way is in the name of M. E. Ascire of this city. The road will use either electric power or the new Healy steam motor.

Marshallton, Pa.—A well founded rumor is afloat that a Wilmington man has offered to put $20,000 in an electric road from Marshallton to West Chester, the route to be through Glen Hall.

Melrose, Mass.—It is stated to be the intention of a number of gentlemen to organize a company with $50,000 capital to unite with the East Middlesex company and run from Melrose to Wakefield, and thus save the necessity of paying two fares.

Milford, Neb.—Some of the enterprising business men of Milford have been in correspondence with Eastern capitalists with a view to organizing and building an electric railway from Lincoln to Milford. A company will be organized for that purpose as soon as possible.

Milwaukee, Wis.—F. T. Day, William Sanderson and Charles L. Clason have incorporated the Milwaukee & Layton Park Street Railway Co. The capital stock is $10,000. The company will build a street railway from Layton Park to the vicinity of Forest Home to connect with the line of the Milwaukee Street Railway Co.

Muncie, Ind.—The Citizens' Street Railway Co., capital stock $250,000, has been organized in this city and articles of incorporation filed. Three of the directors of the new company are: Oliver S. Kelley, of Springfield, O.; J. Smith Talley of Terre Haute, and George F. McCulloch, of Muncie. At a special meeting of the City Council a franchise was granted the company to operate an electric line.

ARTICLES of incorporation have been filed by the Muncie Belt Railway Co., with a capital stock of $50,000. The road will be nine miles long and will completely girdle Muncie.

Nanticoke, Pa.—A charter was issued lately to the Nanticoke & Newport Railway Co.; capital $50,000; to build a line eight miles long which will put into communication with each other a number of small towns and hamlets. The directors are: Thomas D. Shea, John Smoulter, jr., Nanticoke; John B. Reynolds, C. H. Reynolds, Kingston; John T. Lenahan, Wilkesbarre.

New York, N. Y.—The New York, Mapleton & Van Pelt Manor Railway Co. have filed articles of incorporation. The road is to be operated by electricity, horse power or cable, from Brooklyn, through Flatbush and New Utrecht, a distance of about five miles. The capital stock is $50,000, and the directors are: Andrew D. Baird of Brooklyn; J. A. Townsend of Bay Ridge; M. McCormack of Mapleton, L. I., and others.

Niles, O.—The officers of the Mineral Ridge & Niles Electric Street Railway Co. have presented a petition to the City Council asking the right of way to construct a line on Vienna and Robbins Avenues to the city limits.

Norwalk, Conn.—Senator E. J. Hill is president of the Norwalk Tramway Co. who propose to build an electric road from Norwalk to South Norwalk and Darien Point, to be running by November 1. The capital stock of $50,000 is now all subscribed.

Norwalk, O.—This place will soon be connected by electric street railroad with Milan, Huron and Sandusky, the proposed electric line to be constructed and operated by the Sandusky, Milan & Huron Electric Railroad Co.

Oakland, Cal.—It is said that articles of incorporation will be filed shortly of a company to operate the electric roads in Oakland covered by the Meetz franchise, which have been acquired by a number of capitalists interested in the California Improvement Co., among whom are the following: Col. F. H. Meyers, E. S. Denison, W. M. Rank, W. H. Chickering and W. H. Bailey. It is understood that considerable money is to be expended in improving the service.

Oklahoma City, Ok.—The City Council of Oklahoma City has passed an ordinance granting a franchise to A. N. Spencer and his associates to build a street railway line.

Paterson, N. J.—James A. Morrisse, real estate dealer of this this city, is the organizer of the Paterson & Little Falls Electric Railway Co. Thomas M. Ryle and John R. Lee are two others of the incorporators.

Peoria, Ill.—An incorporation license has been issued to Martin Kingman and others, who propose to connect Prospect Heights with the city by means of rapid transit. The capital stock is $100,000.

Philadelphia, Pa.—A charter has been issued to the Philadelphia & Bryn Mawr Passenger Railway Co., capital, $50,000. The road will be operated by electricity and will be seven miles in length. The directors are Samuel F. Gillies, Geo. W. Seltzer, James Jordan, Adolph Hermann, Chas. F. Trego, Philadelphia.

ANOTHER company is the Elmwood & Fairmount Park Passenger Railway Co., capital, $58,000. The road will be operated by electricity and will be about seven miles long. It will begin at the starting point of the Philadelphia & Bryn Mawr Railway.

A THIRD incorporation is the Fairmount Park & Haddington Passenger Railway Co., of Philadelphia; capital, $50,000.

A CHARTER has been granted to the Philadelphia, Cheltenham & Jenkintown Passenger Railway Co. with a capital of $60,000. John H. Fow is president, and the company will proceed immediately to build an electric road along the old York road from Jenkintown to its intersection with Erie Avenue, in this city. It will then cut across to Fifteenth Street and by an elevated structure run down Fifteenth Street to Indiana Avenue, where connection will be made with the lines of the Traction company.

Pittsburgh, Pa.—The directors of the new Kensington Street Railway Co. have decided to commence construction at once. Electricity will be the motive power. It runs from Parnassus to the Chambers Glass Works and Valley Camp. The line is five miles long and is expected to be in operation this winter.

Pomeroy, Wash.—The Judkins Tramway Co. has been formed, with a capital of $6,800.

Pontiac, Mich.—Orchard Lake is to have an electric road from Pontiac. John D. Norton is president of the company.

Portland, Ore.—The Portland Consolidated Street Railway Co., of Portland, capital, $1,000,000, have filed articles of incorporation.

Portsmouth, O.—The franchise for the electric line here has been granted and construction will be commenced immediately.

Radford, Va.—It is said a syndicate has purchased the street car franchise and will proceed at once to furnish an electric railway.

Reading, Pa.—There is a project here to run an electric line from the city to Ringing Rocks.

Reno, Nev.—Articles of incorporation of the Reno Electric Railway & Land Co. were filed recently. They will build and operate electric railroads and street railways and purchase land in Nevada and California. The incorporators are F. G. Newlands, William Thompson, C. T. Bender, T. K. Stewart and M. D. Foley. The capital stock is $200,000.

Reynoldsville, Pa.—An electric street railway is to be built from West Reynoldsville to Rathmel.

Rochester, Ind.—A franchise has been granted for the construction of a street railway along the streets of Rochester. Col. John L. Wood and Capt. Henry L. Heath control the franchise. Under the conditions of the franchise the line must be completed by June 1, 1893.

Sacramento, Cal.—W. A. Jacobs and A. D. Thompson presented a petition to the Board of City Trustees for a franchise for fifty years to construct and operate a street railway.

Salem, Ore.—Articles of incorporation of the Capital City Railway Co. were filed recently by M. L. Chamberlain, Thomas Holman, O. E. Krausse, H. V. Matthews, David Simpson and T. H. Barnes. The amount of the capital stock is fixed at $100,000. The object is to build, own and maintain a street railway in this city.

Salina, Kan.—The charter of the Consolidated Street Railway & Light Co. of Salina has been filed. The capital stock is placed at $100,000.

San Francisco, Cal.—The San Francisco Contract & Equipment Co. have been incorporated; capital stock $100,000. Directors, William Montgomery, T. D. Hoskins, Witscher Jones, A. E. Shuttuck, E. F. Staples. The object of the company is to build, equip, lease and operate street railroads in this city.

MARC W. CONNOR, John O'Byrne, E. Avery McCarthy, Raymond A. Perry, William A. H. Connor, Charles McCarthy and D. H. Austin have applied to the Board of Supervisors for a franchise for a short railway over certain streets. Several branch lines are also designated. The petitioners agree to commence work in ninety days and complete it within twelve months. They will also pay the city 2 per cent. of the gross receipts.

Sandusky, O.—The Sandusky, Milan & Huron Electric Railway Co. have filed articles of incorportion, and the capital stock will be $100,000.

St. Louis, Mo.—The St. Louis, Collinsville & Eastern Electric Railway Co. have been incorporated, with a capital $500,000.

THE St. Louis County Court lately granted the Clayton & Forest Park Railway Co. a franchise to construct and operate an electric railway from the Skinker road to Clayton. The company recently procured a franchise in the city to construct and operate a line from Union Avenue to the Skinker road at the city limits. Messrs. Thomas K. Skinker, John C. Lanphier and B. F. Thomas are the leading members of the company.

A MASS meeting of the most prominent and wealthy citizens of Kirkwood was lately held to take some definite action upon the proposal made by Drake & Orton to build, equip and operate an electric road to St. Louis, provided the property owners along the proposed line raise a bonus of $150,000. The meeting was presided over by Mayor T. D. Kimball and Prof. J. S. Collins acted as secretary. The effort was successful and the company promise to commence the construction before November 1, 1892, and complete it before December 31, 1893.

Stoneham, Mass.—A petition has been presented to the Stoneham Selectmen by the directors of the Boston, Malden & Stoneham Street Railway Co., asking permission to locate tracks, wires and poles for an electric railway in Stoneham. The petition is signed by Jonathon Munyan, George F. Butterfield, E. P. Shaw and Albert C. Pond. The capital stock is to be $100,000. Jonathan Munyan of Worcester, E. P. Shaw of Newburyport and L. W. Gilman of Malden are interested.

Strathory, Ont.—This town is advocating the construction of an electric tram line along the Mount Brydges road to connect with the Canadian Pacific.

Toledo, O.—A new corporation is the Toledo Riverside Railway Co., capital stock, $5,000.

THERE is talk of building a car line, either electric or steam, to Catawba Island, starting from the city and extending to the Catawba Point, and from thence carrying passengers by boat to the surrounding islands, Middle Bass, Put-in-Bay, etc.

Trinidad, Colo.—For some time past New York and Hartford capitalists, represented by Will I. O'Donnell, have had under consideration the erection of an electric street railway in Trinidad. The prospects are good that it will soon be built.

Ukiah, Colo.—J. W. Hartzell, superintendent of the new water company that has been organized by San Francisco and Santa Rosa capitalists for Ukiah, represents a syndicate with $15,000,000 capital who are prospecting the route to Blue Lakes with a view of building a motor road to that place.

Vicksburg, Miss.—Some citizens have applied for a charter under the style of the Hill City Street Railroad & Electric Co., with a capital stock of $100,000. Among the incorporators are: Geo. P. H. Rector, Frederic Speed, H. C. McCabe and Marye Dabney.

THE City Council has been petitioned to grant a franchise for a street railroad to be operated by electricity or otherwise. The petitioners are: R. C. McFarland, J. P. Roach and J. B. Mattingly, of Vicksburg, and E. F. Fuller, of New York.

Whatcom, Wash.—A franchise has been granted for an electric line to Lynden.

Whitehall, Ill.—The road mentioned last month will be built by the Roodhouse & Whitehall Consolidated Street Railway Co. (electric), with a capital stock of $100,000. The incorporators are: John Roodhouse, John W. Roodhouse and Charles T. Bates.

Willoughby, O.—The Lake County Street Railroad Co. have been chartered, with a capital stock of $20,000.

Worthington, O.—Another meeting in the interest of the proposed electric line from Clintonville to Worthington was held here lately. Reports of a very encouraging nature were made, and the stock subscriptions were increased to about $20,000. Worthington people say the project is now on a foundation that insures the construction of the road.

Personal.

Mr. Robert M. Huston, formerly Eastern manager of the Heine Safety Boiler Co., has severed his connection with that company.

Mr. G. F. Steele, of the department of long distance transmission of power, General Electric Co., Boston, called at our office in the *World* Building last month.

Mr. L. Pfingst who for a long time has been master mechanic of the West End Street Railway Co., of Boston, has resigned that position, to take effect on the first of this month.

Mr. J. R. Chapman has been appointed general manager of the South Chicago City Railway Co. and will have charge of the construction and operating of the company's property.

Mr. John MacCormack, M. E., has been appointed agent and sole representative in the East, with headquarters at 45 Broadway, New York, of the Heine Safety Boiler Co., of St. Louis.

Mr. J. W. Peugh, secretary to the Robinson Machine Co., Bellwood, Pa., was in this city during August, and called at our office. Mr. Peugh stated that the demand for the Robinson all-steel truck is increasing daily.

Mr. Charles Flesch, the representative in Australia of the interests of the General Electric Co., made us a visit last month. Mr. Flesch has been in this country studying the recent developments of electric traction, and will sail for Australia from San Francisco about the end of September.

Mr. John W. Fowler, president of the Lewis & Fowler Manufacturing Co., has entirely recovered from the injuries which he received a few months ago by being thrown from his carriage. He is now attending regularly to business again, and seems busier than ever after his period of enforced idleness.

Mr. P. A. B. Widener, the street railway magnate of Philadelphia, is anxious that a series of grand social entertainments be given during the dedicatory ceremonies of the World's Fair next October. Mr. Widener is so certain of the success of his idea that he has offered to guarantee the expense of a number of receptions.

Mr. S. B. Cottrell, engineer of the Liverpool elevated railway has been spending some time in this country inspecting our system of electric traction. He has visited Chicago, St. Paul, Buffalo, Rochester and other cities, and sailed for home August 13. We had a pleasant call from Mr. Cottrell who states that the Liverpool elevated lines, six miles in extent, now nearing completion, will be equipped for electric traction. Gearless motors of home manufacture will be employed.

Mr. G. S. Duncan, of the Tramway Trust of Melbourne, Australia, whose coming to this country for the purpose of studying our transit facilities, was noted in the June issue of the JOURNAL, has completed a tour of the principal cities of this country, and sailed for England on August 13. Mr. Duncan is enthusiastic over the cordial treatment accorded him by all our street railway people and others whom he has met in a business way. He states that he has gained all the particulars relating to electric and cable traction that he has asked for, and that he is favorably disappointed with the success that is attending the operation of electric lines. Seven years ago, Mr. Duncan visited this country to inspect our cable railways, and returned to build a cable system in Melbourne costing $11,000,000. He states that the present outlook for electric traction is much brighter than that for cable seven years ago, and he looks for its speedy adoption in many foreign cities.

New Publications.

Useful Information and Data for Travelers, Railway Men and Mechanics.

A small pamphlet of seventy pages containing this title has been published by Danks & Co., Chicago, giving a number of convenient tables and rules. The compiler, Mr. T. J. Nichol, is a civil and consulting engineer in Chicago.

Report of the Ninth Annual Meeting of the Street Railway Association of the State of New York.

The official report of the last annual meeting of the New York State Street Railway Association at the Hotel Metropole, New York City, September 15, has been received from the secretary. The pamphlet, which has in all seventy-six pages, contains, of course, the paper read by Mr. Beckley before the Association, which will well bear reading. The pamphlet also includes the constitution and bylaws of the Association.

Catalogue No. 8, published by the Johnson Co., Johnstown, Pa. 162 pages.

The first fifty-one pages of this handsome catalogue are devoted to a description of the new "electric girder rail" system just brought out by the Johnson Co. for which they claim very important advantages. The rail dispenses with chairs, clips, rivets and all subconstruction, and the manufacturers state in the preface that they "propose to settle the vexed question of what form of subconstruction is the best by having none." They only ask how deep the railway company wish their cross ties, and how far apart they are to be located in order to furnish a rail to meet the conditions. The rail is homogeneous with the feet or base and has no combination of joints. The system, as shown in the catalogue, has been carefully worked out, and includes solid crossings, joints, etc. The company state that they have the largest electric welding plant in the United States, containing 2,000 H. P., which enables them to make switch pieces, crossings, etc. of one solid piece, accomplishing a revolution in this type of work, and that in their experience of over a year in which many thousands of welds have been made, they have not found one defective.

The Law of Electric Wires; by Edward Quinton Keasby. Published by Callaghan & Co., Chicago.

The marvelous increase in the use of electrical apparatus within the last few years has caused a proportionate increase in litigation concerning the use of streets in the distribution of the electric current. This has been especially true in the case of electric railways, the introduction of which has brought before the courts a train of complex problems, novel in character, and difficult of solution. Just how the courts have dealt with these involved controversies is stated in the volume named above. It is a legal volume, but its contents in the main are clearly within the comprehension of the layman, especially to

ithe railway managers who by no means a stranger to litigation. Mr. Keasby has a just appreciation of the necessity of the distribution of the electric current. His introductory section discloses his point of view. After enumerating some of the objections which may be urged against the maintenance of wires in the streets, he makes this observation: "The wires, however, are too useful to be dispensed with; the purposes they subserve are public purposes, and the conveniences they furnish are enjoyed by many. The use of them is likely to increase rather than diminish. Their purposes, if not the same as those of the highway itself are closely allied to them, and it is only by using the highway that they can fully serve their purposes." The general idea of the book has been stated; it remains mereiy to be said that the work seems to have been well done, while the matter is well arranged and convenient for ready reference Some idea of the scope of the book may be gained by the headings of the chapters, some of which are as follows: "By What Authority the Streets May be Used for Electric Wires," "Municipal Control," "Poles and Wires as an Obstruction of the Highway," "Underground Wires," "Rights of Abutting Owners," "Interference of Different Kinds of Electric Currents," etc.

Equipment Notes.

The Austin Engineering Co., have been incorporated with a capital stock of $10,000; the incorporators are: Edward F. Austin, D. W. Dunn and Joshua L. Clark.

C. Purcell Taylor. patent expert, 57 Chancery Lane, London, Eng., writes us that at a recent fire which had destroyed all his tolos and instruments, his valuable library was saved as well as many valuable papers.

John A. Roebling's Sons Co., Trenton, N. J., supplied the two cables in use on the Otis Elevating Railway, at Catskill, N. Y. This company are also doing a large business in the supply of wire for electiic railways.

Smith & Wallace is the title of a firm recently formed with headquarters at 8 Oliver Street, Boston, Mass., by A. Otis Smith and J. Edward Wallace. Smith & Wallace will deal in all supplies needed in the equipping and running of electric railways.

The Ball & Wood Co., of No. 15 Cortlandt Street, New York, have closed a contract for one 1,000 H. P. steam plant complete at Lancaster,Pa., within the past week. Three of their large cross compound engines will be used in this connection.

Pepper & Register, of Philadelphia, Pa., have secured the contract to build the Easton, (Pa.)South Easton & Phillipsburg Electric Railway, now consolidated and called the Easton Transit Co. Work will begin not later than September 10, and will be completed by the end of November.

Bartlett & Co., of 21-23 Rose Street, New York, have recently issued a small pamphlet entitled, "A Modern Triumvirate" as a specimen of the kind of printing and engraving which they can turn out. The excellent work of this firm is so well known that it is almost unnecessary to say that the design of the brochure is attractive, the reading matter crisp and the illustrations and printing of the best.

The Hall Signal Co., of New York, are now constructing at their works the block system to be used by the Illinois Central in Chicago. It will be an automatic, electric block system similar to that in use upon the Pennsylvania Railroad. There will be signal bridges at Twenty-seventh Street, Forty-third Street, Sixty-seventh Street, Grand Crossing, Burnside and Kensington. The contract cost of the system will be $103,432.

The Pierce & Miller Engineering Co., of New York, have recently completed the additional equipment ordered by the Merrimack Valley Street Railway Co., of Lawrence, Mass., described in our June issue. This station is now using three McIntosh & Seymour engines. The company are also installing a 1,200 H. P. plant for the Globe Street Railway Co., Fall River, Mass., which will also use McIntosh & Seymour engines.

The John Stephenson Co., Ltd., of New York, are booking, as usual, orders from all sections of the country for their standard cars. One of the latest of the Stephenson cars—that for the Broadway, New York. cable line—is illustrated in this issue, and the manufacturers are at work on the completion of this order. A trip through the many departments of this company's works shows the usual number of cars in course of construction, and evincing the continuance of a well earned popularity.

The Lewis & Fowler Manufacturing Co., of Brooklyn, are, as usual, turning out a large number of cars, and their shops present to the observer a very busy appearance. The other derartments of the company are also well supplied with orders. The company have received a number of orders for snow plows from railway companies who wish to be well prepared for the cold season before it sets in. The snow plows of the company gave excellent satisfaction last year in different cities where they were in use.

The Lamokin Car Works, of Philadelphia, write us that among their recent orders are the following: One 16 ft. closed motor car with McGuire truck for the Gallipolis Street Railway, of Ohio; six 18 foot vestibuled cars for the Mahanoy City (Pa.) Shenandoah, Girardsville & Ashland Railway Co., and eight 16 ft. vestibule cars for the Paterson Central Electric Railway, Paterson, N. J. Among their August deliveries they have shipped the Citizens' Passenger Street Railway Co., of Harrisburg, Pa., four 18 ft. vestibule cars, and the Belle City Street Railway Co., of Racine, Wis., four 16 ft. closed cars.

Kingsley & Brewer, is the title of a firm of consulting engineers recently organized with headquarters at 44 Broadway, New York, by Maurice Kingsley, C. E., and Frank Brewer, C. E. One of the members of the firm has had twenty two years experience in railroad work, mining and surveying in connection with lands, roads and irrigation in tha United States and Mexico; the other has had eleven years of similar experience. The firm has already made a number of reports to English capitalists seeking investment in the United States, and make a specialty of reporting on railroads, mines and similar property.

J. G. Brill Co., of Philadelphia, find their car appliances as much in demand, if not more so, than ever before. They have recently sent four cars to Dubuque, Ia., and include among their other contracts during the last month the following roads: Delaware Electric Railway Co., Delaware, O.; Washington, Mt. Vernon & Alexandria Railway Co., Alexandria, Va.; Toledo Consolidated Street Railway Co., Toledo, O.; Philadelphia Traction Co., Philadelphia, Fa.; North Hudson County Railway Co., Hoboken, N. J.; the McKeesport & Reynoldston Passenger Railway Co., McKeesport, Pa., and the Mobile Electric Railway Co., Mobile, Ala

The Charles Scott Spring Co., of Philadelphia, Pa., have gained a high reputation in the manufacture of springs for steam railroads, which is a guarantee of first class material and workmanship, and have been adding constantly to this reputation by the excellent springs which they manufacture for electric, horse and motor cars. Their large output, about 5,000 tons per year enables them to reduce the cost of manufacture, and consequently their prices are very reasonable. Their springs are all made from very high grade stock, and are thoroughly inspected and tested before shipment is made. A full assortment for all the standaid trucks is also kept in stock. The company are represented in the sale of street car springs in the West by the Railway Equipment Co., Pullman Building, Chicago, and A. S. Partridge, Bank of Commerce Building, St. Louis, Mo.

The Genett Air Brake Co., New York and Chicago, are meeting with a la ge call for their air brakes for street railway cars, which we described in our last issue. The reliability and prompt action of these brakes fits them especially for electric and cable cars where the brake is not sufficiently powerful. The Genett Air Brake Co. have already equipped a number of cars in several leading cities, and find that wherever they have installed their appliance it has given the best of satisfaction. They believe it will not be long before their brakes will be considered indispensable on every electric or cable railway which runs in crowded streets or elsewhere where quick stops have to be made. Among the lines upon which this company have already installed their brakes, are the 125th Street branch of the Third Avenue Railway Co., New York, operating by cable; the Denver, Colo., Electric Railway and the Central Electric Railway, of Paterson, N. J.

The Berlin Iron Bridge Co., of East Berlin, Conn., have been asked by the Suffield & Thompsonville Bridge Co., lately organized at Thompsonville, Conn., for plans and estimates for a bridge over the Connecticut River, 1,060 ft. long. Sixty-nine bids were received from fourteen different bridge companies, and, after careful consideration, acting on the advice of their engineer, Mr. Edward S. Shaw, of Boston, the company have placed the contract for the bridge with the Berlin Iron Bridge Co. It will consist of five spans of 210 ft. each, with a roadway twenty feet wide in the clear, and will cost $60,000. The Berlin Iron Bridge Co., will design and build the new buildings for the New Orleans & Carrollton Railroad Co., at New Orleans, La. The power house is 83 × 130 ft. with brick walls and an iron roof. The car shed will be build entirely of iron, 130 × 140 ft. It is the intention of the New Orleans & Corrollton Railroad Co., to have the finest electric railroad plant in the Southern states.

The Carpenter Enamel Rheostat Co. now have their works at Bridgeport, Conn., in full operation. The extreme cheapness and evident advantages of this rheostat have been the cause of an unexpectedly large business, although the works have only been in operation a short time. Orders have already been received from over fifty different concerns, one order alone being for one thousand rheostats. The capital stock of the company is $100,000 fully paid. The officers of the company are, H. Ward Leonard, president; Geo. H. Finn, vice-president; Charles E. Carpenter, secretary and treasurer. Several prominent and wealthy New York gentlemen are financially interested. The manufacture of the rheostats involves a great many trade secrets, which, together with several strong patents and extremely low prices and a progressive business policy, is likely to give the rheostat manufactured by this company a prominent place among electrical apparatus. The company promise some startling developments in the patent situation at an early date.

M. Rounds, of Boston, manufactures a line of street railway appliances which give good satisfaction wherever used. The following are extracts from two letters from Mr. A. T. Potter, general manager of the Union Railroad Co. of Providence, R. I., and show what that company think of the Rounds transfer table and snow plow: "We have had in use at our electric car house since January 1, 1892, the transfer table designed by you for twenty-five foot electric cars, and take pleasure in saying that the same has given perfect satisfaction, one man being able (with your starting device) to start the table with a car weighing ten tons as easily as a man could an ordinary sixteen foot horse car with other tables in use by this company." "On March 1, we had one of the most severe snow storms that we have had in years, the wind blowing a gale, and the snow drifting badly, but, by starting your plow early in the storm, and keeping it in constant use for forty-eight hours, we were able to keep our road (which is about five miles long) one half being double track, in such a condition that our electric cars did not lose a single trip, and were run on schedule time. We were equally successful during the storm of the following week, but were unable to do this on our horse and cable cars."

The Ball Engine Co., of Erie, Pa., are evidently finding a large demand for their engines, as the following list of shipments for three weeks clearly shows: Compania Mexicana y Luz Electrica, City of Mexico, two 60 H. P. engines, two 60 H P. heaters, etc.; Hot Springs Electric Co., Hot Springs, Va., one 100 H. P. engine, two 80 H. P. boilers, one 200 H. P. heater, one 200 H. P. pump; Ames-Bonner Co., Toledo, O., one 80 H. P. engine; Brooklyn Navy Yard, Brooklyn, N. Y., one 80 H. P. engine; Arnold Ore Mines, Ferrona, N. Y., one 35 H. P. engine; Northwestern Supply Co., Tacoma, Wash., one 25 H. P. engine; Carbon Iron Co., Pittsburgh, Pa., one 130 H. P. engine; Diamond Light & Power Co., Sheldon, Ia., one 80 H. P. engine; North Hudson County Railroad Co., Hoboken, N. J., one 250 H. P. engine; Puget Sound Pulp & Paper Co., Everett, Wash., one 25 H. P. engine; Pittsburgh Iron & Steel Engineering Co., Pittsburgh, Pa., one 130 H. P. engine; Whitman & Barnes Manufacturing Co., Akron, O., one 80 H. P. engine; Fort Clark Street Railway Co., Peoria, Ill., one 130 H. P. engine; Boulder Electric Light Co., Boulder, Colo., one 100 H. P. engine, one 100 H. P. boiler. one 150 H. P. pump, two 100 H. P. heaters; Shamokin Electric Railway Co., Shamokin, Pa., one 130 H. P. engine; North Avenue Street Railway Co., Baltimore, Md., two 130 H. P. engines; Mt. Vernon Electric Light Co., Mount Vernon, O., one 150 H. P. H. F. Watson & Co., Erie, Pa., one 350 H. P. cross compound engine; Rock Cut Clay Co., Alfred Centre, N. Y., one 60 H. P. engine; Metropolitan Telephone Building, New York City, one 60 H. P. engine; La Gran Fundicion Nacional Mexicana, Monterey, Mexico, one 60 H. P. engine.

The R. D. Nuttall Co., of Allegheny, Pa., are, as usual, very busy in getting out a large number of their appliances which they find meet with a growing demand. They write us that their works are still running on double time and that they at present employ 135 men. In the line of gears, pinions, bearings, etc., they report very large sales, and that in the near future they expect to place on the market a line of material for overhead construction which will be superior to anything at present in use. Of all their departments, however, none is quite so busy as that of trolley poles and wheels. The Nuttall trolley seems to be doing everything which could be desired on the different roads where it has been installed, and the company have received many orders for it recently as well as testimonials from customers. Among the letters recently received by them are the following: Mr. J. B. Wilson, president, of the Martinsburg Street Railway Co., Martinsburg, W. Va., writes: "Enclosed please find check in payment of amount due, for which please send your receipted bill. We are very much pleased with your trolley and would like to get several more if we can dispose of our present trolleys. What kind of a trade can you give us on them?" Mr. J. S. Hill, superintendent of the LaFayette Street Railway Co., LaFayette, Ind., writes: "We ship you to-day seven trolley stands of another make and one "Nuttall" pole for which we enclose bill of lading. Our agreement was, I believe, to exchange six trolley stands with you, but I find we have seven, and so have sent you all of them and you may ship us by freight another "Nuttall" to square us up, as your trolleys are very satisfactory and we are much pleased with them."

The Page Belting Co., of Concord, N. H., have sent us a list of their recent orders which include the following: A 30 in. belt for the Geo. W. Wheelwright Paper Co., Boston; also a number of other belts including a 16 in., 14 in. and 12 in. double; a 36 in. for the Houston City Street Railway Co., Houston, Tex.; a 36 in. for Portland, Ore.; a 36 in. for Camden & Thomaston Electric Light Co., Rockland, Me., and two 16 in. dynamo belts; a 26 in. to Philadelphia, Pa.; a 22 in. to Dayton, O.; a 20 in. to Hoboken, N. J.; a 20 in. to Dallas, Tex.; an 18 in. for Star Thread Co., Athens, Ga. They have also filled orders for their Eureka dynamo belt (slotted) as follows: Two 18 in. to Schuylkill Electric Railway Co., Pottsville, Pa.; one 18 in to Houston City Street Railway Co., Houston, Tex.; one 16 in. to the Detroit Electric Light Co., Detroit, Mich.; two belts to the Brooklyn City Railroad Co., Brooklyn, N. Y.; one to Nebraska City Water & Light Co., Nebraska City, Neb.; one to the Reading Electric Light & Power Co., Reading, Pa.; one 13 in. and one 16 in. to the Plainfield Gas & Electric Light Co., Plainfield, N. J.; one 16 in. to the Hampton & Old Point Railroad Co., Hampton, Va.; three 25 in. to the Central Railroad Co., Baltimore, Md.; one 25 in. and two 23 in. to the United States Electric Light Co., Washington, D. C. They have shipped recently three 13 in. regular dynamo double belts to Toledo Consolidated Street Railway Co., Toledo, O., and have sent Acme link belts to the following cities: Norfolk, Va.; Ceiba Huera, Cuba; Clearfield, Pa.; Jamaica, L. I.; Penn Yan, N. Y.; Washington, D. C.; the Rosseau Electric Works, New York City and Huntington, Mass. They say that their trade is steadily growing in special belts as well as their standard belts.

WESTERN NOTES.

The Enterprise Electric Co, of Chicago, have started a branch office at North Ninth Street, St Louis. W. H. Ferris is in charge.

B. E. Tilden & Co., of the Monadnock Building, Chicago, have received a great many flattering testimonials from railway managers in reference to their replacing frogs. Joseph S. Minary, secretary of the Southern Railway Co., in ordering six pairs after having made a thorough test, wrote that his company "are very much pleased with them."

Dorner & Dutton, of Cleveland O., have issued their catalogue No. D which, besides containing illustrations of their track cleaner, gives a list of railways equipped with their cleaner, and a large number of letters from prominent railway companies speaking in the highest terms of this appliance. It is easy to see in glancing over this publication that the cleaner gives good satisfaction and that the users are well pleased with its performance.

The Cushion Car Wheel Co., of Indianapolis, Ind., are transferring their manufactory to Ft. Wayne, Ind., where they will have ample facilities for manufacturing. When settled in their new quarters, the company will be prepared to fill orders promptly. At present the facilities are too limited to enable them to keep up with the demand. The Bass Foundry & Machinery Co. are now largely interested in the enterprise of the Cushion Car Wheel Co.

The Sioux City Engine Works, Sioux City, Ia., report a large number of orders on hand, and that they are now operating a night force in order to take care of the orders which they are receiving. The engine manufactured by this company is meeting with great success in all sections of the country. The company intend to issue shortly a catalogue of their engines, which will soon be ready. They are also preparing a list of some of the users of the Sioux City engine which will indicate the large demand which these engines are having.

The McGuire Manufacturing Co., of Chicago, have found their business increasing so rapidly that they have decided to build an extension to their present manufactory. The lot at the corner of Kinzie and Morgan Streets has been secured, and the construction of a building adjoining the present plant, 125 × 116 ft., will immediately be begun. The company have of late received a number of large orders, and they are particularly pleased with the fact that their truck has been adopted as standard by the Joliet Street Railway Co. of Joliet, Ill.

The Stirling Boiler Co., of the Pullman Building, Chicago, are selling large numbers of their boilers to electric companies who find that its employment conduces to the economy in working of their plants. They are receiving many inquiries from those intending to make extensions to their steam plants. Among the most recent orders received by the company are the following: Edison Electric Illuminating Co. (second order), 200 H. P.; Indianapolis Light & Power Co., 1,500 H. H.: Mobile Electric Light & Power Co., for use in the street railway power plant, 350 H. P.

The Railway Equipment Co., of Chicago, are meeting with great success with their new and improved line devices, which are recognized as being of superior quality in point of strength and insulation. Large orders have been received during the last few weeks, among others from Toronto, Montreal and Winnipeg, Can.; Racine, Wis.; Springfield, O.; Galesburg, Ill.; Duluth, Minn.; Defiance, O., and Bloomington, Ill. The company have lately gone largely into the field of furnishing magnet wire and a large business has already been done in the high grade offered by them.

Sargent & Lundy, of the Monadnock Building, Chicago, have completed in remarkably quick time the work on the Belle City Street Railway, at Racine, Wis. The contract awarded to them July 15, included the overhead and the track construction. Before the end of August, the work was completed, notwithstanding the fact that it was found necesary to set three-quarters of the poles in barrels on account of quicksand. There was twelve miles of track constructed, of which three was laid with girder rail and the remainder with T rail. The motors of the Detroit Electrical Works will be used on the system.

The Short Electric Railway Co., have closed a number of orders recently and find their motors are enjoing their usual popularity. Through their New York office, Mr. Edward J. Wessels, general Eastern agent, they have sold the Hartford & Wethersfield Horse Railroad Co. a double equipment of Short, twenty horse power, single reduction gearless motors, as well as some street railway supplies. The Trenton Passenger Railway Co., described in this issue, is equipped with Short electric motors, and the company, as stated, are so well satisfied with the equipment that they have ordered seven additional equipments.

The Brownell Car Co., of St. Louis, Mo.. have recently shipped two of their Accelerator cars to the West End Street Railway Co., of Boston, which have given very good satisfaction in that city. They have recently received an order for twenty from Columbus, O., as a result of the satisfactory operation of an Accelerator car in that city. The Accelerator in Columbus received most complimentary notices from the local press for its excellent qualities, showing that the citizens of that city seem well satisfied with the Accelerator type. Twenty of these cars have also been ordered for the Covington & Cincinnati roads, and other orders are being received constantly by the manufacturers.

S. D. Dodge, of 46 Wilshire Building, Cleveland, O., is confident that the new Mehling car, designed for summer and winter use, will prove of great advantage to street railway companies. The East Cleveland Railroad Co., who have had one of the cars in operation on their Euclid Avenue line for several weeks, have written as follows to the patentee: "Car No. 288, built by us and now in operation, gives general satisfaction. Our patrons enjoy riding in the same and our employes say they can take care of the passengers with greater ease and comfort all around. It has, I think, met with the approval of all the officers of the road, and we believe the car can be used all the year around. Very truly yours, The East Cleveland Railroad Co. By Chas. W. Wason, Vice President."

The Fulton Foundry Co., of Cleveland, O., have supplied, among their recent orders, one from the Toronto Railway Co. They are in receipt of a letter from Mr. H. A. Everett, general manager at Toronto, stating that the company are "satisfied that there is no better truck in the market." They have also received a letter from Mr. Chas. W. Wason, vice-president of the East Cleveland Railway Co., in which he says: "We have tried about all the iron trucks in the market and do not think we shall purchase any more. We can most assuredly recommend your truck to parties wishing to equip their

roads, and would be pleased to answer any questions which they might desire putting to us."

The International Register Co., of Chicago, are meeting with great success in the sale of the Pratt portable fare register described in our May issue. This machine has a capacity for registering 100,000 fares, weighs only sixteen ounces and is very compact. One turn of the knob with the thumb and forefinger cancels the face or trip register, and at the same time reverses the direction sign. The various details of the appliance are carefully constructed, and the bell has a pleasing tone and can be heard distinctly all over the car. The International Register Co. guarantee their registers fully, and will either sell them or lease them on a royalty. They have recently issued a folder giving details of the register as well as a list of the street railways upon which the register is in use. This list, as a glance at the circular will show, has reached considerable proportions, although it is less than seven months since the company commenced the manufacture of the register, which shows that it is popular with those who have to use it. The manager of the International Register Co. is Mr. Englund. The number of roads upon which the International register is being used is increasing daily, and the management of the company write us that at present they have orders on hand for nearly 300 machines.

The Siemens & Halske Electric Co., of America, Monadnock Building, Chicago, are preparing for a large demand for their apparatus. The company are the American representatives of the Siemens & Halske Co., of Berlin, and they are prepared to enter into contracts for the heaviest electrical machinery. Their plant on Blue Island Avenue, adjoining the factory of the Wells & French Co., is rapidly approaching completion. The first building will be 250 ft. in frontage and in depth, and work will be turned out in the plant some time during the fall. The Pabst Brewing Co., of Milwaukee, Wis., have placed an order with the Siemens & Halske Co., for their new 10,000 light incandescent central station. This installation will consist at first of two 250 H. P. dynamos and one ninety horse power dynamo which will be of the well known Siemens & Halske direct coupled type, the armature being placed on the end of the engine shaft. The Lake Erie Engineering Works are building the engines. The ultimate capacity of this plant will be 40,000 lights. The electrical work is being done under the supervision of Mr. Geo. W. Gibbs, M. E., and the steam engineering under the supervision of the Osborn Engineering Co.

G. P. Altenberg, of 220 Walnut Street, Cincinnati, agent for the National Electric Manufacturing Co., of Eau Claire, has recently secured some important contracts, among them being an order from the Bucyrus Steam Shovel & Dredge Co., of Bucyrus, O., now removing to South Milwaukee, who will depend solely and exclusively upon electric motors in the operation of their business. The only engine in the establishment will be an Allis-Corliss engine belted direct to two 200 H. P., slow speed, National generators which will in turn operate two National stationary motors and the electric cranes. The same generators will furnish current for twenty-five arc and 125 incandescent lamps. The cranes, stationary motors and lights will be supplied from the same dynamo. Mr. Altenberg will furnish everything except cranes. He writes us that he has also sold a 2,000 light alternating central station to the Wilmington (Ind.) Jenney Electric Light Co.; a direct current incandescent lamp to the Crescent Cotton Oil Co., Memphis, Tenn,; a sixty arc light plant to a Cleveland (O.) syndicate., an arc outfit to the Bristol (Tenn.) Gas & Electric Light Co., and several weeks ago sold a fifty light arc lamp to the Covington (Ky.) Electric Light Plant.

The Bates Machine Co., of Joliet, Ill., have sent us a list of their shipment of engines during the last sixty days, among which are the following: To the Joliet Sheet Rolling Mill Co., Joliet, Ill., one 28×48 engine; Sioux Falls Linen Mills Co., Sioux Falls, S. D., one 14 × 36 engine; Guetzkow Bros. Co., Milwaukee, Wis., one 16 × 42 engine; Chicago Corset Co., Chicago, Ill., one 14 × 36 engine; J. U. Borden Manufacturing Building, Chicago, Ill., one 12 × 30 engine; Salem Lime & Stone Co., Louisville, Ky., one 20 × 42 engine; W. H. Lathrop Brick Plant, Racine, Wis., one 12 × 30 engine; Cappon & Bertsch Leather Co., Holland, Mich., one 20 × 48 engine. They also number among their sales during July the following: People's Electric Street Railway Co., Springfield, Ill. (second engine), one 24 ×48 engine; Field Engineering Co., New York City, for the West Side Electric Street Railway Co. Elmira, N. Y., two 16 × 42 engines; Robeason Avenue Electric Railway Co., Springfield, Mo., two 16 × 42 twin engines; Elgin, Joliet & Eastern Railway Co. car shops, Joliet, Ill., one 14 × 36 engine; Pullman Palace Car Co., for electric light plant, one 18 × 42 vertical, two 24 × 48 vertical engines. They state that their business was never as good as at the present time, and the Bates-Corliss engine seems to be growing in favor constantly. The simplicity of the valve motion and consequent durability, together with the uniform regulation, make this engine particularly adapted for electrical purposes.

The E. G. T. Colles & Co., of 22 S. Jefferson Street, Chicago, Ill., state that their business has been good, but somewhat interrupted by the protracted strike of the boiler makers. They have been quite full of orders, however, and among their latest shipments are: A large heater for the city of Chicago for one of their electric light plants (second order); a 500 H P. heater for the Chicago Copper Refining Co.; a heater and filter for the Judkins company; a heater, filter and pumps for L. R. Harsha; a filter (fourth order) for the Enterprise Building; a heater and filter for S. M. Peterson; two heaters, pumps and filters for the Harland Brick Co.; two heaters, 1,300 H. P., for J. B. Legnard; heater for the Western Cut Stone Co.; heater and filter for the John McEwen Manufacturing Co.; 400 H. P. heater for Pullman Palace Car Co.; filter (second order) for the Winslow Bros., all of Chicago, Ill.; a large heater for the Nelson Hotel Co.; a filter and heater for the Standard Furniture Co.; a filter for the Union Furniture Co.; one heater and filter for the Palace Folding Bed Co.; a filter (second order) for the Royal Sewing Machine Co.; a heater and filter for the Diamond Furniture Co., all of Rockford, Ill.; a heater and filter for the Zinn Malting Co.; heater and filter for Richter, Shubert & Dick; two filters for the National Distilling Co.; heater and filter for the Merrill Building; filter (second order) for James E. Patton & Co.; 300 H. P. heater for the Northwestern Fuel Co.; two filters for the Geo. Ziegler Co.; a filter for John Langenberger; two filters for T. W. Goodrich & Co.; two filters for the Gugler Lithographing Co. and eight large filters for another firm, all of Milwaukee, Wis.; a heater for the Sandoval Manufacturing Co., Sandoval, Ill.; a heater and filter for the Laclede Gas Light Co., St Louis, Mo.; pump and filter for I. H. Snyder, Mt. Pulaski, Ill.; heater for the Kearsarge Mining Co., Calumet, Mich.; 500 H. P. heater for the Gibbs Chair Co., Kankakee, Ill.; heater for the Planters Oil Mill, Helena, Ark., and a number of others in the adjacent states.

The Detroit Electrical Works have been receiving recently an unusual number of orders, and find their apparatus to be growing in popularity. In order to keep pace with this growing demand, they have recently greatly increased the capacity of their works, and have added a large amount of improved machinery, so that their new factory when completed will be one of the best arranged for street railway work in the country. They make a very interesting exhibit at their Chicago office in the Monadnock Building. At one side of the office is constructed a raised track the full length of the room. On this structure a complete and handsomely finished working model of the company's motor, mounted on a Sheffield truck, is operated. The truck has a wheel base of fourteen inches, and the model is sufficiently large, so that the working of the motor can be readily watched. The track has a grade of 9½ per cent. up which the motor travels at a handsome pace. The idea is one which is greatly appreciated by railway men, as the installation gives them a fine opportunity to watch the exact operation of the motor. Mr. L. E. Meyers, their agent in Chicago, has taken the contract for the electrical equipment for the Delta Electric Co., of Cairo, Ill. The first installment of apparatus will consist of five thirty horse power motor cars and one generator. Mr. Myers has just sold to the Calumet Electric Railway Co. the fifth increase in equipment for their road in the south suburban district, Chicago. The increase consists of four forty horse power motor cars and one 80,000 watt generator. This company now operate sixteen motor cars and two generators of the Detroit Standard type. The company are doing a large business, and are operating their road with great success. They are highly pleased with the motors of the Detroit Electrical Works. It is stated that of the second installment of motors which were put into operation in May last, only one has required any repairs, and in that case only an insignificant amount of work was required to repair the controlling stand. The other cars have not been in the repair shop. The motors sold to the Dubuque Street Railway Co. by the Detroit Electrical Works are giving great satisfaction. J. A. Rhomberg, president of the company, when in Chicago recently, stated that while the cars have covered a mileage of 100,000, no repairs of any kind have been necessary.

What Our Friends Say of Our New Book.

The following extracts are a few selected from the many letters received from persons who have a good word to say for our handbook "Street Railways," and from reviews found in our exchanges:

OFIFCE OF
CHICAGO CITY RAILWAY CO.

CHICAGO, August 8, 1892.

MR. C. B. FAIRCHILD,
EDITOR STREET RAILWAY JOURNAL:

DEAR SIR:—Your book of "Street Railways" received. I will prize this volume much more than any book among the many that I have, and, from a casual survey of its contents, believe that it will carry me over many a rough place. Yours truly, M. K. BOWEN,
Superintendent.

ENGINEERING DEPARTMENT,
BALTIMORE CITY PASSENGER RAILWAY CO.

BALTIMORE, August 8, 1892.

C. B. FAIRCHILD, ESQ.,
EDITOR STREET RAILWAY JOURNAL:

DEAR SIR:—I must congratulate you upon the work. It certainly meets, in a most satisfactory way, a long felt want. It shows plainly the great care and study you have put in it.

Very sincereiy yours, A. N. CONNETT,
Chief Engineer.

ENGINEERS' OFFICE,
NEW YORK & BROOKLYN BRIDGE,
179 WASHINGTON STREET.

BROOKLYN, August 5, 1892.

C. B. FAIRCHILD,

DEAR SIR:—The work you have accomplished belongs to a type of which, unfortunately, the world has too little; full and complete in detail, broad and symmetrical as a whole, the certainty on its author's

part that it was faithfully and conscientiously done, and thereby an essential addition made to human knowledge, will be your greatest reward; although I trust a more substantial return may not be lacking.

Yours truly, G. LEVERICH.

CENTRAL PARK, NORTH & EAST RIVER RAILROAD CO.

NEW YORK, August 4, 1892.

C. B. FAIRCHILD,
EDITOR STREET RAILWAY JOURNAL:

I congratulate you upon your splendid success as a street railway author, as evidenced not only by the work named but also by the monthly installment of good things served to us readers of the STREET RAILWAY JOURNAL. I am, Sincerely yours,

C. D. WYMAN, Vice-President.

KANSAS CITY, August 15, 1892.

C. B. FAIRCHILD, ESQ.,
EDITOR STREET RAILWAY JOURNAL,
New York.

MY DEAR SIR:—I have never placed any book in my library with higher feelings of pleasure, than I find in placing your *excellent* work in my collection. I congratulate you upon your success, in compiling and arranging so valuable a handbook for street railway men; it meels a long felt want, and the selection of the data and the information given could not, in my judgment, be improved; it is most complete.

I am, Very truly, ROBERT GILLHAM,
Civil Engineer.

F. P. LITTLE & CO.

BUFFALO, N. Y., August 4, 1892.

EDITOR STREET RAILWAY JOURNAL:

DEAR SIR:—Your new book entitled, "Street Railways, Their Construction, Operation & Maintenance," was received by us this morning. We beg to compliment you upon the handsome appearance of the volume, and from the few moments' observation which the writer gave the contents, he has no hesitation in saying that the handsome appearance is more than equaled by the mass of information and interesting reading inside the covers. Again complimenting you, we are Yours very respectfully,

F. P. LITTLE & CO.,
Per F. P. LITTLE, Manager.

SUPERINTENDENT'S OFFICE,
THIRD AVENUE RAILROAD CO.,

NEW YORK, August 6, 1892.

MR. C. B. FAIRCHILD,
EDITOR STREET RAILWAY JOURNAL:

DEAR SIR:—Copy of "Street Railways" received. I must say that the book has been gotten up in handsome shape, and it is going to make a splendid book of reference for all engaged in the maintenance, construction and operation of street railways. Yours truly,

J. H. ROBERTSON, Superintendent.

"This book is by far the most complete work on street railways that has thus far been published in this country. The work will be of particular value to those who desire reliable information on car building and track construction. A chapter is devoted to each of these subjects. There are many other interesting and valuable features in this work which will commend it to street railway managers. Under the head of "Discipline and Rules," directions are given for the conduct of a model road. These are especially commended to superintendents as forming the ground work for rules for the guidance of their employes. Many excellent suggestions are also contained in the chapter on bookkeeping and classification of accounts that will be readily appreciated by accountants."

"Throughout the entire work the author has shown a familiarity with the most minute details that will at once inspire confidence. His suggestions are practical, and they disclose an intimate knowledge of the requirements of modern practice. Altogether the work is a most timely and valuable contribution to street railway literature.—"*Western Electrician.*

"It is surprising how much detail the book covers, and it would be hard to mention any street railroad, that is not referred to in some way. Electric Traction (Chapter 1) is considered from the first principles in electricity and magnetism down through the motor to every detail of electric railway construction and operation, and this chapter is one of the most valuable and interesting in the book, because it enables one who is in childlike ignorance regarding electricity, to learn about it in an easy manner and step, by step, attain a knowledge of electric railroading in practice and theory that will be valuable. We think that this book will be of great value to every manager of a street railroad, whether it be horse, steam, cable, electric or any other kind. He will have constantly before him facts and figures concerning his own system that will be of great help to him in meeting the practical problems of operation."—*Electrical Age.*

"Altogether the most complete and, in fact, the first exhaustive treatise on street railways ever published. The subject is a much larger one than is generally supposed, and even railway managers will be surprised at its range and extent. The work not only consecutively takes up every department of street railroading, from track repairs to the general office, but follows out details with a faithfulness that places the street railways of the country under great obligations to the author."—*Street Railway Review.*

"Knowing something of the extreme care used in collecting and verifying the facts presented in this volume, we can confidently recommend it as a careful resumé of the best American practice in street railway construction."—*Engineering Record.*

"On perusing the book it will be seen that the author has fully covered the ground indicated in his prefatory outline, and it is without doubt the most comprehensive work on the subject yet issued. The reader is gradually carried upward from the veritable A B C of electric traction to the final outcome—'Charter, Franchises, Stocks and Bonds,' followed by a fully illustrated chapter on the leading types of cars, and auxiliary appliances. Although the author modestly disclaims any attempt at typographical merit, yet the appearance of the book is both neat and tasteful, and should command, as it undoubtedly deserves, a wide circulation."—*Practical Electricity.*

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, JULY 26, 1892, TO AUGUST 16, 1892, INCLUSIVE.

JULY 26.

Brake Mechanism for Cars, Henry V. Hartz, Cleveland, O.	479,420
Electric Railway, Mark W. Dewey, Syracuse, N. Y.	479,493
Motor Frame for Electric Locomotives, Sidney H. Short, Cleveland, O.	479,469
Trolley, Frederick F. Poole, Newark, N. J.	479,608

AUGUST 2.

Cable Railway, John H. Pendleton, Brooklyn, N. Y.	479,919
Cable Railway, John H. Pendleton, Brooklyn, N. Y.	479,920
Cable Railway, John H. Pendleton, Brooklyn, N. Y.	479,921
Closed Conduit for Electric Railways, Edward H. Johnson, New York.	479,809
Driving Mechanism for Cars, Jacob V. Motter, Brooklyn, N. Y.	479,915
Electric Railway, Charles H. Baker, Lake Geneva, Wis.	480,004
Gas Car Heater, Samuel Stewart, Newark, N. J.	480,216
Rail Clamp, Henry L. Wolpert, Lancaster, Pa.	479,867
System of distributing Electric Currents, Charles J. Van Depoele, Lynn, Mass.; C. A. Coffin and Albert Wahl, executors of said Van Depoele, deceased	479,964
Track Construction for Railways, Thomas W. Hutchins, Wyoming, Pa.	479,808
Trolley for Electric Cars, George E. Purple and Charles W. Purple, Minneapolis, Minn.	480,240

AUGUST 9.

Automatic Car Brake, Richard Condon, Lyons, Ia.	480,250
Cable Gripper, William A. Butler, New York, N. Y.	480,489
Cable Railway, Samuel D. Root and Gordon C. Vincyard, Anaconda, Mont.	480,519
Closed Conduit for Electric Railways, Alexander L. Lineff, London, Eng.	480,409
Electric Railway, Francis B. Badt, Chicago, Ill.	480,543
Motor Truck, John A. Brill, Philadelphia, Pa.	480,362
Rail Joint, Milton C. Niles, Oak Park, Ill.	480,506
Tram Car, Adolf Worner, Buda-Pesth, Austria-Hungry	480,310
Truck for Railway Cars, Ernest D. Dorchester, Malden, Mass.	480,495

AUGUST 16.

Car Wheel, Benjamin F. Haugh, Indianapolis, Ind.	480,922
Charles W. Howlett, Kansas City, Mo.	481,029
Electric Locomotive, Rudolf Eickemeyer, Yonkers, N. Y.	480,918
Electric Railway, Rudolph M. Hunter, Philadelphia, Pa.	480,850
Guide for Replacing Electric Trolleys, Charles Fortin, Florissant, Mo.	480,766
Joint for Electric Wires, Walter E. Harrington, Atlantic City, N. J.	481,025
Operating Device for Fare Registers, John W. Meaker, Chicago, Ill.	480,732
Pilot or Guard for Locomotives and Cars, Robert A. Crawford, Allegheny, Pa.	480,713
Railway Rail Chair, Byron Jennings, San Jose, Cal.	481,032
Supply Station for Car Heating Systems, James F. McElroy, Albany, N. Y.	480,777

AUGUST 23.

Automatic Release for Cable Grippers, Andrew J. Smith, St. Louis, Mo.	481,431
Cable Railway Curve, George Muller, Hoboken, N. J.	481,412
Cable Traction System, George Muller, Hoboken, N. J.	481,413
Car Brake, Charles A. Dahlstrom, Chicago, Ill.	481,163
Conduit for Electric Railways, Wilton F. Jenkins, Richmond, Va.	481,403
Grip for Cable Railways, George Schorpp and Louis Schorpp, Phila., Pa.	481,512
Rail Joint, George G. Stacy, New York	481,433
Railroad Joint, Urban H. Hane, Lakeland, Fla.	481,171
Railway Construction, William J. Morden, Chicago, Ill.	481,368
Sanding Device for Street Cars, John H. Vogan and George L. Vogan, New Castle, Pa.	481,535
Street Car, Frederick B. Brownell, St. Louis, Mo.	481,467
Street Car, Frederick B. Brownell, St. Louis, Mo.	481,468
Trolley for Electric Railways, Wilton F. Jenkins, Richmond, Va.	481,401
Trolley for Electric Railway Conduits, Wilton F. Jenkins, Richmond, Va.	481,402
Trolley Protector, John Walsh, Cleveland, O.	481,517
Trolley Switch, Jacob S. Merkins, Highlands, Colo.	481,503

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Aug. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co ...	50	1,250,000	Q.—J.	1½	.....	112	.....
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	240	.....
Broooklyn City R. R. Co.....	10	6,000,000	Q.—J.	2	.....	188	.....
Coney Island & Brooklyn R. R. Co.....	100	500,000	.....	...	.....	145	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.....	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	104
Broadway R. R. Co.....	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds.....	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates.....	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st.....	.....	125,000	F. & A.	7	Aug. 1897	106	.....
South Brooklyn Central R. R. Co., 2d.....	.....	150,000	F. & A.	6	July, 1941	102	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	108	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Aug. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.....	100	750,000	Q Feb.	1½	1890	119	120
Watervleit Turnpike & R. R. Co.....	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort...	1865	40,000	J. & J.	5	1905	105	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	102½	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	102	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	102	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	102½	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	105¼	.....
" " " Debenture..	1891	200,000	M. & N.	6	1901	113	.....
Watervliet Turnpike & R. R., 1st Mort.....	1889	350,000	M. & N.	6	1919	115	118
Watervliet Turnpike & R. R., 2d Mort.....	1889	150,000	M. & N.	6	1919	108	113

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Aug. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1	.....	145	150
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	130	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	117	120
42d & Grand St. Ferry.....	100	748,000	Q.—F.	3	.....	250	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	54	55
Eighth Avenue.....	100	1,600,000	Q.—J.	2	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	J. & J.	5	.....	116	120
Sixth Avenue.....	100	1,500,000	M. & S.	3	.....	200	204
Third Avenue.....	100	2,000,000	M. & N.	6	.....	205	210
23d St.....	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue.....	100	800,000	.....	3	.....	125	130

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	113
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	104	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	105	.....
Additional.....	.....	1,000,000	J. & J.	5	July, 1905	95	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	116	120
Central Crosstown.....	.....	250,000	M. & N.	6	Nov., 1922	117	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	100	101
Scrip.....	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry.....	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.....	.....	1,200,000	J. & J.	6	1915	59	61
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	100	107
Second Avenue.....	.....	1,600,000	M. & N.	5	Nov., 1909	103	105
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	112	114
23d St.....	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. Aug. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.....	50	$6,406,000	J. & J.	4	1887	87½	87¾
West End Com'n.....	50	9,085,000	J. & J.	5	1890-1892	73¾	74

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Aug. 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co.....	100	$270,000	New.	...	Oct., 1887	93	100
Union R. R. Co., Prov.....	100	2,000,000	Q.—J.	2	1862-1863	200	210
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Aug. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co....	100	1,000,000	J. & J.	4	.....	210	225
Holyoke Street R. R.....	100	200,000	J. & J.	4	.....	212	225
Northampton Street R. R.....	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Aug. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.....	50	$100,000	J. & J.	3	.....	.....	55
Enterprise Ry. Co.....	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.....	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Aug. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
*Carrollton R. R. Co	100	800.000	Quart.	1½	1867	124	126
Crescent City R. Co.....	100	1,150,000	"	1¾	.866	96¼	98
Canal & Claiborne R. R. Co..	40	240,000	.....	...	1888	28¾	35
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	143¾	147
Orleans R. R. Co.....	50	185,000	"	2	1868	63	66
St. Charles Street R. R. Co..	50	600,000	"	2	1866	93	95

Bonds.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	102¼	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93-'99	.....	.....
do do new	1886	40,000	M & N	6	1896	.....	.....
N. O. City R. R. Co.....	1879	495,200	J & D	6	1903	119	.....
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92-'06	113½	.....
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89-'01	.....	.....

*Bids on Carrollton R. R. are ex-privilege of new stock.

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Aug. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$30),000	J. & J.	4	.....	35	.....
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	. .....	.....	...	.....	26	.....
New Haven & Centville H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	.....
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1899	103	.....
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued).....	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Aug. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	60	$900,000	M. & N.	4	May, '91.	232	233
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Period.**	**%**	**Principal Due**	**Bid.**	**Ask'd**
Montreal St. Ry.	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Aug. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	91	92
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	28	28½
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	100	100½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	115	.....
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	115	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Aug. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	470	480
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	99½	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	270	275
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	215	218
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Chicago City	.....	4,619,500	J. & J.	4½	.....	98⅝	98¾
Chicago Passenger	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	101½	102
" " "	.....	1,850,000	M. & N.	4½	1927	96½	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100⅝	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101½	.....
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	96½

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, Aug. 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co ...	50	1,500,000	.....	..	.....	29½	30
Citizens' Traction R. R. Co ..	50	3,000,000	J. & J.	3	.....	.....	.....
Pitts. & Birmingham R. R. Co	25	3,000,000	.....	...	.....	.....	.....
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	57	59
Federal St. & Pleasant Valley	50	1,400,000	J. & J.	3	.....	25½	26⅛
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	.....	.....
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	.....	...	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	.....	.....
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Citizens' Traction R. R. Co ..	1887	1,250,000	A. & O	5	1927	.....	.....
Pitts. & Birmingham Traction Co.	1889	1,500,000	M. & N.	5	1929	.....	.....
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	.....	.....
Pleasant Valley Ry.	1891	1,250,000	J. & J.	5	1919	.....	.....
P., A. & M. R. R. Co.	1891	1,500 000	J. & J.	5	1931	.....	.....
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	.....	.....
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75.000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.	1883	125,000	.....	6	1903	.....	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	.....	.....
Monongahela Incl'e Plane Co.	1887	50,600	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Aug. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.	100	1,000,000	Monthly	5	.....	.....	115
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	95	.....
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	45	65
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	33	39
Omnibus Cable Co.	100	2,000,000	Monthly	4	.....	56	58¾
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	22½	25¾
Bonds.	**Date of Issue**	**Am't Out-stand-ing.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Ferries & Cliff House R. R.	.....	650,000	M. & S.	6	1914	101	.....
Market Street R. R.	.....	3,000,000	J. & J.	6	913	120	.....
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	114¼	116¾
Powell Street R. R.	.....	700,000	M. & S.	6	1912	112	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	111½	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	95	.....
Cal. St. Cable R. R	.....	.....	.....	...	.....	103	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., July 18. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.	100	$324,000	Q.—J.	3	1864	110	150
Cass Ave. & Fair Grounds.	50	300,000	.....	...	1876	45	46
Citizens'	100	1,500,000	A. & O.	1¼	1887	90	95
Jefferson Avenue.	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	72	74
Missouri.	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central.	100	200,000	.....	...	1884	100	105
People's.	50	1,000,000	M. & S.	6	1889	45	50
St. Louis.	100	2,000,000	J. & J.	6	1890	150	160
4th Street & Arsenal.	50	150,000	Jan.	.50	1872	10	12
Union.	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban.	100	2,500,000	.....	...	1891	48	50
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Benton-Bellefontaine.	1891	$500,000	F. & A.	6	1911	102	102½
Cass Avenue & Fair Ground...	1892	1,800,000	J. & J.	5	1912	96	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	106	107
Lindell	1890	1,500,000	J. & J.	5	1895-1910	99	100
Mound City	1890	525,000	A. & O.	6	1900-1910	105	106
Missouri Cable	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort	1882	125,000	J. & D.	6	1902	102	105
" 2d mort	1886	75,000	M. & N.	7	1902	104	105
People's Cable	1889	800,000	J. & J.	6	1889-1914	97	100
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union	1885	150,000	M. & N.	6	1895-1915	102	103
Union Depot	1890	1,600,000	A. & O.	6	1900-1910	105	106

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, Aug. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'.	50	$500,000	Q.—J.	4	1858	260	270
Continental.	50	1,000,000	J.—J.	6	1873	125	126
Frankford & Southwark.	50	1,250,000	Q.—J.	5	1854	210	212
Germantown.	50	1,500,000	Q.—J.	2¼	1858	102	103
Green & Coates.	50	500,000	Q.—J.	3	1858	120	121
Hestonville.	50	2,050,000	.....	...	1859	32	34
Lombard & South.	25	500,000	A.—O.	8	1861	59	61
People's Common.	25	1,500,000	M.—S.	2½	1873	49	50
" Preferred.	25	750,000	M.—S.	2½	.....	49	.....
Philadelphia City.	50	1,000,000	J.—J.	7½	1859	150	151
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	65	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	85	88
Ridge Avenue.	50	750,000	Q.—J.	5	1872	220	225
Second & Third.	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth.	50	1,000,000	J.—J.	9	1858	200	203
Union.	50	1,250,000	J.—J.	9½	1864	186	188
West Philadelphia.	50	750,000	J.—J.	10	1857	200	202
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	135	137
Baltimore Traction.	25	5,000,000	.....	1	1889	24¼	24½
Buffalo (N. Y.) Railway.	100	6,000,000	.....	...	.....	44	45
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	29	30
BONDS.	**Date of Issue**	**Amount Out-standing**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1,250,000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	106	107
Germantown, 1st mort.	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Aug. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-standing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Aug. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	109¾	109⅞
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	108	108½
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	122	125
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	40
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	91½	92½
" " " Pref.	100	100,000	.....	6	.....	100	101
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	.....	.....
" "	.....	50,000	J. & J.	7	July, 1893	103	.....
" "	.....	50,000	J. & J.	7	July, 1894	107	.....
" "	.....	50,000	J. & J.	7	July, 1895	108½	109
" "	.....	50,000	J. & J.	7	July, 1896	110½	111½
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	102	103½
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	106
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable.	.....	250,000	M. & S.	5	Mar. 1906	105	106
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	116	.....
" " " "	.....	300,000	J. & J.	6	Jan. 1914	107½	108
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	100
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	.....	111¼
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	112	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Aug. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	24½	25
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	105	110
" " " cons. mort.	1892	500,000	.....	5	.....	102½	103
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " gen. mort.	.....	1,500,000	.....	5	.....	103	.....
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	110½	111½
Balt. Trac. Co., No. Balt Div	1892	1,750,000	J. & D	5	1942	106¼	106¾
" " "	1891	1,250,000	M. & S.	6	1901	105	.....
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	111	112

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Aug. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	310	320
Metropolitan R. R.	50	750,000	Q. J.	...	1864	98	.....
Columbia R. R.	50	400,000	Q. M.	...	1870	.....	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	37	.....
Eckington & Soldiers' Home	50	352,000	.....	...	.....	.....	.....
Georgetown & Tenallytown	50	200,000	.....	...	.....	.....	55
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	102	.....
do. do. convert.	'83-'91	3.000,000	J. & J.	6	1899-1929	125	.....
Eckington & Soldiers' Home	.....	150,000	J. & D.	6	1896-1911	97	.....
Capitol & North O St. R. R.	1891	240,000	J. & J.	5	1921	.....	.....
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	110	.....
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	102	.....

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Aug. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	40	42
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	44	46
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	.....	25
Newark (N. J.) Pass. Ry	100	6,600,000	.....	...	1890	29½	30
Columbus (O.) St. Ry.	100	3,000,000	.....	...	1892	35	39
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	92	95
Buffalo (N.Y.) Ry.	1891	5,000 000	F & A	5	1931	95	97½
Paterson (N. J.) Ry.	1891	850.000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry	1890	6,000 000	J & J	5	1930	90	92
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	92	97½

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Aug. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	170	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	100	2,000,000	Quart.	2	.....	172	175
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	135	140

Annual Report of the West End Street Railway Co., Boston.

In the annual report of the West End Street Railway Co., is the following table which shows the remarkable growth in the earnings of the company during the last five years.

	1887-8	1888-9	1889-90	1890-1	1891-2
October	$421,006	$418,935	$458,834	$513,779	$541,435
November	391,349	410,190	449,363	494,459	490,227
December	372,578	412.466	439,893	463,305	497,836
January	322,876	381,255	399,784	427,502	449,208
February	323,442	336.472	381,058	398,080	427,524
March	350,212	381,576	419,876	444,438	468,556
April	376,594	409,611	451,486	474,072	503,375
May	420,431	478,630	508,233	514,731	534,205
June	451,978	494,244	231,271	544,897	593.146
July	460,249	490,321	545,081	549,343	596,157
August	454,853	477,762	577,371	522.789	.....
September	427,938	465,928	511,486	539,506	.....

The track of the company now covers 260 miles, one half of which is practically new. The electric mileage is about two-thirds of the whole, and by the end of the year will probably be seven-eighths of the whole, or 15,000,000 for the year. The following table is also interesting showing the relative earnings per car mile of electric and horse cars.

Horse cars.—Nine months.

	1891.	1892.
Miles run	9,615,736	7,258,689
Net earnings	$543,497.34	$367,036.68
Net earnings per car mile	5¾ cts.	5 cts.

Electric cars.—Nine months.

Miles run	3,494,231	5.477.571
Net earnings	$312,765.01	$810,024.00
Net earnings per car mile	10 cts.	15 cts.

Electric.—Three months.

	1891.	1892.
Total mileage	1,131,317	2,280,012
Total earnings	$432.947.70	$950,446.89
Net earnings	179,069.17	418,648.43
Net earnings per car mile	16 cts.	19 cts.

Estimated earnings of electric cars for current year.

	Nine months.	Three months. Estimated.	Total.
Total mileage	12,736,260	4,500,000	17,236,260
Electric mileage	5,477,571	3,000,000	8,477,571
Net earnings	$810,024	$570,000	$1,380,024
Net earnings per car mile	.....	.....	16 cts.

During the last year the operating expenses were 74.48 per cent. of receipts, a reduction of 3. 81 per cent. since 1888. The company have paid regularly 8 per cent. on the preferred and 10 per cent. on the common stock since commencing operations. The fixed charges and dividends for the current year as estimated are $1,850,000. The company is charging for the depreciation of horses $11,000 per month and a large proportion of track repairs in operating expenses.

A BRAKE shoe has recently been put on the market, in which the face is cast with holes and into these are driven wooden plugs, giving a face against the wheel composed of both wood and iron. The manufacturers, the Safety Brake Shoe & Construction Co., of Boston, claim that by this method of construction the friction is so greatly increased that the car will stop in about one half the time required with the ordinary method of construction.

New Uses for Graphite.

A correspondent says: "I have used handhole and manhole gaskets eight to ten times by carefully smearing the surface next boiler shell, taken out at periods of three to four weeks, using steam pressure as high as 100 lbs. In packing water glasses, by putting a little graphite and oil on the gasket they would vulcanize as soft as lamp wick and retain their elasticity until the glass was changed, when the old rubber could be removed without trouble, while by the old way, I have spent much time in digging out the rubber, baked hard as vulcanite. Another thing I used it for was after putting back my handhole plate or plugs in back connection, I carefully brush away all soot and ashes, then with a small brush paint a good coat of graphite over flange, stud and nuts. After running boiler from three to six months, and using coke for fuel, with forced draft, the nuts can be removed without trouble as the heat has not been great enough to burn the lead."

Financial.

THE Citizens' Rapid Transit Co., of Nashville, Tenn., will issue $100,000 of bonds.

$ $ $

THE Georgetown (Ky.) Street Railway Co. have declared a semi-annual dividend of 4 per cent.

$ $ $

AT a recent meeting of the York (Pa.) Railway Co. the capital stock of the company was increased from $100,000 to $200,000.

$ $ $

THE Madison (Wis.) Street Railway Co. have amended their articles of incorporation, increasing their capital from $30,000 to $75,000.

$ $ $

THE Columbus (O.) Street Railway Co. report receipts for July, 1892, $44,695, a gain of $7,875 over those of the same month in 1891.

$ $ $

THE gross earnings of the West End Street Railway, of Boston, for July, were nearly $606,000, as against $551,000 for the corresponding period last year.

$ $ $

THE stockholders of the Eddy Manufacturing Co., of Windsor, Conn., lately voted to increase the capital stock from $100,000 to $225,000, and the number of shares from 4,000 to 9,000.

$ $ $

THE Wakefield (Mass.) & Stoneham Street Railway Co. have received permission from the State Board of Railroad Commissioners to add $40,000 to their capital stock on account of electric equipment.

$ $ $

THE New Jersey Traction Co., who operate the street railway system in Newark, report for the first two weeks in August, receipts $47,496, against $41,658 in the same weeks last year, an increase of $5,838.

$ $ $

THE quarterly dividend of 1¾ per cent. has been declared on the stock of the West Chicago Street Railroad Co. It had been rumored that a change might be expected, but the 7 per cent. rate has not changed.

$ $ $

THE street car lines of Chicago have paid to the City Controller their license money for the quarter ending August 1. The amounts were as follows: South Side, $4,556.25; North Side, $2,727.50, and West Side. $4, 814.64.

$ $ $

THE Natick (Mass.) & Cochituate Railway Co. voted at a recent meeting to divide the surplus, which had accumulated since its construction, among their present stockholders and to raise $6,500 new stock for its equipment with electricity as a motive power.

$ $ $

THE directors of the Newburyport (Mass.) City Railroad Co. have authorized the treasurer to convert the investments into cash and to pay the bonded debt of the company, due September 1, amounting to $25,000. The board also voted to transfer to sinking fund account a sum sufficient to make the full sum of $25,000.

$ $ $

THE total receipts for July 1892 of the Pittsburgh (Pa.) Traction Co. including the receipts of the Duquesne company were $8,401. Last year for the same month the receipts, excluding those of the Duquesne company, were $4,549, or a net increase of $3,852. Three cent fares were in force during July 1891.

$ $ $

THE stockholders of the Denver (Colo.) Tramway Co. were agreeably surprised at their annual meeting by the fact that the earnings of the company for July were $96,000. On July 4, 150,000 passengers were carried and $7,000 earned. The company's stock is quoted at $1.95, and there is none for sale.

$ $ $

THE profits and assets of the East Middlesex (Mass.) Street Railway Co. last year amounted to $398,554.32. The income was $90.831. The company had fifty-six cars and 223 horses. During 1891, 1,587,913 passengers were carried. Indications show that the income the present year will show an increase of from 7 to 10 per cent.

$ $ $

THE total receipts of the Chicago (Ill.) West Side Street Railway Co. for the month of July, 1892, were $407,455, for the month of July, 1891, $376,525; increase $30,930. Including July, the receipts since January 1 have been $2,546,245, against $2,323,839 in the corresponding period of 1891, a gain for ths year to date of $322,406.

$ $ $

A MORTGAGE has just been executed by the East Oakland Street Railroad Co. to the California Safe Deposit & Trust Co., dated June 1, 1892, in the sum of $250,000 to secure 6 per cent. bonds. to be issued by the directors of the corporation. The mortgage is executed upon all property estate, rights, franchises and privileges of the company.

$ $ $

MANHATTAN Railway Co., of New York, report for the quarter ending June 30, 1892: Gross $2,773.449, increase $228,236; operating expenses, $1,420,681, increase $133,013; net $1,352,817, increase $95,222; other income $35,000: gross income, $1.387,817, increase $95.222; interest and taxes $605,428, increase, $4,881; net for quarter $782,389, increase $90,341.

$ $ $

DRY Dock, East Broadway & Battery Railroad Co., of New York, report for quarter ended June 30: Gross earnings 1892, $187,533; 1891, $192,926; operating expenses 1892, $130,057; 1891, $132,197; other income 1892, $1.663; 1891, $2,618; fixed charges 1892, $41,334; 1891, $46,708; net income 1892, $17,805; 1891, $16,639; cash on hand 1892, $61,496; profit and loss surplus 1892, $16,383.

$ $ $

IT is understood that steps are being taken to organize a strong syndicate in Chicago to purchase the cable railway property of the Pacific Railway Co. at Los Angeles, Cal., at the coming foreclosure sale. It is reported that the road is earning considerable money at present, over and above operating expenses, and that the prospects are good for a still further increase in earning capacity.

$ $ $

THE Metropolitan Traction Co., it is reported, have recently made an important addition to the number of street railways which they control in New York City. This latest railway to come under their control is the Central Park, North & East River Railway Co., commonly known as the "Belt Line" and extending along the river front on the North and East River sides of the lower part of the city as far as 59th Street. The price mentioned as paid per share was $150.

WE PURCHASE

Total Issues of Street Railway Bonds.

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Small model on successful exhibition.

Applications for patents allowed.

Inventor will advance no preliminary expenses to "promoter" or "company."

Send for illustrated description.

R. L. ELLERY, Taunton, Mass.

THE stockholders of the Ridge Avenue Passenger Railway Co., of Philadelphia, on August 18, ratified the lease of the line to the Traction company. 10,301 shares out of 15,000 were voted on, and all were in favor of the lease, which is to run 999 years, and which provides for the guarantee of $10 a share for the first three years and $12 a share thereafter. In addition, the Ridge Avenue Co. are allowed $2,000 a year to keep up their organization, and the Traction Co. agree to do certain paving.

$ $ $

THE half yearly meeting of the Bristol Tramways & Carriage Co., Ltd., of Bristol, England, was held August 10. The report of the directors showed: Number of passengers carried during the last six months on the company's cars and omnibuses was 5,502,426; receipts during the half year are £38,127; net receipts £7,318; increase in street railway department £1,875; in carriage department £295. The usual 6 per cent. dividend was declared, and £1,133 carried to the Contingent and other funds.

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FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

POSITIONS WANTED.

WANTED.—By a Practical Man, position with Street Railway Company as Superintendent or Manager. Have had experience with Electric, Steam Motor and Horse Lines. Satisfactory references as to ability and character in the construction, operation of Street Railways and Surburban Lines. Address, "STREET RAILWAY," 6,608 Evans Ave., Chicago, Ill.

WANTED—A position as chief engineer by a thoroughly competent man who understands doing all repairs, and also understands repairing and managing railway generators and motors, having had charge of the assembling and testing those machines in the Thomson-Houston works; also understands wiring and repairing cars. Can take entire charge of mechanical department of power house and station. Can furnish the best of city reference in Brooklyn and New York. Have first-class papers from both cities. Address ECONOMICAL, STREET RAILWAY JOURNAL.

EQUIPMENT WANTED.

WANTED.—Bids for the construction of two and one miles of suburban street railway. Address J. C. COLLINS, Henderson, Ky.

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125 tons second-hand 38 lb steel tram rails, in excellent condition.
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100 tons 38 lb steel girder rail, excellent condition.

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FORTY (40) OPEN AND FORTY (40) BOX (12 FOOT BOBTAIL) CARS, with fare box in each. All in good order. Gauge 4 ft. 10 in.
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Have for Sale 14 and 16-foot Second-Hand Box Cars, in Good Running Order.—Gauge, 4 feet, 8½ inches. APPLY AT THE OFFICE,
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TWO FIFTY H. P. ARMINGTON & SIMS ENGINES,

9½ x 12. These engines are in good condition, and are sold on account of change to water power.

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RE-LAYING RAILS For Sale Cheap for Immediate Delivery, in Good Condition.

200 Tons....Johnson Girder. | 50 Tons....40-lb. Steel Tee.
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Rails Cut to Lengths for Buildings,

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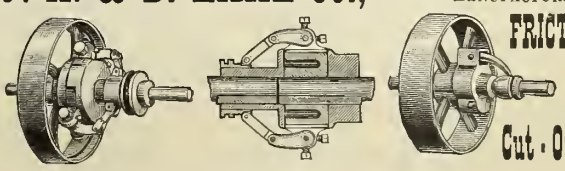
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THE following annual reports were filed recently with the New York state board of railroad commissioners. Hudson Electric Railway Co. of Hudson: Gross income from all sources, $7,668.15; net income, $4,692.31; surplus for year ending June 30, 1892, $1,692.31. Poughkeepsie City Railroad Co.: Gross income from all sources, $3,961.06; net income, $2,741.07; surplus, $735.25. Frankfort & Ilion Street Railway Co., of Frankfort: Gross income $1,501.65; net income, $1,301.74; dividend declared, 10 per cent. on capital stock.

$ $ $

A BIG mortgage has been executed from the Cincinnati, Newport & Covington Railway Co. to the Farmers' Loan & Trust Co. of New York, for $3,000,000, secured by the property, right of way and franchises and 6,436 shares of stock in the South Covington & Cincinnati Street Railway Co., and the entire stock of the Cincinnati, Covington & Rosedale Street Railway Co., and of the Covington & Latonia Railway Co. The bonds are issued in denominations of $1,000. The company giving the mortgage is the new corporation formed by the union of the South Covington & Cincinnati Street Railway Co., the Cincinnati & Newport Street Railway Co., and the Covington & Rosedale Street Railway Co.

$ $ $

THE Metropolitan Traction Co. is to be reorganized under a New York State charter with a capital stock of $30,000,000. The outstanding stock of the company comprises 200,000 shares, representing an aggregate par value of $20,000,000. On these shares but 60 per cent. has been paid in, or $12,000,000 of the total capital of $20,000,000. According to the plan outlined, each holder of 100 shares of the present stock will receive 120 shares in the new company, thus taking $24,000,000 of the new capital. It is also proposed to permit present stockholders to subscribe to 10 per cent. of their present holdings in new stock at par, which will put $2,000,000 of money in the company's treasury. The remaining $4,000,000 stock is to be held for future use in developing the property.

$ $ $

A SYNDICATE composed of E. W. Clark & Co., J. & W. Seligman & Co., August Belmont & Co., Kuhn, Loeb & Co. and H. B. Hollins & Co., have recently secured control of several important street railway lines in the northeastern part of Massachusetts, and have organized the North Shore Traction Co., with a capital of $6,000,000, under which name the road will be operated. The lines included are the Lynn & Boston, the Lynn Belt Line, the Naumkeag Street Railway and the Essex Electric Railway, comprising altogether 120 miles of track and forming a line from Boston to Marblehead. Except the Belt Line, in which it is said that 1,115 out of 20,000 shares were secured, the several lines were bought outright, about $5,000,000 being necessary to complete the purchase. Of the $6,000,000 capital of the new company, $2,000,000 will be in preferred 6 per cent. stock and $4,000,000 in common stock. The preferred stock will probably be offered at par with a bonus in common stock equal to the subscription.

The Railway World.

The Railway World is the new name given to our English contemporary heretofore known as *The Tramway and Railway World*, published in London, and indicates that the managers of this enterprising and readable paper have decided to enlarge the field which the paper covers. We understand that this is a fact, and while the tramway and street railway field will remain a special feature the steam railway field will also be covered.

The last issue of *The Railway World* contains many interesting articles, among which a description of the manufacture and use of manganese and other steel castings at Hadfield's steel foundry, Sheffield, is especially worthy of mention. The advertisements in this issue show that the paper has the confidence of many leading manufacturers, not only of England but also of this country.

Great Railroad Traveling.

"I happened to take the 10:30 A. M. train the other day, from Chicago, on the Lake Shore and N. Y. Central, and thought the entire trip would be a bore," said Geo. W. Lederer to a DRAMATIC TIMES reporter. "But imagine my surprise, when I found upon entering the train, a *fac-simile* of their famous Chicago limited, and positively the same comfort, convenience and equipment which I have so often enjoyed on the latter. I arrived in New York City at 2:10 the next day, the train being on time to the minute, and had sufficient time left that day to transact a great deal of very important business. I shall return again to Chicago on the very same train, as it leaves here at 1.55 P. M., and gives me a good half day to settle up my unfinished business."—*New York Dramatic Times.*

The 10:30 A. M. train to which Mr. Lederer refers, is the popular "Chicago and Boston Special," the latest addition to the train service of the Lake Shore & Michigan Southern R'y. The equipment, which is of Wagner build, consists of two Vestibule Sleeping Cars, one Vestibule Buffet Smoking and Library Car, running through to Boston, arriving at 3:40 P. M. next day; one Vestibule Sleeper through to New York, arriving at 2:10 P. M.; a vestibule Dining Car, Chicago to Cleveland, and Utica to Boston, and day Coach, Chicago to Buffalo, and Buffalo to Boston.

The train leaves daily from Van Buren Street Station at the hour named above, and is the greatest favorite with business men and tourists, as by it not only are the cities on the B. & A. R. R. reached early in the afternoon, but the Atlantic Coast resorts are reached before dark.

RAILWAY FEEDER-WIRES

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THE STREET RAILWAY JOURNAL

Vol. VIII. NEW YORK & CHICAGO, OCTOBER. No. 10.

ELEVENTH ANNUAL CONVENTION

OF

The American Street Railway Association.

Everything points to a most successful convention this year at the city of Cleveland on October 19, 20 and 21. The local committee has been very busy making arrangements for the reception and care of the delegates, and every person who attends can be certain of a visit which will be both pleasant and profitable. The meetings of the American Street Railway Association have been growing in importance and interest yearly, and that to be held this month merits the attendance of every street railway official in the country. Certainly each street railway company should be represented by at least one delegate, and should send as many others as can be spared from active service.



JOHN G. HOLMES.

PRESIDENT OF AMERICAN STREET RAILWAY ASSOCIATION.

We take pleasure in presenting on this page a portrait of the president of the Association for the current year. Mr. John G. Holmes, president of the Citizens' Traction Co., of Pittsburgh, Pa., is a native of the city of which he is a resident, and was born in 1846. His father was Nathaniel Holmes who was prominent in the organization of the Citizens' Passenger Railway Co., of Pittsburgh, which built the first street railway west of the Allegheny Mountains, and with which Mr. Holmes, the subject of our sketch, has been identified since the running of the first horse car. After completing the usual preparatory studies, Mr. Holmes entered Dickinson College, Carlisle, Pa. His business career commenced in 1866, with his connection with the banking house of N. Holmes & Son, of which firm he is now the senior member. This firm was established in 1822 and is the oldest banking house in Pittsburgh.

Mr. Holmes was elected treasurer of the Citizens' Passenger Railway Co. in 1871, retaining that office until 1882, when he became president of the company. In 1887 all the lines of the Citizens' Passenger Railway Co. were leased by the Citizens' Traction Co., of which Mr. Holmes had also been elected president, and about twelve miles of road were changed from animal to cable power. During the last two years the electric system has been introduced extensively on the other lines under Mr. Holmes' control.

Mr. Holmes has been connected with the American Street Railway Association since the first regular meeting and has missed very few of the conventions. In 1883-84 he was a member of the executive committee, and in 1890-91 of the local committee, and added much to the pleasure of last year's convention by his hospitable treatment of the delegates and their friends who were present.

THE CITY OF CLEVELAND.

Cleveland is an exceedingly interesting place for the street railway man to visit, and it is an extremely desirable meeting place for the Convention. Many local industries of peculiar interest to railway men are located here, and much of the equipment used in rapid transit service is manufactured in the city. Cleveland is wonderfully well supplied with street railway facilities, and many methods are worthy of study and imitation, especially in view of the fact that electricity has been employed for a long a time, and all departments have been thoroughly organized. There are few, if any, cities in which so varied an assortment of equipment of every department can be found in use. No extended reference to the systems is contemplated at this time, for the reason that a Souvenir Number of the STREET RAILWAY JOURNAL will soon be issued in honor of the Convention, in which will appear detailed descriptions of all the street railways in the city.

SUBJECTS FOR DISCUSSION.

The subjects for discussion at the Convention include topics which are of timely and of universal interest to street railway men, and the ability of the gentlemen composing the committees is sufficient assurance of an able presentation of each subject.

The first paper to be read is on "A Model Electric Street Railway Roadbed and Underground Wiring," by Geo. W. Baumhoff, general manager of the Lindell Railway Co., St. Louis. Mr. Baumhoff's road was one of the first to make experiments with storage battery cars, and later, when the advantages of the trolley method had been shown, one of the earliest to adopt that system on a

large scale. Mr. Baumhoff understands the needs of an electric railway, and his paper will, undoubtedly, contain many important facts as the outcome of his experience.

"A Perfect Overhead Electric Construction" is the title of the second paper which will be read by Charles H. Smith, superintendent of the Troy & Lansingburgh Street Railway Co. Mr. Smith has a good subject, and will give many important facts and suggestions which will be of value to electric railway managers.

A third paper is on the "Economy of Machine Shops for Electric Street Railways," and will be read by John H. Bickford, engineer of the Naumkeag Street Railway, Salem, Mass. Mr. Bickford holds, besides his office with the Naumkeag Street Railway, that of consulting engineer with several important electric railway companies, and is well fitted to present many valuable facts on the important subject upon which he will treat.

Following this will be a paper on "Power House Engines," which will be read by T. W. Wrenne, president of the United Electric Railway Co., Nashville, Tenn. The other members of the committee on this subject are: L. H. McIntire, engineer of the Union Railway Co., New York City, and F. S. Pearson, chief engineer of the West End Street Railway Co., Boston. All of these gentlemen know the needs of an electric railway power station, and we can confidently assert that Mr. Wrenne's paper will contain a great deal of new and valuable matter on this subject.

The fifth paper is upon the "Relative Cost of Operating Horse, Cable and Electric Roads," a subject of vital importance to street railway managers. The chairman of this committee is W. McC. Ramsey, electrical superintendent of the Federal Street & Pleasant Valley Railway Co., Pittsburgh. Mr. Ramsey is well acquainted with the economical management and care of electric railways, and his figures will undoubtedly be of great value to every railway company in the country, especially those who are now contemplating a change from animal to mechanical power. The other gentlemen on this committee are F. R. Greene, secretary of the Chicago City Railway Co., one of the largest cable railways in the country, and John L. Heims, superintendent of the Brooklyn City & Newtown Railway Co., whose experience as superintendent of a large horse railway eminently qualifies him to give valuable information on this branch of the subject.

"Standards for Electric Railways" is the subject of the paper which will follow, and which will be read by O. T. Crosby, president of the Utica Belt Line Railway Co., Utica, N. Y. Mr. Crosby's important paper and valuable suggestions on this subject before the Association last year will be well remembered, and assures an equally interesting presentation of further data this year. Associated with Mr. Crosby on this committee are: H. I. Bettis, assistant treasurer Atlanta Street Railway Co., Atlanta, Ga.; Edward E. Higgins, consulting engineer, Brooklyn Street Railroad Co., Cleveland, O.; Chas. W. Wason, general manager East Cleveland Railroad Co., Cleveland, O.; Julius E. Rugg, superintendent Citizens' Traction Co., Pittsburgh, Pa.

"The Form of Street Railway Electrical Statistics" is the title of the paper to be read by Thomas H. McLean, secretary and general manager of the Twenty-third Street Railway Co., of New York City, and general manager of the Houston Street, West Street & Pavonia Ferry Railway Co. of New York City. Mr. McLean's experience in street railway affairs has been a long one, and enables him to deal intelligently and practically with the subject. The other members of the committee are Henry M. Watson, president Buffalo Railway Co., Buffalo, N. Y.; H. I. Bettis, assistant treasurer Atlanta Consolidated Street Railway Co., Atlanta, Ga.; Charles E. Warren, accountant Broadway & Seventh Avenue Railroad Co., New York.

Notice is also given by the secretary that special papers will be read under the following titles: "Experiments on the Expansion of Continuous Rails," and "Is a Standard Rail Head Possible," subjects which are of much interest to street railway managers.

Upon the request of the executive committee, Mr. D. F. Longstreet has also consented to prepare and will read a paper relating the events which led up to the formation of the American Street Railway Association. Mr. Longstreet is a veteran in the street railway industries and his reminiscences will undoubtedly be of great interest, not only to the old timers, but also to the more recent members of the Association.

REDUCED RAILROAD RATES.

As usual, reduced railroad fares have been secured for the benefit of attendants at the Convention. These reduced rates, the secretary announces, include the lines controlled by the different traffic associations except for the Western and Pacific Coast States included in the territory of the Trans-Continental and the Western Passenger Association. The latter has, however, granted a fare and a third rate from Peoria via Chicago, Rock Island & Pacific, Chicago, Burlington & Quincy, Jacksonville Southeastern, and Atchison, Topeka & Santa Fe railways only. The charge for the trip to Cleveland and return will be a fare and a third. In order to secure this reduction, which is open to attendants and their families, whether delegates or not, it will be necessary to secure from the ticket agent at the station of departure to Cleveland a certificate stating that the passenger has paid full fare over certain lines to Cleveland, and that he has purchased his ticket not more than three days prior to the date of the meeting. Before purchasing a return ticket these certificates must be countersigned by Mr. John J. Stanley, general manager of the Broadway & Newburgh Street Railway Co., who will act as Clerk of the meeting for this exclusive purpose, when a return ticket can be procured at one-third fare.

LOCAL ENTERTAINMENT.

The Cleveland street railway companies, supplemented by the Street Electric Railway Co. will entertain attendants at the Convention in a most hospitable way.

Among the excursions already planned, is one to the works of the Short Electric Railway Co., which will undoubtedly be one of the most interesting of any. The special excursion to these works will occur on the afternoon of the first day, when visitors will be taken on street cars over the East Cleveland road directly to the factory. The exhibition here will be very fine and will consist of the different types of motors, and of new and improved generators, line appliances, etc., manufactured by the Short company.

HOTEL RATES.

The headquarters of the Association will be at the Hollenden Hotel, one of the largest and best equipped hostelries in the country. The prices for board per day will be the same as the ordinary rates of the hotel, so that delegates need have no fear of exorbitant charges being made for this special occasion. In case delegates prefer to patronize other hotels or boarding houses, they will find a large number which will furnish ample accommodation at reasonable rates. Those desiring to secure rooms at any of the hotels should communicate with Mr. H. J. Davies, secretary of the local committee.

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will be represented as usual at the Convention, and will occupy spacious parlors in the Hollenden Hotel. Our friends who will do us the honor of calling will be sure of a cordial welcome, and we desire that all delegates and visitors should register at our headquarters.

THE EXHIBITS.

The exhibits of apparatus and appliances designed for street railways will be located for the most part in the Army and Navy Hall on Superior Street, almost directly opposite the headquarters at the Hollenden Hotel. Manufacturers have applied for space very generally, and several exhibits of more than ordinary interest have been planned. The plans of the local committee are sufficiently flexible to admit of the extension of the exhibit to rooms adjoining the main hall should the demand for space be unexpectedly large. It is a fortunate fact that the lot adjoin-

ing the hall on the east is vacant, and the committee in all probability will locate there apparatus too large to be placed indoors. Unless all signs fail the exhibit will be the largest and most interesting ever seen at a convention of the Association.

ATTENDANCE OF LADIES.

The attendance of the wives and daughters of the gentlemen attending the Convention was gratifyingly large last year, and it is hoped that a still larger number of ladies will be present at Cleveland. Their participation in the excursions and banquet will be fully arranged for by the local committee.

THE ANNUAL BANQUET.

That enjoyable feature of the Convention, the banquet, will take place on Thursday evening, October 22, at the Hollenden Hotel. Each member-company of the Association is entitled to the free admission to the banquet of two of its officers.

The tickets admitting an additional officer or any gentleman in attendance at the meeting, can be obtained from the secretary for $10 each; ladies' tickets for $5 each. The secretary has requested that members and others who expect to be present at the banquet will notify him promptly in order that definite arrangements as to the number who will attend may be promptly made.

SOME OF THE ADVANTAGES TO BE GAINED

by attending the Convention are set forth in our editorial columns, and we can only add that the best evidence of the value of the Association to individual roads is the testimony given by the delegates who have most frequently attended the meetings. We have yet to hear of a person who deprecates either the aims or the methods of the Association. There has been at times a little complaint that certain parties made themselves too prominent and assumed to shape the proceedings after their own peculiar ideas, but it is expected that at the coming meeting the business will be quickly and systematically dispatched, and that members will be considerate of the wishes of other members, and see to it that every one who desires shall have a chance to be heard. The new plan of providing copies of the papers in advance will go into effect at this meeting, so that all who wish to take part in the discussion will have ample time to prepare themselves. This arrangement, if properly observed, will doubtless make the proceedings of more value than those of any previous meeting.

The following are among the companies and firms which have expressed an intention of being represented at the Convention, and have secured space to exhibit their appliances:

Baltimore Car Wheel Works, Baltimore, Md.
Barnes Brake Co., Cleveland, O.
Billings & Spencer Co., Hartford, Conn.
Bodifield Belting Co., Cleveland, O.
Brownell Car Co., St. Louis, Mo.
Brooklyn Railway Supply Co., Stamford, Conn.
Brill, J. G. Co., Philadelphia, Pa.
Bruce, F. E., Agent Stirling Co., Cleveland, O.
Cleveland Frog & Crossing Co., Cleveland, O.
Combination Car Co., Cleveland, O.
Davis & Cook, Watertown, N. Y.
Detroit Electrical Works, Detroit, Mich.
Dorner & Dutton, Cleveland, O.
Duplex Street Railway Track Co., New York.
Ford & Washburn Co., Cleveland, O.
Fulton Foundry Co., Cleveland, O.
General Electric Co., Boston, Mass., and New York.
Graham, J. H. & Co., New York.
Griffin Wheel & Foundry Co., Chicago, Ill.
Hill Clutch Works, Cleveland, O.
International Register Co., Chicago, Ill.
Jewell Belting Co., Hartford, Conn.
Johns, H. W. Manufacturing Co., New York.
Johnson Co., Johnstown, Pa.
Johnson Electric Co., Cleveland, O.
Loomis, H. N., Hightstown, N. J.
Lewis & Fowler Girder Rail Co., Brooklyn, N. Y.
Lewis & Fowler Manufacturing Co., Brooklyn, N. Y.
Mitchell-Brandt Copper Co., Erie, Pa.
Meaker Manufacturing Co., Chicago, Ill.
Morton Safety Heating Co., Baltimore, Md.
New Departure Bell Co., Bristol, Conn.
New York Car Wheel Works, Buffalo, N. Y.
Nuttall, R. D., Co., Allegheny, Pa.
Peckham Motor Truck & Wheel Co., Kingston, N. Y.
Pittsburgh Steel Hollow Ware Co., Pittsburgh, Pa.
Pennsylvania Steel Co., Philadelphia, Pa.
Pomeroy & Fischer, New York.
Railway Equipment Co., Chicago, Ill.
Reliable Manufacturing Co., Boston, Mass.
Robinson Machine Co., Altoona, Pa.
Rochester Car Wheel Works, Rochester, N. Y.
St. Louis Register Co., St. Louis, Mo.
Schieren, Chas. A., & Co., New York.
Scott, Charles, Spring Co., Philadelphia, Pa.
Short Electric Railway Co., Cleveland, O.
Sperry Electric Railway Co., Chicago, Ill.
Taylor Truck Co, Troy, N. Y.
The New Process Raw Hide Co., Syracuse, N. Y.
Wall, P., Supply Manufacturing Co., Allegheny, Pa.
Walworth Manufacturing Co., Boston, Mass.
Washburn & Moen Manufacturing Co., Worcester, Mass.
Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.
Wharton Wm., Jr., & Co., Philadelphia, Pa.

A number of other companies and firms have signified their intention of exhibiting, but up to the time of going to press had not secured space.

Cable Service on the Brooklyn Bridge.

The cable service on the New York & Brooklyn Bridge cable railway up to September, 1, 1892, was as follows:

CABLE.	Number of Days.	Passengers Hauled.	Car Miles.	Ton Miles.
No. 1 removed,	1,140	49,002,442	228,329	22,142,706
" 2 "	607	47,840,262	120,232	25,492,892
" 3 "	393	36,941,884	82,099	20,395,073
" 4 "	356	34,134,409	74,111	18,923,469
" 5 in use,	468	50,299,888	100.120	30.251,456
" 6 "	300	33,024,020	64,297	20,310,394

As will be seen, No. 5 has already performed nearly 19 per cent. more work than any other of the cables, and seems capable of lasting for at least 100 days more.

This great service is attributable, in the opinion of the engineers of the road, first, to its excellence as a cable; second, to the fact that it is not in contact with iron except in the drum grooves, all the sheaves, pulleys and grips being packed either with leather or with leather and india rubber; and third, probably greater in effect than either or perhaps both the above, the method of driving whereby the slip of the cable in the drum grooves is reduced to the least possible quantity.

Crosstown Electric Lines in Chicago.

As soon as the preliminary work is completed, electric motors will be put into operation on the crosstown lines of the Chicago City Railway Co. President Wheeler and Supt. M. K. Bowen, of that company, have recently visited Cleveland for the purpose of examining the electric roads there and express themselves pleased with the workings of electric railways in that city.

The first lines to be equipped are the roads on Sixty-first and Sixty-third Streets, and as these lines run to the World's Fair grounds no doubt they will be liberally patronized next year.

East Cambridge Power Station, West End Street Railway Co., Boston.

On January 15 last an electrical event took place which deserved, we confess, a very different sort of notice from that which has been bestowed upon it. We refer to the starting up of the above plant which has since been in successful operation. Many reasons have made it impossible for us to lay before our readers, until now, the details of this very interesting plant; but now, acknowledging that we have already deferred too long the duty of paying some tribute to the designers and builders of this plant, we bring to our readers without further delay the details of its construction.

This station is rivaled in capacity only by the central power station of the same company, which was illustrated and described in our last issue, and in some respects the details of construction are the same. The power equipment (Fig. 1) consists of three cross compound, triple expansion engines and twenty M. P., No. 80, Thomson-Houston generators (Fig. 3), which will be replaced by ten M. P, 500 H. P., generators. The two flanking engines are rated at 1,000 H. P. each, but can be worked at 2,000 H. P., and the intermediate engine is rated at 500 H. P., with a maximum of 1,000 H. P. The high pressure and intermediate cylinders are tandem and rest on one foundation, those for the larger engines being twenty-three inches and thirty-six inches in diameter respectively, with a forty-eight inch stroke. The low pressure cylinders of each engine are on separate foundations, and are fifty-two inches in diameter by forty-eight inches stroke. The dimensions of the cylinders of the intermediate engine are $16 \times 25 \times 36$, with forty-eight inch stroke. There are two intermediate receivers provided for each engine, which are placed above the cylinders as shown, with suitable steam pipe connections. These receivers are also lined with a coil of copper pipe about one and a half inches in diameter, which are charged with live steam to dry and superheat the exhaust steam before it enters the next cylinder; these receivers are also provided with insulating covering to prevent radiation. The cylinders are all steam jacketed and are also properly covered. Steam is supplied to the engines from two mains, all branches being connected by suitable valves. There is also a separator of special design located over the throttle valve of the high-pressure cylinder.

The Corliss vertical, circulating engines, placed behind the others, perform three distinct functions, namely, circulating the salt condensing water, operating the air pump for the condensers and acting as feed pumps for the boilers. Each engine is provided with a surface condenser located beneath the floor. There is also a duplicate system of exhaust piping to be used in case of emergency, and the engines can be run condensing or non-condensing as desired. There is also a free exhaust pipe, extending through and above the roof of the building for use when running non-condensing.

The steam equipment of the station has been constructed regardless of cost, making it absolutely reliable and capable of taking care of any possible emergency. The flywheels of the large machines are double crowned, and are of mammoth proportions, being each twenty-eight feet in diameter with a ten foot seven inch face, and weigh eighty tons. These wheels are built up of two rows of ten sections each with two sets of ten arms of elliptical section, which are bolted to the rim at the intersections, and also bolted to the hub which is cast independent of the arms. Each flywheel is coupled to the countershafting, which is located to the right in the basement of by two enormous double-ply leather belts, each fifty-four inches wide, and 150 ft. long, being carried under the generator floor by means of adjustable belt tighteners.

The system of countershafting is about the same as that adopted in the central power station, and its mechanical details are clearly shown in the accompanying illustration (Fig. 2). As will be seen, it is provided with the latest appliances for reducing the amount of useless friction and wear. Each section consists of a ten inch steel shaft with nine inch bearings. The main pulleys are each eight feet in diameter, with the same width of face as the flywheels, and carry the main driving belts. These pulleys are supported on a hollow steel sleeve with

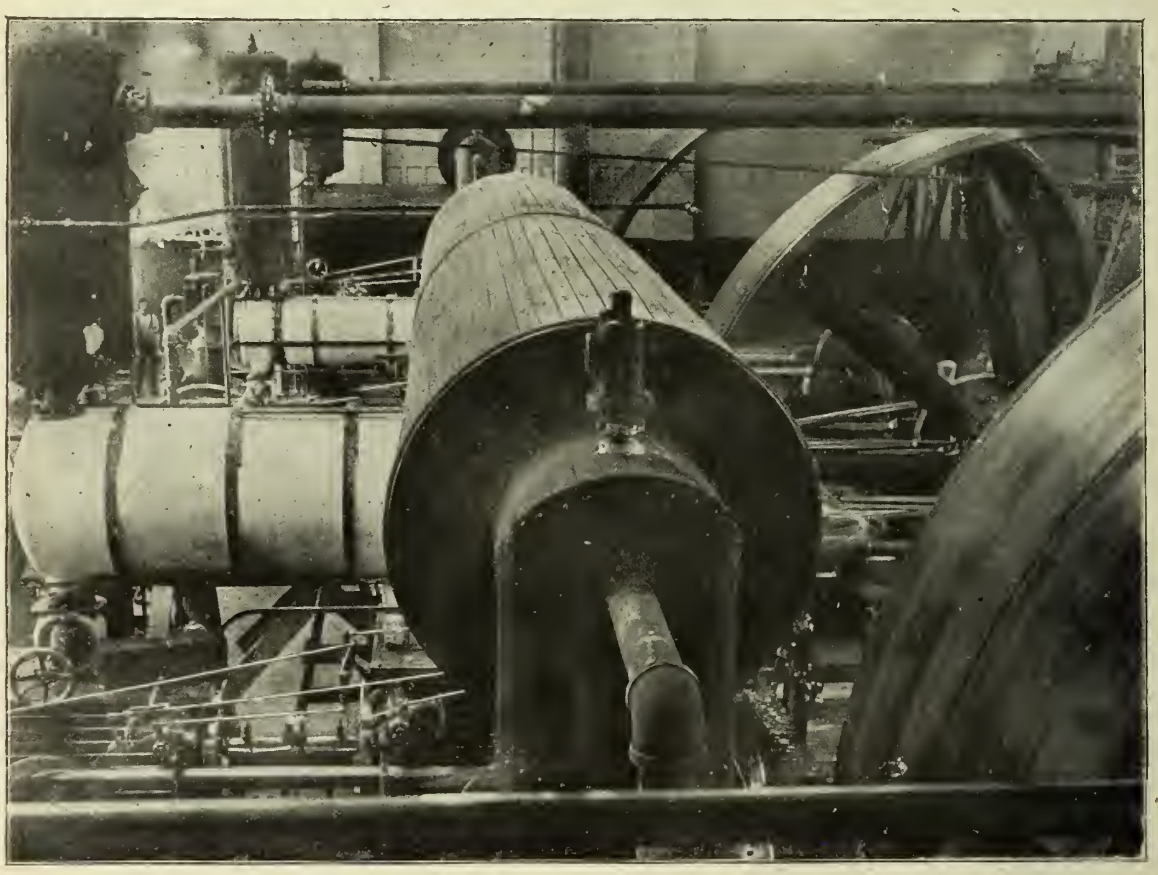


FIG. 1.—VIEW SHOWING GENERAL ARRANGEMENT OF STEAM SEPARATOR AND INTERMEDIATE RECEIVERS OVER ENGINES—CAMBRIDGE POWER STATION, WEST END STREET RAILWAY.

independent bearings, which allows the shaft to pass freely through so that it can be driven, when the clutch is set, by each engine independently of the other. This method of mounting provides that the weight of the pulley and the strain of the heavy belt are borne independently of the shaft, as the strain on the shaft when running is taken outside and close to the bearings instead of between the bearings. A clutch ring is attached to the sleeve, and to the shaft adjoining is keyed an eighty-four inch friction

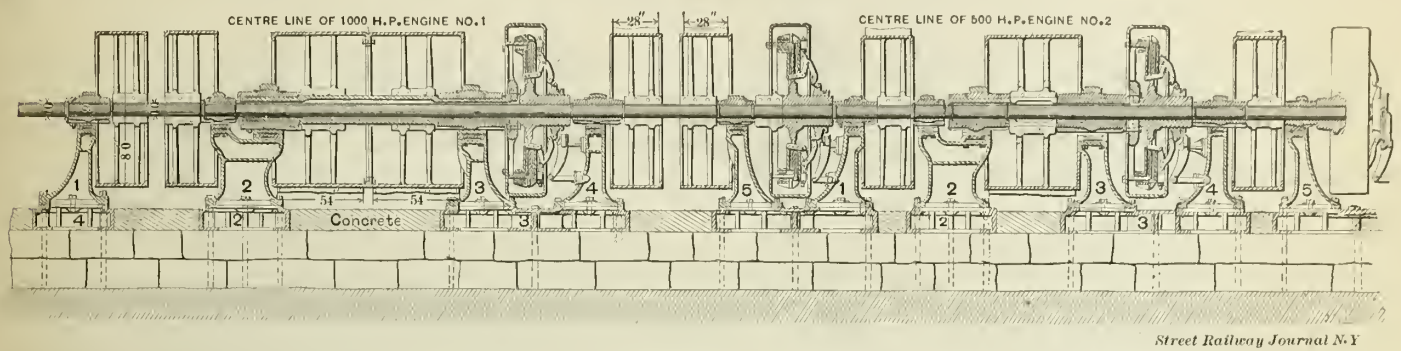


FIG. 2.—SECTION OF SHAFTING—CAMBRIDGE POWER STATION, WEST END STREET RAILWAY.

clutch, specially designed for this purpose, the whole being provided with a casing. The dynamo or driving pulleys are placed on each side of the main pulley, and are of the same diameter, with a thirty-two inch face, and drive the generators, which are located on the floor above by thirty inch double ply belts.

All the journal boxes of the countershafting are water jacketed to prevent their being overheated, and the circulation is maintained by means of a system of pipes which communicate with the feed water pipes. The journals are also automatically lubricated by means of a second set of pipes which are parallel to the water pipes, and which connect with a supply reservoir, to which the oil is pumped after passing the filter and drip tank.

An interesting feature will be noted from the illustration in connection with the method of mounting the temporary generators; it is that two armatures are attached at the terminals of the same shaft and are driven from one belt pulley which is placed between the armatures; by this arrangement one belt drives two generators.

The switchboard is located at the back of the platform on which the generators are placed, and is provided with the usual switch equipment with a lever so arranged that all the drop switches can be closed at once by one movement of the lever. Both the engine and generator floors are served with a traveling crane which provides for readily handling the heavy parts.

The boilers of the Cambridge station are the Babcock & Wilcox water tube type, and are arranged in five batteries. Each battery consists of two distinct boilers composed of three horizontal steam and water drums three feet in diameter running the full length of the setting (twenty-three and a half feet), beneath which are arranged in an inclined position the water tubes which form the principal part of the heating surface. The usual gauges, test cocks, etc., are provided. The arrangement of the interior of the boilers is such that the gases are compelled to travel from the furnace across the tubes three times on their way to the flues which lead to the stack so that nearly all the heat of the gases is utilized before being led into the flues. The coal is handled automatically, and underneath the floor of the boiler room is located a track with iron cars which receive the ashes from a chute connected with the firedoor of each furnace, when they are conveyed to the ash dump and removed by cartage.

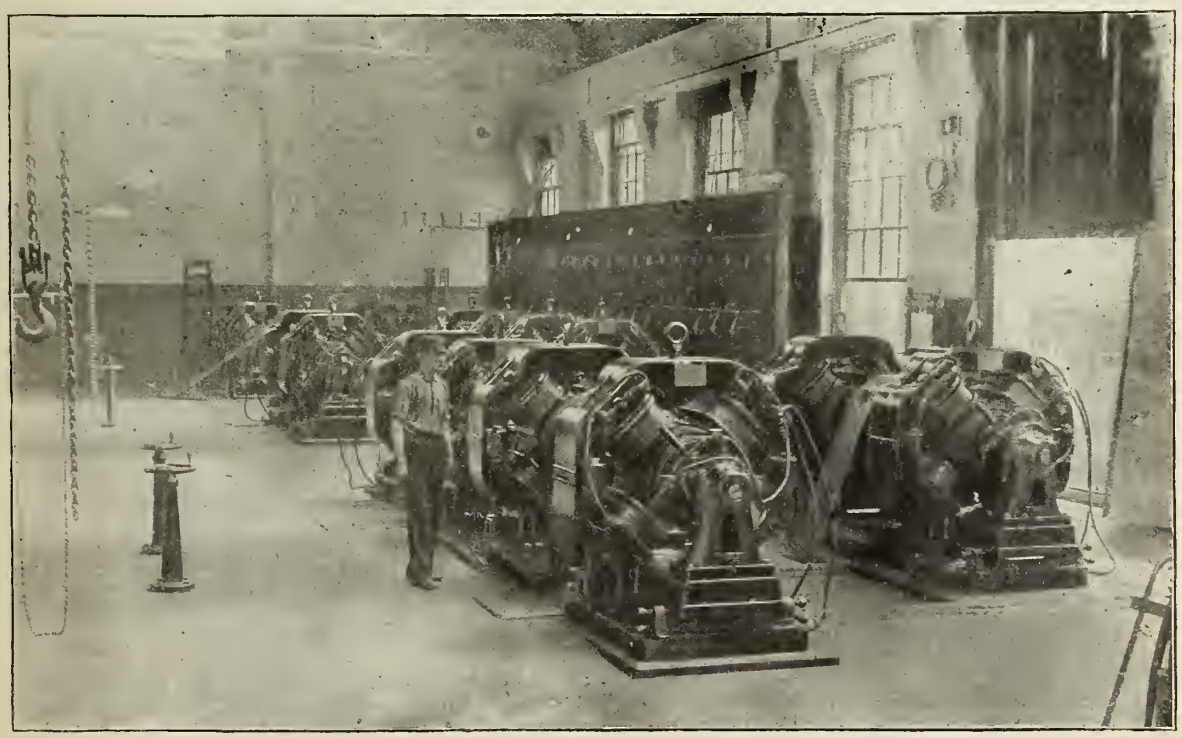


FIG. 3.—TEMPORARY GENERATORS—CAMBRIDGE POWER STATION, WEST END STREET RAILWAY.

The land on which the Cambridge plant is located is a part of the old New England Glass Works property, all of which has been purchased by the West End company, and will be utilized for storing track and other material. The building is a plain brick structure with a smoke stack 235 ft. in height with a seven foot flue. The roof is supported by a riveted lattice truss construction, and is of

a most substantial character, reflecting great credit upon the builders, the Boston Bridge Co. The engines, condensers, countershafting, pulleys and belt tighteners were all supplied by the E. P. Allis Co., Milwaukee, Wis., whose facilities for manufacturing large engines are probably not surpassed by any engine works in the United States, while the clutches were manufactured by the Hill Clutch Works, of Cleveland, and are among the largest and most powerful friction clutches ever built for electrical purposes.

The belting was all manufactured by Mr. Charles L. Ireson, of Boston. Each one is endless, made of the very best stock and is cemented only, neither pegs, rivets nor lacing being employed. The approximate breaking strain of each engine belt is 64,800 lbs., and each pair will transmit 2,000 H. P. at a speed of 6,000 ft. per minute. They are all made from the centres of extra oak tanned hides, and on the pulley sides are made of two twenty-seven inch widths, and on the outside of one middle twenty inch width with a seventeen inch width on each side, requiring the centres of five hides for one width, and 165 hides for each belt. Mr. Ireson also supplied the belting for the central power station, as noted in our last issue, the order for the belting of the two stations being the largest single order for leather belting ever given to one firm.



FIG. 1.—POWER STATION AND CAR HOUSE—ROCHESTER, PA., ELECTRIC STREET RAILWAY.

The Rochester, Pa., Electric Railway.

By Hartford P. Brown.

The People's Electric Street Railway Co., of Rochester, Pa., was chartered August 18, 1891. John C. Whitla, Theodore P. Simpson, James P. Stone and Harry W. Reeves, of Beaver Falls; Dan H. Stone, of Beaver; Chas. H. Bentel, of Freedom; Henry M. Camp and Hartford P. Brown, of Rochester, were the incorporators and compose the board of directors. All preliminaries having been arranged, work was begun May 18, 1892; and on August 11, 1892, eighty-eight days after construction was begun, the first car was put in operation. The formal opening took place amid the most favorable auspices, on Saturday, August 13, 1892, in the public park at Rochester.

The power station (Fig. 1) is of brick, one story in height and substantially built. The dimensions are 45 × 70 ft. The boiler room is 27 × 45 ft. and is separated from the engine room by a brick wall. It contains one Manning tubular boiler, sixteen feet high and six feet in diameter with seventy flues, each four inches in diameter. A feed water heater and a No. 4 Cameron pump complete the equipment of the boiler room.

The engine room is 43 × 45 ft., and contains a compound, condensing, automatic cut-off engine, manufactured by the Phœnix Iron Works, of Meadville, Pa., who were also the contractors for the entire steam equipment. The cylinder dimensions of the engine are thirteen and twenty inches by twelve inches stroke, and with 100 lbs. initial steam pressure, cutting off at four-tenths stroke and running 240 revolutions per minute; it develops 150 H. P. There are two flywheels each seventy-two inches in diameter and fourteen inches face. The generating apparatus consists of a Thomson-Houston multipolar generator with a rated capacity of 125 H. P. This is connected to the engine by an endless, light, double belt made by the Bradford Belting Co., of Cincinnati, O., and fifty feet in length by thirteen inches in width.

The power station is located centrally, between the Pennsylvania Railroad and the Ohio River, while water for all purposes is pumped from the river, and coal is delivered both by water and rail close to the door of the boiler room. Coal costs delivered at the doors of the furnace ninety-five cents per ton, net.

The car equipment consists of four motor cars built by the Laclede Car Co., of St. Louis. The trucks are the J. G. Brill Co.'s, No. 13 pattern, equipped with elliptical springs. The electric motors are of the Thomson-Houston make, and consist of two fifteen-horse power, waterproof motors to each car. Their type J controller is used on all of the cars, and electric headlights are placed in the dash at both ends of the cars. H. P. Bruce was electrician in charge of this branch of the equipment, and the work speaks well for his skill and ability.

The track consists of forty-five pound girder and T rail made by the Pennsylvania Steel Co., of Steelton, Pa. The former is mounted on chairs and is used in the town, where street paving is expected. The T rail is used in the suburbs, and here the track is planked. This is accomplished by laying outside of each rail a plank six inches wide and of sufficient thickness to come to the surface of the rail and was done to enable teams to drive on and off the track easily and to use it in rural districts for a driveway.

The overhead construction is both bracket and span, the former in the rural districts, and the latter in the towns. A supplementary wire bonded to every rail runs the entire length of the track and aids in the return of current to the generating station.

The line parallels the Pennsylvania Railroad for a distance of about four miles and connects with the Beaver Valley Traction Co.'s line, which in turn parallels the railroad a further distance of six miles. The track of the People's Street Railway crosses the steam railroad three times at grade—twice over four tracks (Fig. 2) and once over two tracks. Safety switches have been adopted as the best security at these danger points, and a brief description of their working may not be inappropriate.



FIG. 2.—CROSSING STEAM RAILWAY AT ROCHESTER PA, SHOWING ARRANGEMENT OF SAFETY SWITCH.

The safety switches, two of which are placed at each railroad crossing, consist of a switch which is set to derail the street car approaching the crossing, and run it from the track in a line parallel with the steam railroad. By this means a car not under control can never run into danger from collision with the steam cars. The safety switch is controlled by a lever placed at the opposite side of the steam railroad tracks and connected with the switch point by interlocking material.

In order to make the crossing the car is stopped at the point of derail, while the conductor crosses over to the

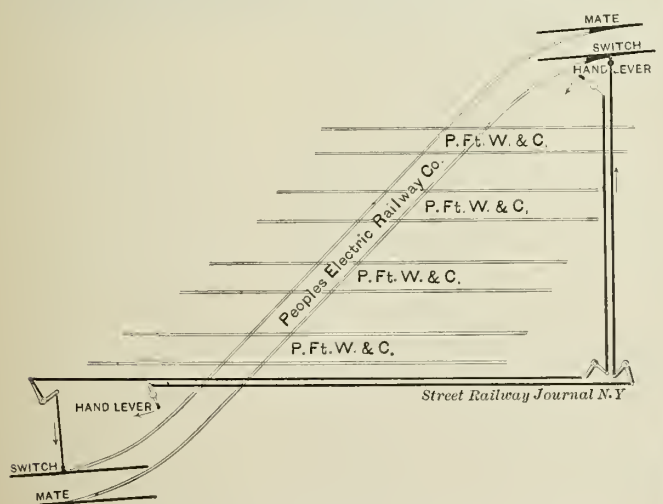


FIG. 3.—DIAGRAM OF SAFETY SWITCH MECHANISM—ROCHESTER, PA.

lever, and if the crossing is safe, raises it to a perpendicular, which throws the derail into continuous rail, and permits his car to pass the derail point. The motorman, with his eye on the switch point, sees the change as soon as effected, runs his car through the safety switch, rings his gong three times as a signal for the conductor to return to his car and cross over with it. Cars moving away from railroad crossings pass through the derail points as through any other automatic switches. The operation of the safety device requires about thirty seconds.

This road is also equipped with a block signal system which renders collisions out of the question, and reduces delays at sidings to a minimum. This consists of signal boxes, one of which is located at each siding and contains two groups of lamps, each group consisting of three lamps of sixteen candle power each. These lamps are wired in series of six, the three lamps in the upper half of one box being connected directly with the three lamps in the lower half of the next box about 4,000 ft. away, and are supplied by a current of about one ampere, taken from the trolley wire and carried by a No. 12 galvanized iron wire, in order to get the resistance necessary. Each box is equipped with two three, way switches for turning off the lights, or turning them on as the car enters the section. The cars going in one direction are blocked by lamps burning in the upper half of the boxes, and in the other direction by lamps burning in the lower half of the boxes.

The conductors and motormen are all neatly uniformed and are noted for their tidiness, and vie with each other in polite attentions to the traveling public.

The first half month of operation the road registered 28,000 passengers, and travel continues to increase rapidly. The completion of this road has connected the towns of Beaver Falls, New Brighton, Beaver, Bridgewater, Rochester, Freedom, St. Clair and Vicary, with an aggregate population of nearly 40,000 inhabitants, into one community.

The officers of the road are: H. P. Brown, president; J. P. Stone, secretary; C. H. Bentel, treasurer. C. A. Danals is superintendent, and Frank Mason electrician.

A Lang lay wire rope manufactured by Thomas & William Smith, ropemakers, Newcastle-on-Tyne, England, which has been in service for nine and a half months on the line of the Providence Cable Tramway Co., was retired from service on July 1, it having been in service two months longer than any rope previously employed on this line. Its total mileage was 39,238. The rope is still in fair condition, and will probably be again put in service during a season of light traffic in the winter, it having been removed for fear it might not stand the extra Fourth of July traffic.

A new electric railroad, to be known as the New York, Mapleton & Van Pelt Manor Railway, is to be operated between Brooklyn (N. Y.) and Coney Island.

THE STORY OF A PAVING BLOCK.



when of a proper texture, is generally considered the most desirable formation for paving blocks, for the reason that the stones make a more excellent and enduring pavement than sandstone or trap rock. All granite, however, does not possess good paving qualities, and a capital distinction should be made between a formation that is too soft, too brittle and unsound, and that which is tough, light colored and sound. It is the story of the latter that we are to tell, such a block as will sustain a crushing weight of about 18,200 lbs. to the cubic inch, and will have a life of fifteen or twenty years under heavy traffic in the streets of our large commercial cities.

When we reflect that the two cities, New York and Brooklyn, alone consume on an average from 15,000,000 to 20,000,000 of blocks per year to keep their streets in proper condition, we are impressed with the importance of this industry for the entire country, and our curiosity being excited, we are at once possessed with a desire to know the history of the little blocks that form such an important factor in road making. In order to gratify this desire we recently made a trip to Cape Ann on the coast of Massachusetts, one of the most interesting granite regions in this country, where we obtained the material for our story.



FIG. 1.—VIEW OF GRANITE QUARRY FROM THE BRINK.

Granite is a crystalline granular rock consisting, in its typical varieties, of feldspar, mica and quartz, and is so named from the Latin *granum*, a grain, in allusion to its granular texture. A large number of other minerals occur in granite, and upon the presence of these supplementary minerals, the numerous varieties of granite are founded. The most common accessory constituent of granite is hornblende, a mineral which appears to replace to some extent the mica, and thus produces a hornblendic or syenitic granite, so named from Syene in upper Eygpt where the extensive quarries of this type of rock were worked by the ancient Egyptians, and from which the obelisks were quarried. Many students, however, restrict the term syenite to a granite from which the quarz has disappeared while the mica has been superseded by hornblende. The hornblendic varieties are remarkably tough, rendering them the most suitable as a road material.

Granitite is a name applied to a variety of granite made up of orthoclase and quartz with more or less plagioclase and a small proportion of mica. This formation is also durable as a road material.

The granite of Cape Ann is designated in the government geological reports as a granitite, while some local petrographers claim that there are large areas of typical syenite, and that the name should be hornblende biotite granite. This question we will leave for the petrographers to settle, as well as that regarding the origin of granite, whether it is to be regarded as the original bed rock of the earth's crust, forming the floor of all subsequent deposits and the nucleus of mountain chains, or whether it is a metamorphic rather than a truly igneous rock and the child of almost any geological age. It is sufficient for our purpose that it is old enough to be tough.

Cape Ann though nominally a promontory is practically an island. It is about ten miles wide, and is formed by the projection to the northeast of a ridge of granitic rocks extending from near Dedham, Mass., until cut off by the sea, and extends about twelve miles from the general line of the shore. The internal area of Cape Ann is pretty deeply and evenly covered by glacial drift, but on the shore line, especially near the extremity of the promontory, the surface has been planed down by the erosive power of glacial ice and by the action of the sea in a post-glacial period, both when it was at its present level and when the shore was higher, so that large areas of granite are exposed and in favorable position for quarrying. The quarries that interested us most were in the vicinity of Rockport, Lanesville and Pigeon Cove, villages located at the extreme point of the cape, and which are reached by rail from Boston. Near the first the Rockport Granite Co., of which Mr. F. E. Foster, is superintendent and Mr. Chas. E. Rogers, treasurer and general manager, work extensive quarries and mine the rock, not only for paving but also for monument and building purposes. At the other places Mr. Charles Guidet owns a number of quarries which are worked under the supervision of Mr. L. A. Martin, and the entire output is employed for paving purposes, Mr. Guidet himself being a paving contractor in New York.

Figs. 1 and 2 show the general and economic equipment of typical quarries, from which it will be seen that a number of steam derricks are employed for lifting the blocks and placing them on tram cars or wagons for transportation. The derricks are operated by steam power, a portable hoisting engine being located at suitable positions for this purpose, from which the power is

transmitted by either manilla or wire ropes which are attached to the block to be moved by suitable clamps or hooks. The entire area of the quarry illustrated in Fig. 1 is about two acres, and in places the excavation has reached a depth of fifty feet. The rock in all the quarries is cut into irregular shapes by joint planes, which in most cases run in horizontal lines, but sometimes in a perpendicular direction (Fig. 3). The attitude of the joint planes to each other regulates the quarrying of the rock in large or small masses as the case may be.

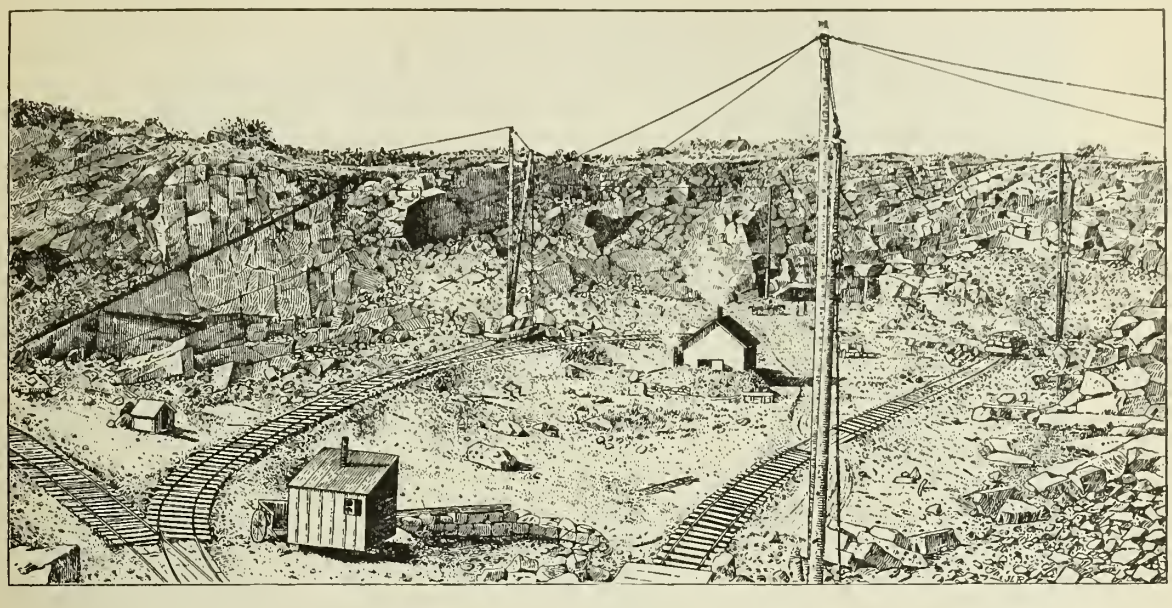


FIG. 2.—SOUTH PIT OF ROCKPORT GRANITE CO.'S QUARRY, SHOWING GENERAL STRUCTURE OF ROCK AND ECONOMIC EQUIPMENT OF THE PIT.

Besides being cut up into irregular masses by the joint planes, the quarried rocks of Cape Ann exhibit in an interesting manner the phenomenon of "rifting." By the term "rift" is indicated an incipient fracture in the rock which has not developed in the form of a joint plane, but along which the rock readily splits, although no relation seems to exist between these incipient fractures and the joint planes. It is owing to these features that the rocks of this region are so serviceable to the quarrymen. For convenience the quarrymen divide the rift lines into the "rift" and the "cut-off"; the most manifest of these is whatever direction they term rift, and the economical quarrying of the rock with reference to the rifts and joints measures the skill of the quarry foreman.

Having studied the character and some of the peculiar traits of the rock of this region, we are now ready to follow the details of quarry work, and for this purpose we will go down into the pit (Fig. 4) among the workmen. The first work consists in starting from their original bed as large masses as possible by blasting, and for this purpose steam drills are employed, with which a nest of three or four holes within a few inches of each other are drilled to the depth of from ten to eighteen feet, depending upon the depth of the seam. Each hole is then charged with twenty-five pounds of blasting powder, and exploded by an electric spark. Frequently it requires three or four charges to accomplish the work, as the holes are not usually tamped, a better break, it is claimed, being obtained by repeated charges rather than by tamping, when it would require only one charge. The charge is usually so placed that one end of the mass to be displaced is free, as the rock seems to be held in its bed under enormous pressure, and a satisfactory fracture cannot be had if the entire mass is bound. So great is this normal pressure that a block on being released seems to expand, as it cannot be replaced in its bed, being much too large for the hole from whence it came. The blast having done its work, the detached portions are now cut up by hand into blocks of a suitable size for handling. The foreman first lays off the dimensions and indicates the rifts with a chalk line when a number of men with hand drills proceed to cut a line of five-eighths of an inch holes (Fig. 4) to a depth of three inches and four to five inches apart. A row of holes being completed across the mass, a wedge is inserted in each one, or rather "plugs and feathers," as the quarrymen say, which consist of a tapering steel plug and two steel cheeks. These being in place, one of the men with a hammer of medium weight gives each wedge in succession a firm blow, and then a second, and usually by this time he has gone half way across the block; with the third blow the block has opened with a nearly straight fracture. Masses of almost any size are thus detached and in an incredibly short time. The dimensions to which the blocks are cut

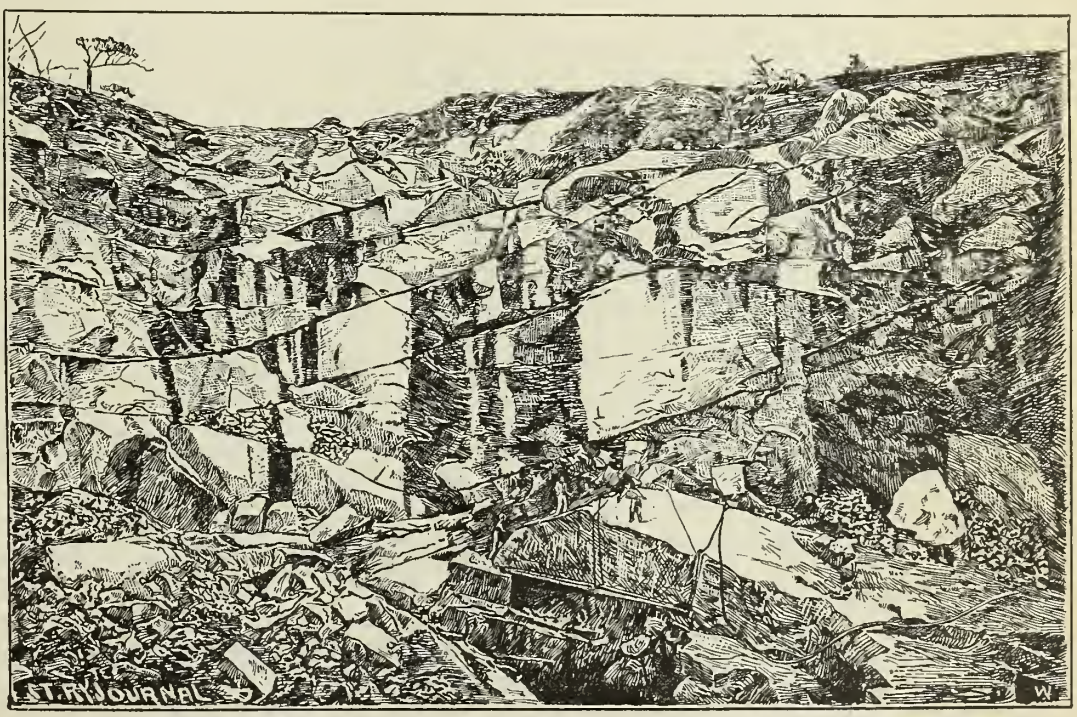


FIG. 3.—JOINT PLANES, SHOWING CHANGE IN CHARACTER IN DEEPEST PARTS.

in the quarry depend upon the size of the paving blocks which are to be made from them. Usually these are three feet wide and from three to six feet long and two and a half feet in depth. A day's work for one man in drilling wedge holes is usually from seventy-five to 150 holes in a day, but occasionally an expert will drill as many as 200.

This work being accomplished, the foreman places a mark upon each block to indicate the direction of the rift as a guide to future cutting, when the blocks are removed by the derricks (Fig. 5) and transported upon wagons to the cutting shed (Fig. 6), whither we will follow them presently. Frequently the quarrying continues to such depth that water veins are struck and it becomes necessary to provide powerful steam pumps and lines of hose and iron pipe for the purpose of lifting and discharging the water over the brink of the pit. Steam for the operation of the pump, drills and derricks is usually obtained from the boiler of the hoisting engine, but sometimes special boilers are provided. The area of a quarry is frequently limited on one side by what the quarry men term a "blue seam," but which is known as a dike; in most cases these are perpendicular veins from a few inches to a foot in width across the granite, and are generally composed of diabase or quartz porphyry. The dikes are in most part characterized by clean parallel walls, and are supposed to be fissures which were filled with melted material injected from the earth's interior before the faulting which formed the joint planes took place. Besides the dikes proper, some of the quarries of this region are cut by numerous veins only two or three inches wide, which are probably in their nature secretions from the granitic mass formed during the cooling process.

As stated above, the quarry which we are visiting, near Pigeon Cove, covers an area of about two acres,

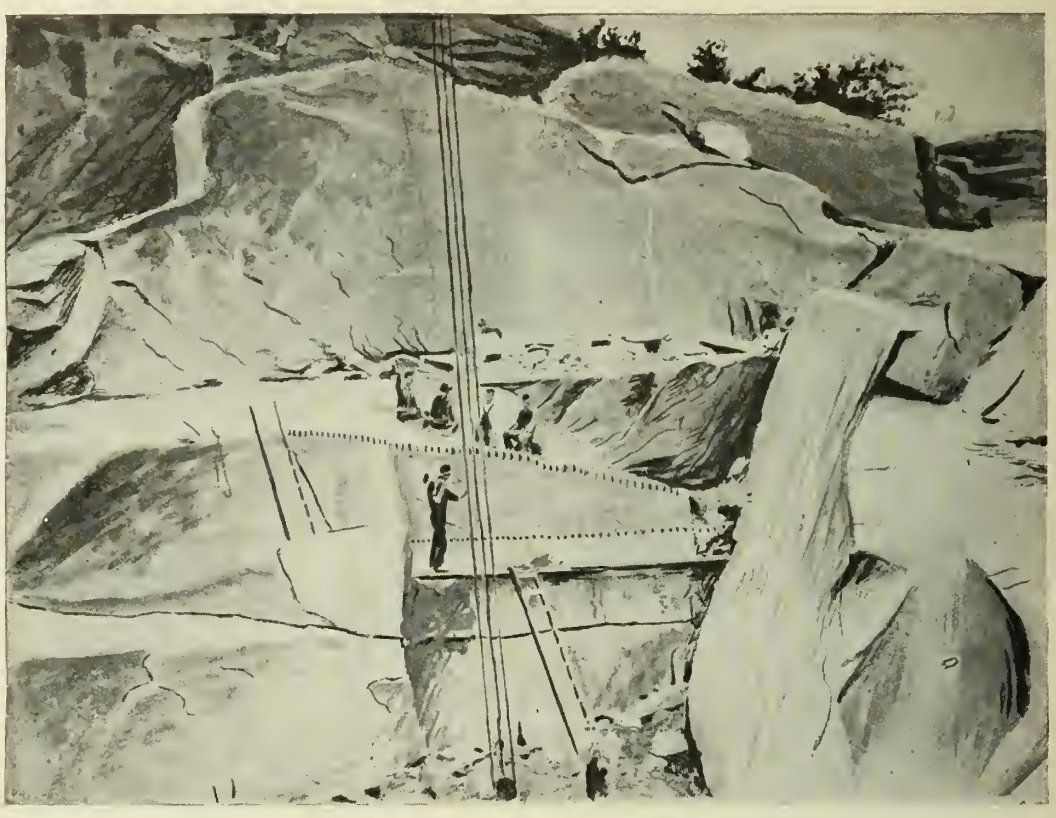


FIG. 4.—SPLITTING UP THE ROCK BY HAND AFTER THE BLAST HAS DONE ITS WORK.

but of irregular depth. At the time of our visit four layers of thick granite had been quarried, and a fifth, with an area of about one acre and estimated to be thirteen feet thick, had been uncovered, and was being cut out. The texture of the rock is said to improve with the depth, it being of a lighter color and firmer grain. The top and bottom surfaces of the different layers are discolored to the depth of two or three inches, which is termed the "sap portion." For cutting into paving blocks the sap is not removed, as it is just as durable as the other portions, but from stones designed for monuments or building purposes it is trimmed off. In this connection it is interesting to refer to the skill that must be exercised on the part of the foreman in placing a blast for breaking up the large masses, especially in the quarries where the rock is employed for monument and building purposes. The superintendent of the Rockport Granite Co.'s quarries called our attention to a mass that had been detached, which he said would be worth $15,000 when prepared for market, but which could have been spoiled by an injudicious placing of the blast. In the same quarry we saw another block just quarried that was estimated to weigh 7,500 tons, being about sixty feet long, forty-five feet wide and thirty-five feet high.



FIG. 5.—HOISTING THE BLOCKS FROM THE QUARRY.

But to return to the paving work. Our block, which has been removed to the cutting sheds (Fig. 6), is now drilled and split with wedges into slabs by the cutter, in the same manner as before described. The slabs, which are about eighteen inches across and three or four feet

wide, are then laid on the ground, when the workman traces a shallow channel across the middle with a chisel or a sharp edged hammer, and then with a heavy sledge breaks the slab along the line of the tracing; this process continues until the slab is broken up into paving blocks



FIG. 6.—CUTTING SHED—SPLITTING AND TRIMMING TO STANDARD DIMENSIONS.

of proper dimensions, the New York standard being three and a half to four and a half inches in width, from eight to twelve inches in length and seven to nine inches in depth. The blocks are then placed upon a stand, shown at the back of the shed, and trimmed with a square faced hammer, one deft blow being sufficient, usually, to remove a large chip. The blocks are then thrown through the window to the back of the shed and are ready for shipment. A cutter usually gets out from 75 to 150 blocks per day, and the price received for cutting is about $23.00 per thousand. The cutters become very expert at the work and can trim a block in a remarkably short time. Besides the regular quarry work in this locality, a number of cutters work independently of the contractors, and cut up the granite boulders and surface rocks which are found in all the regions and sell their products to the regular dealers. From the sheds the blocks are transported in wagons to the harbor and piled along the wharf or upon the sea wall to await shipment (Fig. 7).

As no natural harbor exists on this rock bound coast, it has been necessary to build breakwaters to provide a safe haven for the vessels. These harbors belong to private owners, and have been built at great expense. The sea wall consists of a riprap composed of refuse material from the quarries, and is necessarily very high, as the waves on the coast at times reach an enormous height. These harbors provide for vessels drawing about twelve feet of water at low tide, and these being laid alongside the wharf as shown, are loaded by means of chutes or by buckets operated by derricks. About 50,000 blocks constitute the ordinary load for a schooner, and they are shipped to all the principal cities on the Atlantic Coast, going as far south as New Orleans. For a return cargo these vessels usually bring coal which they discharge at Boston or at the coast towns of the vicinity.

Our block having completed its voyage and been discharged, on some New York wharf, for instance, is then after a little while transferred, with its fellows, in wagons, and stored along the curb of the street to be paved (Fig. 8), where it awaits the advent of the pavers. A suitable foundation having been prepared and covered with a layer of sand, the pavers place the blocks one by one in regular rows across the street, when they are thoroughly tamped and brought to a level and the joints are filled with a grouting material. Although our story is nearly completed, the real life work of the subject has only now begun, and although, at first sight, it seems to occupy a very ignoble position, being always under foot and subject to the ceaseless pounding of passing vehicles and animals, yet it contributes more largely to human comfort as a road material than the stones that enter into the construction of imposing buildings, or those which mark the resting places of the dead, or compose the monuments to heroes. Granite makes a comparatively smooth pavement, is easily kept clean, and although noisy and sometimes slippery in wet weather, it is, as before stated, very durable, provided the blocks are of proper texture and care has been exercised to prevent the placing of blocks from different quarries in the same section. In case these precautions are not observed, unsatisfactory results will follow, for the blocks will wear unevenly and produce a rough surface.

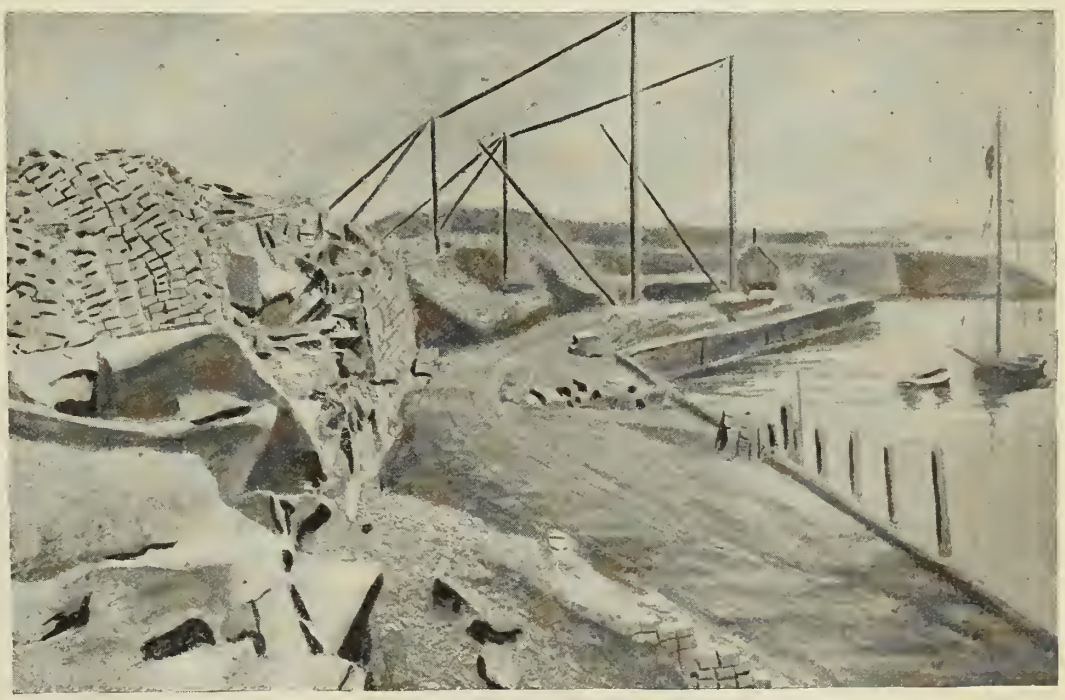


FIG. 7.—BREAKWATER AND HARBOR NEAR PIGEON COVE, WHENCE THE BLOCKS ARE SHIPPED.

It must not be inferred from the above, that granite for paving purposes is quarried only on Cape Ann, for this industry is extensively conducted in other localities throughout New England, but chiefly in Quincy, Mass.,

and on Rockland, Fox, Deer and Hurricane Islands off the coast of Maine. The quality of the blocks varies with the different localities, but it is claimed that there is no paving quarried superior to that found on Cape Ann.

Our story proper is concluded, but there is much of interest both physical and commercial that clusters about the region from whence our paving block was quarried and upon which we may dwell with profit. The first relates to dikes, of which there are more than 360 in the Cape Ann region, and of which we have before spoken. Their formation and the peculiar manner in which they cut the granite is strikingly illustrated in Fig. 9. The presence of these dykes has much to do with the contour of the rocky shore, for, being generally of a softer material than the granite, they yield to the erosive action of the sea which forms chasms or sea caves in the direction in which the lines of weakness extend. In sections where the dykes are not numerous, and the original inclination of the shore toward the sea is not abrupt, the effect of the marine action is not very apparent (Fig. 10), as the surges slip up over the slope and expend their energy in lifting the mass of water above the base.



FIG. 8.—FINAL STAGE—PLACING THE BLOCKS IN THEIR LITTLE BED.

The cost of Cape Ann is cut at frequent intervals with small fiord-like embayments, and these bays afford a place of deposit for the materials derived from marine action. Much of this beach accumulation is composed only of pebbles or boulders measuring from two inches to two feet in diameter, the mud produced by the wearing of the pebbles on the beach having been drawn away into the depths of the sea by the undertow. These pebbles are often thoroughly polished by marine action, and when of suitable size and shape—from six to ten inches—are frequently collected by the inhabitants who build them into garden walls, or place the more ornamental stones along their walks, or build them into ornamental towers which answer for gate posts. The material from which the pebbles are rolled consists in part of glacial detritus in the form of small boulders lying upon the sea floor, but which have been detached from their beds and transported within the area of wave action by the growth of seaweed upon their upper surfaces. This action of the sea weed is brought about partly by the impulse to float due to the relative lightness of the plants, and in a large measure through the pull which the deep currents are able to make on the extended fronds of the seaweed; thus in time the pebble is detached from its ancient fastenings and is brought into the mill of the surf when it is separated from the plant that brought it ashore, and is rolled about the beach until worn out or becomes impounded in some beach pocket.

Another portion of pebble material consists of blocks of granite which have been ruptured from the cliffs by the action of the waves and frost, but a good many of the small beach pockets, especially in the vicinity of Halibut Point, are almost entirely composed of rounded waste from the quarries, or from angular stones which have been discharged into the sea from excavations made in the headlands around the cape by parties exploring for suitable quarry stone.

Still another source of supply is found in the riprap of which the breakwaters are composed. The pebbles formed from quarry stones are termed artificial pebbles and are readily distinguished by the eye from those formed in the natural way of material broken from the cliffs, or from deep sea deposits, as the former usually retain a blue gray hue of the ordinary quarry stones, while the latter are generally discolored by decay. The rate of wear which the surges produce on the angular masses from the quarries is very considerable, and it only requires the exposure of a single year to the full beating of the waves to produce a considerable rounding of the mass, while in ten years a large block will wear away to the familiar form of a beach pebble.

Other interesting features of this region are the evidences—consisting of the scouring action of the waves and the indentations which they have produced on the bed rocks—that the sea has stood in ages past at successive levels above its present tide mark to the height of 150 ft., and also that it has retreated to a still lower level; and there are now evidences—consisting of submerged forests—that the coast line is gradually sinking. While these are interesting features we cannot dwell upon them, and must refer the reader to the Ninth Annual Report of the U. S. Geological Survey for further physical features.

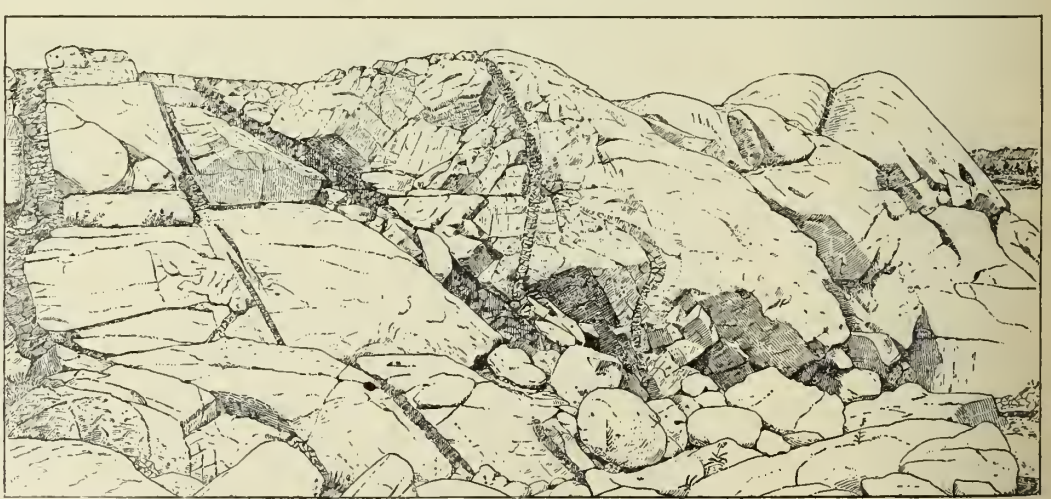


FIG. 9.—DIKES CUTTING GRANITE.

We now turn to a more practical feature and one

which is destined to work considerable change in the character of the extreme coast line and in the business of the locality. We refer to the extensive breakwater now being constructed by the government near Rockport, and which when completed will provide one of the largest harbors of refuge on the Atlantic Coast. The breakwater is located some distance from the shore and extends from Straitsmouth Island towards Andrews Point. The wall is being built of granite which is furnished by the Rockport Granite Co. and the Pigeon Hill Granite Co. The foundation will be of riprap, but from near the surface a solid sea wall will rise sufficiently high to protect the harbor from wave action, and into which coasting vessels can take refuge during storms. The material is transported from the quarries near by on tram cars. A deep cut having an arched bridge leads out from the quarry, so that it is not necessary to hoist the rock except to place it upon the cars which descend by gravity and deliver their loads directly upon dumping scows which are towed into position by tugs, and discharge their contents upon the line of work. This breakwater when completed will enclose 1,664 acres of good anchorage which, it is estimated, will accommodate 5500, vessels. The entrances will be located so that vessels can enter or leave with the wind from any point of the compass.

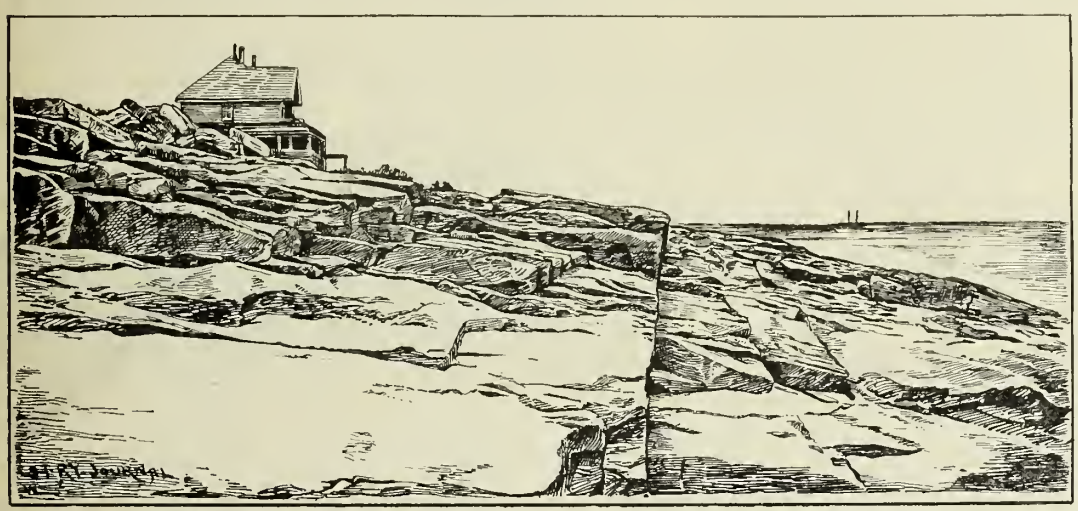


FIG. 10.—SEA SHORE NEAR PIGEON COVE, SHOWING THE EFFECT OF WAVE ACTION.

The importance of this work can be readily seen in the fact that from 78,000 to 100,000 vessels pass this point annually.

This illustrates another way in which granite is utilized and made to minister to human progress and human comfort, and, as in the case of coal, emphasizes the wise provision made by the Creator in ages past for the present comfort of man.



FIG. 11.—STEAM DRILL AND OTHER TOOLS EMPLOYED FOR CUTTING GRANITE.

Compressed air delivered from a flexible hose with a small nozzle at a pressure of fifty pounds to the square inch is very effective in cleaning plush cushions. It is so used on the Union Pacific Co.'s road.

New Electric Railway at New Haven.

The city of New Haven was for a long time one of the few cities in this country having a population of over 20,000 which had not installed an electric railway, but two are now in operation in that city, viz., the Morris Cove Electric Railway and the New Haven & West Haven Electric Railway. The latter, which is the larger, has now fifteen cars equipped with electric motors, and the entire line, with the exception of a small branch, is now being operated by electric power.

This railway extends a distance of about four and a half miles from the centre of the city through West Haven to Savin Rock, a popular shore resort. There is also a branch of three quarters of a mile in length to City Point also operated by electric motors.

The line is double track, and is laid throughout, except at curves, with a sixty pound T rail, furnished by the Johnson Co., of Johnstown, Pa. The curves are laid with sixty pound, grooved, girder rails. On those streets where block pavement is in use chairs are employed to support the rail; elsewhere it is spiked directly to the ties. The latter are 6×6 ins. × 7 ft. in size and are spaced three feet between centres. On part of the road within the city the track is also supported on a layer of concrete. For bonds galvanized iron is used, fastened through the lower flange of the rail by wedges and then riveted.

The power station is at about the centre of the line, and is located on West River very near New Haven Bay, so that fuel can be brought by boat to within a few hundred feet of the boilers, and plenty of water is available for condensing purposes. The boiler room is 28 ft. 9 ins. × 72 ft., and contains three Manning upright boilers manufactured by the Bigelow company of New Haven. The principal dimensions of these boilers are as follows: Diameter of shell, 56 ins.; diameter of firebox, 60 ins.; water leg outside, 72 ins.; number of tubes, 152; height of boiler, 18 ft.; the pressure in use, 150 lbs. This room also contains a Deane feed pump and condenser, a National feed water heater and Lowcock economizer. At present a forced draught is employed, produced by a G. C. Hawkins fan driven by a five horse power Westinghouse engine. The engines are at present running non condensing.

The generator room is 31 × 72 ft., and contains room for 1,000 H. P. of engines. The engines at present in position are three in number, and were furnished by Westinghouse, Church, Kerr & Co. They are compound, with cylinder dimensions 13 × 22 × 13, and each is directly connected to a Westinghouse multipolar, 180 H. P. generator. The switchboard is one of the open frame type, and is supplied with station appliances manufactured by the Westinghouse Electric & Manufacturing Co.

Part of the old rolling stock of the company now serves as trailers, and part has been fitted with electrical apparatus. The new cars are especially handsome, and are from the works of the Newburyport Car Manufacturing Co., of Newburyport, Mass. The motors were built by the Short Electric Railway Co., are of the single reduction pattern, horizontal split, and have shown excellent results in practice. The line has frequently to carry large crowds on holidays, and a car crowded and propelled by one motor has frequently drawn a crowded trail car.

The erection of the overhead line was done by the company themselves, and span wire construction is used throughout. The line is divided into three sections. The feed wires were supplied by the Simplex Electric Co., and the trolley wire by Wallace & Son, of New York. The

poles within the city limits are of iron, and outside of wood. The manufacturers of the iron poles were the Walworth Manufacturing Co.

On Labor Day the company, with fifteen motor cars and seven trail cars, carried 21,000 passengers.

The First Trolley Road in New York.

The first electric railway to be put in operation in New York City was on September 18, when ten cars belonging to the Union Railway Co. were put in service between 134th Street and Fordham. The event called out a large crowd of observers who made many favorable comments on the handsome cars and the change of motive power. Since that date a second division, that running out Boston Road to West Farms, has been put in operation, and on September 25 the cars crossed Harlem River, and started making regular trips from the southern terminus of the road at 128th Street and Third Avenue.

The line of this railway extends for a considerable distance under the structure of the Suburban Elevated Railway and the engineers wisely concluded to use this for the support of the trolley wires. The method adopted where the lower girders are within reach of the trolley pole, and the appearance of the system are shown in Fig. 1. An inverted wooden trough, which contains the trolley wire, is bolted to the cross braces of the structure, as shown, the trolley insulators being of a special type and secured by bolts to the trough. At points on the

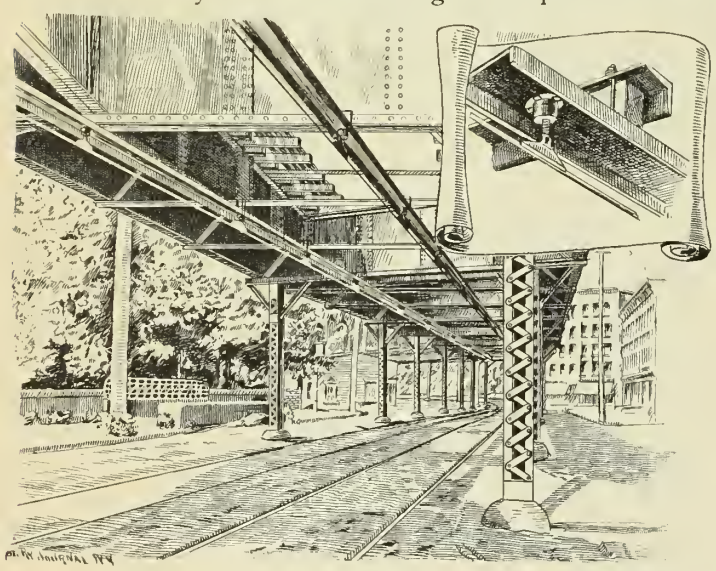


FIG. 1.—METHOD OF ATTACHING TROLLEY WIRE TO ELEVATED STRUCTURE—UNION RAILWAY CO.

line where the height of the elevated track above the street does not admit of this construction, ordinary span wires are employed, supported on the side posts of the elevated railway. Two great advantages of this method are that there are no added obstructions to the street, and that the danger of crosses and grounds from falling telephone, telegraph or other wires is entirely eliminated.

The cars of the Union Railway Co. are especially worthy of mention on account of their substantial and handsome appearance. The bodies are eighteen feet in length and were built by the St. Louis Car Co. There are six high windows on each side and the name of the company appears in gold on the main panel which is painted a Munich red with silver striping. The car number is in English vermilion shaded with yellow and orange, and is on the cove panel, while this panel and the rest of the exterior is a cream with chrome green decorations. The interior of the car is finished in cherry, with brass trimmings throughout and ceiling of birdseye maple, natural finish and vine decorations. There are bevel glass windows at each end, and the car is lighted with four interior electric lamps, and carries an electric headlight. A Meaker fare regis-

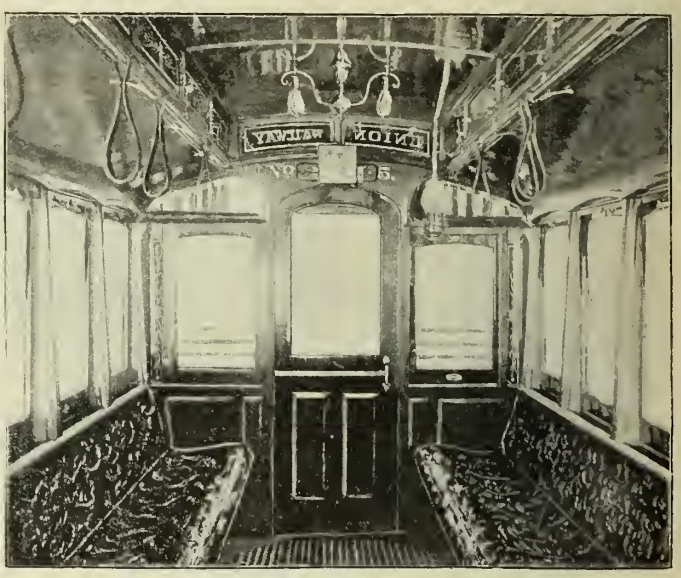


FIG. 3.—INTERIOR OF CAR—UNION RAILWAY CO.

ter, Lieb trolley stand and ratchet brake handle complete the equipment of the car body.

The trucks are of the Peckham radial gear type and carry two Thomson-Houston W. P. motors of twenty or thirty horse power each. Thomson-Houston lightning arresters and type D controller are also used.

The entire equipment was installed under the direction of L. H. McIntire, chief engineer of the company. Further details in regard to the road, and full particulars of the power station, were published in our last issue.

The Buda-Pesth Convention Postponed.

The Annual Convention of the International Street Railway Association, which was to have occurred at Buda-Pesth during September has been postponed on account of the cholera. The meeting will probably be held at Buda-Pesth, during the month of May, 1893.

THE prospect is that the Engineering Congress, which is to be held in Chicago in 1893, under the auspices of the World's Congress Auxiliary, will be a gathering of very great scientific importance. Of the $15,000 estimated to be necessary for its expenses, $10,000 have been raised. Many of the most prominent engineers of the world have

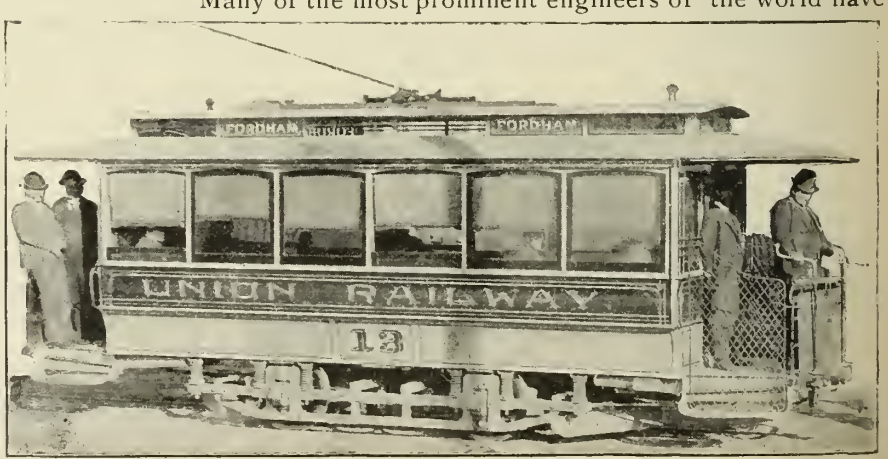


FIG. 2.—ELECTRIC CAR—UNION RAILWAY CO.

accepted memberships on the Advisory Council, among whom may be mentioned William H. Maw and James Dredge of the London *Engineering*; Don Fernandez Leal, president of the Mexican Society of Engineers & Architects; Sir C. S. Gowzski of Canada, and others.



DELEGATES AND OTHERS IN ATTENDANCE AT THE TENTH ANNUAL MEETING OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION.

Tenth Annual Convention of the Street Railway Association of the State of New York.

The Tenth Annual Meeting of the Street Railway Association of the State of New York was convened at the United States Hotel, Saratoga Springs, at twelve o'clock, September 20, 1892, Mr. John N. Beckley, of Rochester, president of the Association, in the chair.

The following delegates from railway companies were present: John W. McNamara, president Albany Railway, Albany, N. Y.; Daniel F. Lewis, president Brooklyn City Railroad Co.,Brooklyn, N. Y.; W. J. Richardson, secretary Atlantic Avenue Railroad Co., Brooklyn, N. Y.; James A. Powers, superintendent Glens Falls Electric Railway, Glens Falls, N. Y.; John N. Beckley, president, and Charles J. Bissell, counsel Rochester Railway Co., Rochester, N. Y.; Charles Cleminshaw president, and Charles H. Smith superintendent Troy & Lansingburgh Railroad Co., Troy, N. Y.

The technical press was represented by James H. McGraw and C. B. Fairchild, Street Railway Journal. M. J. Sullivan and E. S. Reynolds, *Street Railway Gazette*, Chicago; F. L. Kenfield, *Street Railway Review*, Chicago; N. D. Webster, *Electrical World*, New York; T. C. Martin, *Electrical Engineer*, New York, and T. R. Taltavall, *Street Railway News*, New York.

There were also present, H. C. Evans, Johnson Co., Johnstown, Pa.; J. A. Hanna, McGuire Manufacturing Co., Chicago, Ill.; W. F. D. Crane, H. W. Johns Manufacturing Co., New York; D. W. Pugh, John Stephenson Co., Limited, New York; Elmer P. Morris, W. J. Clark, A. Lewis and Prof. Feary, General Electric Co.; W. H. Delaney, Royaline Manufacturing Co., New York; W. S. Silver, Graduated Car Spring Co., F. D. Russell and E. Packer, Rochester Car Wheel Co., Rochester, N. Y.; C. S. Merrill, Engineering Equipment Co., New York; G. N. McKibben, Reed & McKibben, New York; J. E. Wallace, Smith & Wallace, Boston; A. R. Cook, Q. & C. Co., Chicago; J. F. Ostrom, Pennsylvania Steel Co., New York; Frank R. Ford, Short Electric Railway Co., Cleveland, O.; Willard S. Brown, American Casualty & Insurance Co., New York; John Patterson, Taylor Truck Co., Troy, N. Y.; Frank A. Magee, The E. S. Greeley & Co., New York; J. H. Jones, of the J. M. Jones' Sons Co., West Troy, and Louis Pfingst, Boston.

The first business was the address of the president, which was as follows:

ADDRESS OF THE PRESIDENT.

The Street Railway Association of the State of New York:

Gentlemen:—The past year has been without special incident, so far as the street railroad interests of the state are concerned. I shall take your time but a few moments in giving a brief summary of the record of the year, and in calling your attention to a few practical matters.

Many members of the Association feared that the street railroad interests would be subjected to uncalled for attacks on the part of the legislature at its late session, and much apprehension was felt that unjust and hostile legislation might be successful in impairing the value and usefulness of street railroad properties throughout the state. The Executive Committee of this Association took early action looking to the protection of our common interests. The report of the work done by the committee in this regard, will, I am sure meet your approval. The success which has attended the efforts put forth is evident to every member of the Association. No bill striking street railroad interests, and no bill which injuriously affected street railroad interests, became a law. The obligation of protecting the properties which we are called upon to manage against adverse and iniquitous legislation is lost sight of. Certain of our brethren seem to rely upon the success of efforts which they trust will be put forth by others who, perhaps, have no larger interests to protect than have they.

The most important function of a state street railroad association is to furnish information to the members of the legislature as to the needs of street railroad companies, and to combat before legislative committees, and in personal intercourse with senators and assemblymen the erroneous propositions which are often advanced without adequate knowledge of the condition of things. A great majority of the

members of our legislature are honest men, who, when informed as to the facts will act intelligently without injury to any legitimate industry or business. There always has been and there always will be others in every legislative body, who take advantage of every opportunity which ingenuity can suggest, to strike corporations by the medium of unjust and hostile legislation. Thus far, the street railroad companies of the state have not been injured by unwise or dishonest legislation. But immunity cannot always be secured, except as the result of diligent and intelligent effort on the part of the street railroad companies themselves. A fair and intelligent presentation of the facts as they exist, made at the proper time, I believe, will always protect the interests with which we are identified ; but such presentation ought to be made by the representative of this Association, and such representative ought to stand for every street railroad corporation in the state.

I trust the time will very soon come when every street railroad company in this commonwealth will not only have its name enrolled on the books of this Association, but will be as well an active, earnest and enthusiastic member. Our interests are common ; our efforts should be united.

During the past year much progress has been made in the education of the people of the larger cities of the state upon the subject of the "trolley system" of propelling street cars. Even in the city of New York, where a year ago it seemed electric cars could never be operated because of the intense and unreasonable prejudice of the people, franchises are now being obtained, and there is every reason to believe that the old fashioned, slow moving and nuisance-causing horse car system of that great and prosperous city will soon give place on all the lines to the modern systems of propulsion by electricity or cable.

Our Brooklyn friends have carried on their campaign of education with skill and unceasing effort, and the complete success of such effort seems now to be assured. So, throughout the state, until as error, ignorance and hostile interests are cleared away, the people of every community are coming to realize that they live in the last decade, and not in the middle of the nineteenth century. The improvements which have been made in electric and cable railroad appliances, machinery and construction, may be said to have kept pace with the demand for the same. The electric motor of to-day represents a great advance over the electric motor of last year, and the cable roads under construction in the city of New York represent the cable system at its best.

We shall have the pleasure and the honor to-day of listening to papers from two gentlemen, each of whom is in the front rank of his profession, and from them we shall learn what science, skill and experience have done in perfecting the two systems of street car propulsion, which are doing so much to make life the more worth living in the cities of our state.

Street railroad men are learning that in the management of our properties it pays to be liberal. I do not mean that it is wise to be extravagant, or reckless, or improvident in the management of such properties, but that a broad and progressive policy, which furnishes to the people increased facilities for travel, adds to the net income to be derived from the operation of street railroads. The public, as most of us have come to know, are quick to appreciate improvements made, and as quick to respond with their nickels to the effort of a company to intelligently and efficiently serve them.

It seems to me wise, and in accordance with the best business principles, to keep a little in advance of the reasonable demands of the people with reference to improvements, additions and extensions. I do not mean that a company should heed the request or demand of a 100 families to extend a line where it will require 1,000 families to support that line when extended. But constructing an extension somewhat, perhaps, in advance of the time when such an extension will pay operating expenses, is, in my opinion, as a rule, the wise thing for a railroad company to do. The same principle obtains as to the number of cars to be run on each line, and as to other improvements and betterments of the system. We depend upon the people for our patronage, and every street railroad man knows that a good feeling on the part of the people towards the company which serves them adds to the receipts of the line, makes it easier to obtain needed concessions from city governments as well as from individuals, and prevents the granting of franchises on parallel lines to competing companies where perhaps, only one line can be made a commercial success.

While upon this subject of liberality of treatment on the part of railroad companies I desire to call your attention to the advisability, from a business standpoint, of adopting, whenever local conditions will warrant, a transfer system. It seems to railroad companies who now obtain two fares from passengers who desire to go ftom one part of the city to another by means of the cars on two lines, that the income of the company must necessarily be decreased if passengers are carried for a single fare of five cents.

After a careful study of this whole question, we decided at Rochester to introduce a transfer system under which a passenger can ride from any point in that city reached by the lines, of the Rochester Railway Co., to any other point reached by said lines for a single fare. We commenced giving transfers on this plan on October 5, last. We provided reasonable restrictions and necessary conditions. The experiment has proved an undoubted success, not only from the standpoint of the passenger, but from the point of view of the company as well. There is no question that the receipts of the company have been materially increased by the adoption and use of the transfer system. Perhaps the location of lines and other local conditions prevailing in other cities of the state may prevent the successful introduction of a transfer system. But I thought it might be of interest to members of the Association to know of the pronounced financial success of the undertaking, so far as Rochester Railway Co. is concerned.

Until March 1, the conductors and motormen of the Rochester Railway Co. were paid the same wages as were formerly paid to conductors and drivers of horse cars. We very soon found after commencing operating electric cars that we required men of higher capacity to perform the duties of motorman and conductor than seemed to be necessary with the old system. It seemed to us that as the duties of the the positions which the men held under the new system were more onerous and exacting, and as it required more judgment and skill to properly handle electric cars, that the men should be paid a somewhat higher compensation than they had before received. Therefore, the company, before the men themselves made any request for an increase of wages, advanced such wages. The action of the company. of course, gave great satisfaction to the men, and the result has been very beneficial, so far as the company itself is concerned. It has been found that while the item "wages of employes" has been materially increased the cost of operating the road per mile has in fact been diminished. This is accounted for by the fact that the men are more attentive to duty than before, and more careful in the handling of cars, by the greater freedom from accidents, and by the material lessening in the cost of maintenance.

I am satisfied that the management of many street railroad corporations, where electricity is the motive power, have not as yet given sufficient attention to the thorough instruction of their motormen as well as conductors, as to the function of each part of the motor, and as to the proper thing to be done by the motorman and conductor when trouble develops while the car is in service on the line.

Some weeks since I had occasion, while riding on an electric car in a city of another state, to ask the motorman some questions about the motors he was running. I found he did not know whether the motors were Thomson-Houston, Westinghouse, Edison or Short. He d d not know whether they were double or single reduction. He did not even know whether he had under his car body one or two motors. I asked him what he did in case he had any trouble on the line? He said. " If the motor don't work I wait until another car comes along and pushes me in." I found that this motorman had been for nearly nine months in regular service as motorman in that city. This motorman knew enough to turn on and turn off the current, and to set and loosen the brake. This, of course, is an extreme case, but it illustrates a principle. My own judgment is, based upon some experience, that too much pains cannot be taken to thoroughly instruct the motorman as well as the conductor, so that each will know the cause of trouble when trouble develops in either of the motors in service.

The plan the company with which I am connected has adopted, is to select from among the motormen one of the men who is pronounced by the master mechanic, the electrician and the superintendent, the best posted as to the construction and use of a motor, and make such man, for the time being, instructor of motormen on cars in actual service. This instructor rides with motorman after motorman, observes the manner in which he handles his car under all conditions and gives detailed instructions as to exactly what to do whenever trouble of the usual sort develops. The instructor spends from half a day to three days with each man until he pronounces him in every way qualified to run a car on every portion of the line, and to do that which needs to be done when trouble develops.

I might call your attention to many other matters of practical interest if occasion seemed to call for further statement. It is, perhaps, presuming in me to say what I have said, addressing as I am many who have had more experience than I. My only object in calling your attention to the matters I have referred to, is to make some suggestions which may be of value to some who have had less experience than I have, brief and limited though that experience may be.

John N. Beckley, President.

The secretary then read the report of the executive committee as follows :

REPORT OF EXECUTIVE COMMITTEE.

To the Street Railway Association of the State of New York :

GENTLEMEN :—Your Executive Committee respectfully submits the following report :

MEMBERSHIP.

At the last annual meeting of the Association, the by-laws were amended so as to provide, by nominal fees, for the admission to membership of all operating street surface railway companies in the state. Pursuant to this action, two invitations were sent during the year to all street railway companies not members, to join the Association. The first was sent immediately after the annual meeting in connection with the circulation of the address of the president and the report of the special committee on electric motive power for street surface railways ; the second invitation was sent later in the year, accompanied with a printed copy of the annual report. As a result, five companies are members in the second class.

The Christopher & Tenth Street Railroad Co. having been leased by the Central Cross Town Railroad Co., the membership of the former has lapsed.

The trend of the times is towards consolidation. There was a time when we had over one-third more members than now. By lease and purchase by existing members, the number has gradually been reduced, until now, in the first class, there are but twenty companies.

It is believed by your committee that our annual social dinner is an essential element of the success and good fellowship which exists between the officers and members. We furthur believe that the Association should provide for this (as it has done at times, but not with regularity) and not depend therefor on individuals interested in its welfare.

The balance in the treasury has gradually reached the point when prudence and wise financiering suggest that ample provision be made for the future. Considering the efficiency of the Association as an

organization, and the work accomplished by it every year—especially before the legislature of the state—the judgment of the executive committee is that the annual dues of members in the first class should be fixed at $50 ; and we submit for your consideration an amendment to Article XV. of the by-laws, substituting the word "fifty" for the word "thirty-five." The adoption of this provision would place the Association on a sure financial basis for years to come, considering its present running expenses, and at the same time provide for the cost of its social entertainments at our annual gatherings. The counsel employed by the Association is present, and will report as to the work done and results accomplished at the last session of the legislature.

SPECIAL REPORTS.

The money comes into the treasury of a street railway company in such very small sums and goes out in such correspondingly large amounts that it behooves us to see that the operating expenses are reduced to the lowest minimum. Inventive genius is very active, especially with electrical devices, and whatever tends to increase the accommodation of passengers, improve the service, and, at the same time, reduce the cost, must necessarily be welcomed by us ; for they are the declared objects for which the Association was organized

Two special reports were, therefore, provided on subjects of vital concern to the street railway business. The titles are : "Recent Improvements in Cable Traction," and "Recent Improvements in Electric Traction ;" both subjects to be treated by men than whom none are better able to prepare papers thereon.

Cable power has been with us for some time, but on a small scale comparatively with the systems which it was believed would be in operation before this meeting. The undertaking both on the Broadway and Third Avenue lines has been so extensive that it has been impossible to get the roads in operation. Much, therefore, that would have tended to make the report on the first subject of unusual interest has been denied the committee, so that the request has quite recently been made that the presentation of this report be deferred until the next annual meeting.

Electricity has been booming in this state since we last met. Brooklyn, fortunately for its citizens, will soon be blessed with the overhead system on a scale nowhere equaled in the world, the very best construction both for track and overhead work having been adopted throughout the city. When fully developed to successful operation in that city the system will bring about the condition of things throughout the country by the substitution of electricity for horses, set forth in the advertisement of a famous patent medicine, of which it is declared the "children cry for it."

Already some of the leading dailies of New York City are beginning to change their hitherto insane abuse of the so called "deadly trolley" that has never yet killed even one human being ; and they will soon be tumbling over one another in their enthusiastic advocacy of a system regarding which they have finally decided to learn something, and no longer to depend upon their imagination for their facts.

Whatever recent improvements with manifest merit have been made in the electric system, will be hailed with delight by those interested in this form of motive power.

COMMUNITY OF INTEREST.

For the first time in several years, there has been no "strike" on any surface street railway in the State. In the light of the year's experience, the report of your committee at the last meeting is prophetic, for the time has indeed come, of which that committee said, "all matters of difference which may, and inevitably must, from time to time, arise between employer and employee, will be adjusted amicably by the parties interested." The time has at last come when their community of interest is not only recognized, but appreciated. by both the employer and the employed in the street railway business.

THE OUTLOOK.

As we look out upon the future, our business prospects were never better. At peace with all the world, our people, for the most part, are contented and happy, because they are prosperous, and with the enlightenment of the press as to the new motive power to cheer us, the outlook is good for the nation, the state and the business with which we are so intimately associated.

Respectfully submitted,
Daniel F. Lewis,
John N. Beckley,
Chas. Cleminshaw,
W. J. Richardson.
Executive Committee.

The treasurer's report was read, and showed during the year :

Receipts	$945.66
Expenses	918.17
Balance	$27.49

The president then introduced Mr. Charles J. Bissell, the counsel of the Association, who briefly stated the work that had been accomplished at the state legislature at Albany, during the recent session. Mr. Bissell said that he had been retained by the Association to appear before the committees and the Governor, and by argument and reason to restrain the enactment of legislation injurious to the interests of the street railway companies of the state, and other corporate bodies. Mr. Bissell stated that the result of his experience was, that he believed that the great majority of the members of the legislature were honest and straightforward, and needed only to have matters presented to them in a logical and open manner to properly appreciate the right side of any question and vote accordingly. He believed that there was but a very small minority, in either house, whose votes could be influenced by any other means.

Mr. J. W. McNamara, of Albany, followed by a statement to the same effect, which was seconded by Mr. Powers, of Glens Falls, as also Mr. W. J. Clark, of the General Electric Co., the latter statement referring to the legislature of Ohio.

Mr. D. F. Lewis, of Brooklyn, then called attention to the fact that much more effective work could be done in this direction if the smaller companies in the state could be brought into membership in the Association, the dues in such cases being merely nominal, and suggested that the supply men present could be instrumental in bringing the matter of joining the Association before the smaller companies in the state in the course of their business calls upon them.

Mr. J. F. Ostrom, of the Pennsylvania Steel Co., on behalf of the supply men present, said that he believed he could say that they would be willing to use their best endeavors in this direction. This was endorsed by Mr. W. J. Clark. The result was that during a brief recess of the Association a meeting of the supply men was held, of which Major Evans was chairman, and a committee appointed to report measures for the formation of a material men's association as an auxiliary to the state Association to secure this end. The committee consisted of Messrs. J. F. Ostrom, W. J. Clark and J. H. McGraw.

Later in the day another meeting was held, and a permanent organization effected, as noted below.

Following the remarks of Mr. Bissell, the next business was the report of the committee on "Recent Improvements in Electric Traction."

The report was read by Mr. McIntire, as follows :

REPORT OF COMMITTEE ON RECENT IMPROVEMENTS IN ELECTRIC TRACTION.

By L. H. McIntire.

The Street Railway Association of the State of New York :

Gentlemen :—We understand that anything which tends to an increase of reliability or economy of operation of an electric railway is an improvement ; and it is with the intention of bringing before you in a brief manner the results of my experience and observation during the past year upon these points that this article has been written.

As you, of course, know, electric systems as first constructed were built on altogether too light a plan, and the increasing tendency year by year has been, and is, for heavier and more solid construction in every department, but particularly in the way of track and station equipments. It has been well said that no new departure is ever perfect at the beginning, and no one realizes this more than he who has watched the development of electric traction during the last few years.

The storage battery has made but little progress during the past year, and is not likely to cut much of a figure in electric traction until it is able to make a better showing, financially, than it has in the past.

It may seem strange that the management of roads, even at present operated by horses, cannot see that a change of some kind must come soon, owing to the great cry for rapid transit ; and yet I know of roads at present being laid with flat centre bearing rails on stringers in streets being newly paved. I do not mention this as an "improvement," but simply to show that what may be regarded as an improvement by some would be called a makeshift or temporary piece of work by others.

The general tendency of the times to consolidate all common interests under one management is showing its effect in electric traction, more now than ever, and scarcely a week passes that we do not hear of some syndicate obtaining control of some horse road, and the information usually ends with the statement that "it is intended to equip all the lines with electricity." From many points of view this is an improvement and a marked one.

TRACK.

The improvement in track construction has been very great, and although many expensive errors have been made, we ought, on the whole, to feel satisfied with the progress.

The early forms of track construction were too light and soon went to pieces ; but during the past year heavier rails have been rolled and better joint plates made, so that it is possible to keep the roadbed in perfect line and surface. This improvement has been a great help to the electric equipment and has reduced the cost of maintenance. As the cost of laying tracks is about the same, whether light or heavy, it is economy to put in only the best.

Now, on the question of what constitutes the best form of track, there is considerable variance of opinion. My experience and observation have convinced me that the deep girder rail, about nine inches high, spiked directly to the ties, is the best form for paved streets, and in dirt or macadam streets, a six inch girder rail laid in the same manner. In the country, and where the local authorities are willing, I would lay a T rail spiked directly to the ties.

The weakest place in all forms of track construction is at the joint. Every manufacturer of rails, and many of the railroad companies, have tried to overcome this trouble. There are probably as many patents upon rail joints as upon car couplers, and most of them about as impracticable. Up to the present time there has been nothing brought out which surpasses a properly designed "fishplate."

While speaking of track construction it might be well to call attention to the bonding of rails for the return circuit. Many forms have been used, and some of them are still in operation. I believe that No. 0 copper bond wire, long enough to connect with the web of the rail on each end of the fish plate is the best plan, and then grounding the whole system at frequent intervals, and abandon the supplementary wire which it has been the custom to use with the common form of bonding.

ELECTRIC EQUIPMENT.

Probably the greatest advance in any particular line has been in the matter of armatures for motors and dynamos. I consider that the introduction of the "iron clad" type will do more towards reducing the bill for repairs in that direction than any other one thing that has been introduced during the year. The electric companies have all, I believe, now adopted this form as their standard, and all roads that have tried them will, I think, agree with me that for simplicity, ease of repair and ability to stand the hard usage they receive, they stand at the head.

In the matter of controlling the motors, most of the companies still use the time honored rheostat; although I believe one company is endeavoring to introduce a new type of controller which they will, doubtless, be happy to explain at a later date.

Many roads, acting under a misapprehension of the requirements, started off with motors too small for the work, and endless trouble has been the result. Some new classification should be adopted by the electrical companies for designating the power of their motors, as the present office classification does not afford a proper understanding of its capacity, and the horse power term is but little better, depending on so many limiting conditions. A more satisfactory way would be to to specify the number of pounds the motor can pull at different speeds, and the maximum current for which it is designed.

TRUCKS.

The first car trucks employed in electrical work were of the pedestal form; that is, the trucks were fastened to the car body and oscillated with the car. The motors, of course, had to be suspended from the car body, and the result was that the grinding of the gears was transmitted through the whole car; also, the oscillation of the car body caused the motors to correspondingly rise and fall. This was very undesirable, and it was soon found necessary to adopt the post form, in which the truck was complete in itself and the motors supported directly on the frame of the truck. The body was connected with the truck only by springs, thus being entirely free from the jolts and pounding of the truck.

In this form slight spiral springs were first used, the same as in the previous styles, but it was soon found that the high speed attained caused the body to oscillate to such a degree that it became very objectionable, and the different builders then modified their trucks by extending the side bars beyond the axle boxes, a sufficient distance to allow an auxiliary spring to be added at each end. For this auxiliary support, coil and elliptical springs have been used, both forms with marked success, and it is now possible to carry a car body, twenty-eight feet over all, practically without oscilation. This last modification has been a very great improvement, and has settled the long car question on most street railways. I mean by this that but very few double truck cars will be used, though, of course, there are places where two trucks can be used to advantage, and in such places they will still be employed. But where we are able to carry nearly as many people on four wheels as on eight, and to apply the power equally on each axle, so that there is no possibility of lack of traction, there can be no gain to the railroad company in using eight wheels.

CARS.

The car bodies first employed were of the same style and proportions as those used for horse roads, and were not properly designed for electrical purposes; first, the framing of the roof was too weak and would not support the trolley board properly; second, the framing of the floor was not adapted for the use to which the cars were put; for not only was the framing too weak, but it also was not well planned for putting in the trap doors which are required in order to inspect the machinery underneath the floor.

The car which it seems to me is best adapted for the present service is one eighteen feet six inches long inside, with platforms three feet six inches long. The rafters should be strengthened with steel plates, and the framing throughout should be heavier.

The coloring of the cars and the necessary signs are attracting considerable attention from the different railway companies, but up to the present time I do not think any concerted action has been taken. For my part, I believe that all of the cars on a system should be painted the same color, that is to say, each separate line should not have a distinct color, but signs should be used to designate the different routes, perferably by means of the well known reversible sign on the top of the car, both at the sides and front. At night the lines might be distinguished by the color of the ventilator glass, which would in each case be the same as the ground color of the reversible sign.

OVERHEAD CONSTRUCTION.

There has been a general improvement in all parts of the overhead material. We are using stiffer poles, stronger span wires, better trolley wire insulators and handsomer curve fittings, so that the general appearance of the system is much pleasanter. The quality of insulation now in use is far superior to what we had two years ago, and as double insulation is now employed on the span wires, very little trouble from leakage is experienced.

The method of feeding the line is a very important matter, and should receive careful attention. The best arrangement is to divide the system into several sections, so that in case of trouble along any portion of the line, such as fire, etc., that section can be cut out and the balance of the system run as usual.

THE POWER STATION.

This may be rightly called the heart of any electric system. The trolley and feeder wires form the arteries, the rails and return wires the veins, and the cars the capillaries connecting them The Biblical injunction to "Guard thy heart with all diligence, for out of it are the issues of life," would certainly seem applicable to the station. The chief element to be considered should be reliability, and, after that, economy. Just what means shall be used to attain this end seems so far to have been a disputed matter, as shown by the stations now in operation, which contain almost every conceivable device, good, bad and indifferent; all shapes, sizes and descriptions of engines, boilers and dynamos. Many designers of stations—if some of them can be said to have been designed at all—seem to have gone at their task utterly regardless of the future and oblivious to the experiences of the past. However, through it all I can say that a very marked improvement is observable lately. The designers of stations are learning wisdom from their past experiences, and the makers of apparatus are more alive to the requirements of the system, and better material and workmanship can be had where required.

The recent introduction of large multipolar dynamos has brought about a change in station arrangements not heretofore obtainable, and in all large stations now being built countershafting is dispensed with entirely, and the general tendency is towards reduction of parts, which in turn means simplicity. It is very probable that we have reached now a form of station that will be fairly permanent, and the main point in the future will be the size of the units. For medium size stations engines with releasing valve gear belted direct to the multipolar dynamo will be the best where the price of land is not excessive, and direct coupled engines and dynamos for larger stations. To my knowledge there have been no comparative tests made as to the economy of the various types of stations, although all reasoning would point to these latest types as being by far the most economical.

There has been heretofore too much taken for granted or assumed in electrical work, and the rapid growth of the business has called into it many who were totally unqualified for the positions which they obtained. I attribute much of the unsatisfactory work in the past to this course, but am happy to note that the great majority of these are passing into the background, and their places are being filled with men of good judgment and mechanical resources.

At the conclusion of the reading of the report, Mr. D. F. Lewis offered the following resolution:

Whereas: The Street Railway Association of the State of New York, assembled at Saratoga Springs for its Tenth Annual Meeting, has learned that the Union Railway Co., of New York, has put in operation this week the first electric trolley cars within the city of New York,

Resolved: That the Association congratulates the company and the public of the greatest city in the Union upon this adoption of the latest and most improved method of street railway traction;

Resolved: That this Association earnestly deprecates the opposition manifested against the trolley system in various quarters, as being founded upon neither reason nor fact, and as being contrary to the best interests of any community seeking rapid transit facilities and suburban homes for a growing population; and

Resolved: That the Association hereby tenders to Mr. L. H. McIntire, engineer of the Union Railway Co., its thanks for his able address on the work already accomplished in New York, and its wishes for the development in the metropolis of the system thus inaugurated.

The resolution was adopted.

The president then announced the report on electric traction to be open for discussion.

Mr. McNamara: Mr. McIntire failed to tell us if anybody has tried the deep girder rail, which he refers to, and found it any better than the system which he recommended to us a year ago. We are using the ordinary girder rail; and I still hope that we are right and he is wrong. As to the large generators, it is very comforting to know that you have got a machine that is capable of delivering a large amount of power, but if it breaks down

what then? Your large unit is taken out of service, and unless you have a correspondingly large unit to take its place, you are left without power. It is a question for us whether it is desirable to increase the size of the units, and if so, what should be the limit. Of course, I take it that the limit is only reached when you are enabled to duplicate the unit; because no one would attempt to operate a railroad, electric or otherwise, unless he was able to operate it continuously; so that if one of your large units fails you must have another to take its place.

Mr. Beckley: In other words, the expression is relative. What would be a large unit for the Rochester Railway Co., would be a small unit for the Brooklyn City Railroad Co.

Mr. McNamara: Yes, that is it; we have found in Albany that we have worked very successfully with small generators. Our success has been so great that it was not until a week ago that we lost our first armature, running nine or ten machines. We discovered a defect in the armature which compelled us to take it out. Lightning has been in the station many times, but we have escaped its destructive influences, and it has been safely carried to the ground.

As to the painting of cars, we have them all one color; and the question is how to designate by colors the lines upon which they are to be operated, because every person who runs is not able to read. We have so far designated our lines by dash signs, painted the same color as the cars were when operated by horses.

Mr. Beckley: What do you do at night?

Mr. McNamara: That is the point where the difficulty lies. The headlights usually preclude the possibility of giving sufficient notice in advance of what line the car runs on, so that when you exhaust the primary colors of red, blue, white, green and yellow, you have come to the end of it. Most people cannot distinguish between shades of color. I think this is a problem to be solved; but how to solve it, we are in doubt.

Mr. McIntire: The form of girder rail I refer to is laid on fifteen miles of road, in the northern part of New York. It weighs seventy pounds per yard and is laid on yellow pine stringers 5 × 5. The rails are spiked directly to the stringers, which rest upon cross ties. I use a joint plate twenty-six inches long, bolted with six bolts; and the joint plates fit the taper under the head and at the bottom of the rail, so that as we pull the plate it wedges and tightens. At the joints, which is the weakest place, I put a tie directly under the rail joint, and one under where the timber joints; the balance of the ties are spaced thirty-six inches on centres. I also use an additional tie three feet long, under each end of the fishplate, so that the rail joint is supported by three ties. Every tie is tamped perfectly. That gives us a direct support joint. If it should come down, we have the suspended joint by means of the support from the ties at the end of the fishplate.

Mr. Lewis: Do you advocate an absolutely rigid joint?

Mr. McIntire: Yes, in paving. There is nothing else that you can put there that will stand; you can make it of iron or T rail, or use any of the devices that have been brought out, and it will go down if the joint is open and the wheels are allowed to pound. The rail men will immediately inquire, what will you do if expansion takes place? Now, if you lay a centre bearing or tram rail in this manner, you get into trouble, because it is exposed to the sun, and expansion will take place; but with a deep girder rail down in the earth, the heat is radiated, and you do not have that trouble.

Mr. Lewis: Do you put your rails close together?

Mr. McIntire: Yes, solid together.

Mr. Beckley: Did you pass through last summer with this road?

Mr. McIntire: Yes, sir.

Mr. Cleminshaw: Is that the road you built in New York?

Mr. McIntire: Yes, sir.

Mr. Cleminshaw: Then you have not given it a test with an electric system, except during the last week?

Mr. McIntire: That is all.

Mr. Cleminshaw: That settles the question.

Mr. McIntire: The trucking on Third Avenue is equal to any wear on the tracks which will be given it by electric motors.

Mr. Cleminshaw: There is nothing known in traction that compares with the pound on the track which is given by an electric motor. What might be all right in the case of a horse road, with very heavy trucking, experience has told us is as nothing compared with the pounding of the motor on the rail.

Mr. McNamara: I have seen some of this seventy pound rail that was laid last year, on a road operated by horses, and it has got a pound at every joint that you can hear.

Mr. McIntire: It was not constructed properly. If you will lay your track and put your rails solid together, and bring the joint plates home with the bolts and properly tamp as it is drawn up, and see that it is supported properly, you will have a good track. As to dynamos, I have not seen any that begin to compare with the new type of iron clad armature, multipolar dynamo, and I cannot see why we should have any trouble with them. Of course, if something happens to the engine you must have a relay.

Mr. Powers: To my mind the first question that presented itself in this matter of electric roads and tracks, was the problem of the joints. The steam roads have solved this question to their satisfaction, perhaps not altogether, but practically so, so that you cannot count the joints as you ride over the best tracks. They have solved it on a totally different principle from that generally shown in the types of joint which I have been accustomed to see on street railway tracks. The general idea of the steam railroad man is to make his rail continuous, and then the question of supporting the joint becomes one of secondary consideration. If we could roll the rail continuous and have no joints, the track would be perfect; but the ordinary joint for street railroad tracks and electric railway tracks has been merely something for keeping the ends of the rails from spreading apart vertically. I had a liberal education on this question in about five minutes at Poughkeepsie. I looked at the joint which the New York Central road put on its tracks. They had an angle bar as heavy as could be taken in between the head and sole of the rail; it was about forty inches long, four bolts near the joint holding it firmly from having any up and down motion, with two bolts at the extreme ends. The bolts seemed to be larger than those generally used. I believe that is their standard system now, and there is no difficulty about holding your rail if you will put simply the ordinary amount of support under the track. We adopted this form on our road at Glens Falls, using a very light rail—forty pounds; and if anyone can count the joints on our road, I should be glad to have him do it.

Mr. Lewis: Do you notice any declension in the joints?

Mr. Powers: They are absolutely smooth, and the matter is well worth your consideration. It seemed to me that after all the experience the steam railroad people have gone through, and the enormous weight they get on a single pair of driving wheels, the fact that they have solved the problem to their satisfaction should be of value to us; while most of the so-called joints in the street railway business have been formerly tried on steam roads and are not satisfactory. It is no uncommon thing to find a new piece of electric track going to pieces in a short time. One reason is, the sparseness with which the ties are apt to be put in. We put them in less than two feet apart centres; less than sixteen inches at the joints. We stagger the rail joints.

The headlight question is very important. We run very fast, averaging ten miles an hour including stops, sometimes reaching eighteen miles an hour. I find in looking about among the electric railroads that the headlight is one of the easiest things to be neglected, mirrors soiled, burners old and the light dim, and you might almost as well not have any. They should cast a good re-

flection, so that any obstruction on the track, such as a drunken man or a carriage, may be seen and the car stopped before reaching the place.

Mr. Lewis: Where do you locate your headlights?

Mr. Powers: On the dash. We have adopted a thirty-two candle lamp. It adds to the appearance of the car to have this brilliant light, and it costs but a trifle more.

Mr. Cleminshaw: Anyone who runs an electric road six months knows that there is nothing so important as this matter of joints. The Troy road has spent a good deal of money in that direction. Mr. Powers' statement may mislead somebody as to the joints on his road, and one sentence will explain the whole matter—he runs a single track road. That is all there is in it. We have a road where we run both ways, and it is one of the smoothest roads anywhere. The pounding is in both directions.

Mr. Powers: The steam roads do not run both ways.

Mr. Cleminshaw: No, that is true; but they can screw up the nuts at the joints. We cannot do that in a street railroad, as they are underground. There is not an electric road in existence to-day that has run one year that has got a perfect joint. We built a road about fifteen months ago, sixty-three pound rail, new pavement, new ties thirty inches apart, and everything first class. It ran six months very well, but to-day it is going, going. There is no remedy. We have come the nearest to it with a suspended joint. The theory is taken from the steam railroad practice. We have so far had no trouble with these joints, but it may come.

Mr. McNamara: We have had some experience with headlights, and we have concluded that the place for the headlight is on the hood, for several reasons. The first is from an economic point of view. If you have it on the dash it is going to be broken. You are going to have cars on the line that will have a slight brush with some vehicle, and while your car may be uninjured, you will be minus your headlight.

Mr. Powers.: Cannot you make the frame stronger?

Mr. McNamara: We are liable to have these accidents all the time; and the headlight is the first thing to go if you have it on the dash. We do not break any headlights on the hood, and our motor drivers all say they get better results; and we know that people who are to be warned are better warned with a light on the hood than with one on the dash. We have had an experience in accident cases, and have been able to demonstrate that our headlights are visible at a distance of 1,000 ft., plainly showing the car and surrounding objects. I doubt if a light on the dash would be as effective. Of course, unless the color light, showing the line on which the car runs, is very strong, if placed at the front of the car it is apt to be counteracted by the headlight. We have tried using a headlight with a rim of colored glass around it; in this case, red. We had a rim about an inch wide. It was distinguishable at forty feet away, but at 100 ft. away it was not distinguishable.

Mr. Powers: There is one condition which has occurred to me, and which strikes me as important in regard to the headlight on the hood; you avoid the possibility of the headlight being obscured by a wagon or other vehicle.

Mr. Beckley: I want to say a word or two on the question of the color of cars. We have in Rochester eleven different lines of cars in operation, and it would be quite a serious matter for us to maintain the necessary equipment to have the cars of different colors, and each color devoted to a particular line. So far as the daytime is concerned, we have the problem solved to our satisfaction. We have the plan, adopted by the elevated railroad in New York, of employing two disks. These disks are put on the hood of the car, set in a socket, so that we can take one color of disks off and put in another. After we have exhausted the five chief colors, red, green, blue, yellow and white, we simply combine the colors. Of course, we have signs on the cars for the benefit of those people who can read, but the people who travel on the cars very soon learn to depend on the coloring rather than the lettering. Our signs and disks, by reason of the socket arrangement, can be very easily exchanged, one line for another. We do not have the reversible sign. We get along all right in the daytime, but we must go a little further and get a light that can be seen 1,000 ft. away. We propose to use large bull's eyes at night, making similar combinations of color as on the disks in the daytime.

Mr. Cleminshaw: We are having cars made now with bull's eyes, four times as large as usual.

The discussion was then closed.

Mr. George W. McNulty, engineer of the Broadway Railroad, New York, was to have prepareda report on "Recent Improvements in Cable Traction," but owing to the fact that it had not been possible to get the road in operation before the time of the meeting, as was expected, he requested that the report be deferred until the next meeting. The request was granted.

Messrs. Cleminshaw, Lewis and McNamara were appointed a committee on nominations, and they proposed the following names, and the gentlemen were thereupon elected:

President, C. Densmore Wyman, New York; vice-president, Daniel B. Hasbrouck, New York; second vice-president, James A. Powers, Glens Falls; secretary and treasurer, W. J. Richardson, Brooklyn.

Executive Committee: D. F. Lewis, Brooklyn; John N. Beckley, Rochester; John W. McNamara, Albany.

Mr. Lewis offered an amendment to the by-laws, increasing the annual dues of members in the first class to $50, as recommended by the executive committee, which was adopted.

The meeting then adjourned to meet in Rochester, the third Tuesday in September, 1893.

In the afternoon nearly all in attendance at the meeting accepted an invitation from the Union Railway Co., of Saratoga, to participate in a ride on the electric road to Saratoga Lake. The ride, which was in the side vestibule, double deck Pullman cars, was a very enjoyable one, and a vote of thanks was tendered to the officers of the road for their courtesy.

After the trip over the line of the Union Railway Co., the material men met in Parlor 8, United States Hotel, at 5.00 P. M., and received committee's report, which was as follows:

The name of this organization shall be Association of Dealers in Street Railway Materials, of the State of New York.

The object of the Association shall be to make possible concerted action on any matters that may affect the business of its members, and to aid the New York State Street Railway Association in its efforts to prevent any legislation which it may cansider hostile to the interests of the street railways of the state of New York, as well as to aid it in promoting beneficial legislation.

The officers of the Association shall be a president, two or more vice-presidents and a secretary and treasurer, to be elected annually.

The work of the Association shall be performed by the officers and committees as follows:

A. An executive committee of nine members, to be elected annually.

B. A legislative committee of five members, to be appointed by the president annually.

The dues of the Association shall be:

Initiation dues	$ 5.00
Annual ,,	5.00

This Association shall hold an annual meeting on the date and at the place of the annual meeting of the New York State Street Railway Association, and other meetings at such time and place as may be called for by the president.

MEMBERSHIP.

Any individual, firm or corporation, dealing in street railway materials; any engineer, individual, firm or corporation engaged in street railway construction work, or any trade paper published in the interest of the street railway profession, may become a member by registering with the secretary and treasurer and paying the initiation fee and annual dues. Each member to carry one vote.

Your committee would suggest the following as officers and committee to serve for the ensuing year: President, Wm. J. Clark, New York; vice-presidents, D. W. Pugh, New York, Jno. W. Fowler, Brooklyn; J. H. Jones, Troy, W. E. Gilbert, Troy; secretary and treasurer, C. E. Stump, New York. Executive committee, W. J. Clark, New York; H. C. Evans, New York; Jno. A. Wood, New York; Wm. S. Silver, New York; C. E. Stump, New York; T. C. Martin, New York; S. W. Baldwin, New York; F. D. Russell, Rochester; D. C. Breckenridge, New York.

It would also suggest that the president be authorized to appoint a committee to perfect a constitution and by-laws as embodied in the above.

Respectfully submitted,

(Signed) John F. Ostrom, Chairman.

After some discussion, the report of the committee was adopted and the officers declared elected. It was decided that only residents of New York State be eligible as officers or committee men and that the Constitution contain such a provision.

Also resolved that the president be appointed a committee of one to advise with the New York State Street Railway Association and advise it of the action of the meeting.

NOTIFICATION OF THE PRESIDENT.

The president-elect not being present, the notification of his election was duly sent him by the secretary of the Association, of which the subjoined is a copy, together with a copy of Mr. Wyman's reply :

OFFICE OF

THE STREET RAILWAY ASSOCIATION,

OF THE STATE OF NEW YORK,

Cor. Atlantic and Third Avenues,

Brooklyn, N. Y., September 22, 1892.

C. Densmore Wyman, Esq.,

Vice-President Central Park, N. & E. R. R. R. Co.

My Dear Sir:—It gives me pleasure to inform you that at the Tenth Annual Meeting of this Association, held at Saratoga Springs, Tuesday, the 20th inst., you were unanimously elected president of this Association for the ensuing year.

In this connection allow me to state that we missed you at the meeting which was altogether enjoyable and profitable.

Sincerely yours,

W. J. Richardson, Secretary.

CENTRAL PARK, NORTH & EAST RIVER RAILROAD CO.,

TENTH AVENUE, 53D AND 54TH STREETS,

President's Office,

New York, September 24, 1892.

William J. Richardson, Esq.,

Secretary N. Y. State R. R. Association :

My Dear Sir :—I beg to acknowledge the receipt of your favor of the 22d inst., conveying official notification of the action of the New York State Street Railway Association at its annual meeting on the 20th inst., in electing me as president for the ensuing year.

The election occurring during my unavoidable detention from the meeting was a grateful surprise to me, and I should be untrue to my feelings not to express my sincere pleasure at being accorded so honorable and important a position.

While I am sure the good wishes and friendship of the members influenced their favorable judgment as to my fitness for the post, yet coming to me as it does by so unanimous a vote I am constrained to accept, and to promise my best endeavors for the success of our Association.

The Empire State has not been as progressive as it should have been in the advance movement of late years made in many states, in the art of street railway transportation, yet inspired by the activity displayed by some of our members in the various cities within our confines, I believe the companies of the state will during the next year take the advanced place they should occupy in this important department of industry.

The State Association will, I trust, be of efficient aid in this matter, and as president I must beg the advice and hearty co-operation of each member, and for which I shall be exceedingly grateful.

Again expressing through you, my dear sir, my earnest thanks to the members of the Association for the honor they have conferred upon me by their choice, I am,

Very sincerely yours,

C. Densmore Wyman.

Electricity and the Cable in Great Britain.

By Alex. McCallum.

The slowness with which the street railways of Great Britain take to mechanical power as a substitute for the time-honored horse is apt to engender derisive contempt among American street railway men. But there are several adequate reasons for the present state of things, and the fault does not wholly lie with the directors and managers of British tramways. We must, first, remember the caution of the investing public and of all actively concerned in the management. When an American sees what he thinks is a good thing, he rushes for it at once, and sometimes he has to pay dearly for his precipitancy. When a Britisher sees what appears to be a good thing, he walks around it gingerly, surveys it from all points, demands that it shall be put to stringent and prolonged tests, and if, at length, it emerges triumphantly from these, he puts his money into it. Thus progress is slower in the old country than in America, but it is sure and very solid. By this process of waiting and watching and sometimes nibbling, the Englishman frequently benefits by the experience of his more go-ahead neighbors, and at the same time he often keeps money in his pocket which he might otherwise lose. This is in the fullest sense the case with the tramway traction problem, for John Bull is evidently beginning to move in the way of adopting electric and cable haulage rather extensively.

Another reason why the horse is still almost universal on British street railways is the difficulty with local authorities. No doubt there is a similar bugbear in the United States, but probably no company there has to face such a combination of stumbling blocks as the Board of Trade, the Tramways Act of 1870, and the argus-eyed jealousies of local authorities. The Board of Trade does not look with a favorable eye on anything in the way of street construction which may be supposed to hinder traffic in any way, and it would never allow a car speed, unless in quite suburban districts, of more than eight miles an hour. The Tramways Act empowers town councils at the expiration of twenty years after the opening of any street railway to purchase, if they choose, the undertaking. In very many towns the time is just expiring or will do so in a year or two, and street railway companies will not even consider the advisability of adopting mechanical power, till they know whether they are to have a new lease of life or whether they are going to be bought out. No one could expect them to go in for new capital expenditure in the circumstances. Then the town councils or other local authorities have great suspicions as to the public safety with mechanical haulage, and in many towns the question of the amenity of the district is trotted out.

Americans have no idea of the power of that blessed word amenity in some British cities. Edinburgh, the proud and self-superior city which still calls itself the capital of Scotland, is notorious in this respect. The very mention of a trolley wire railway being installed there would raise a storm, both in the Council and among the citizens at large. The cable, which does not interfere so much with the appearance of the street, they have less objection to, but the difficulty is the paying for it. This public objection to the overhead conductor method is widely spread, but in many districts in England it can, we believe, be easily got over.

A fourth obstacle is consequent upon the caution we have remarked upon above. It is that even where a street railway company can settle everything to its own satisfaction with the local authority and the Board of Trade, the public is sometimes rather chary in subscribing the necessary capital to make the change. Only time and a gradual advance can cure this. The whole subject is being ventilated and discussed in Britain now as it has never been before, and the next few years will see some big changes.

Having said so much by way of preliminary explanation, a glance may be taken at what has already been done and what is now being done in the way of adopting mechanical power. We shall deal first with the electric lines, but shall leave out of account the electric railways in Antrim and in London, as these are not street lines at all, but railroads pure and simple. The earliest electric line in England is that of the watering place, Blackpool, in Lancashire. It uses the underground conduit system, and has been in operation with gratifying financial results since 1885. It is two miles long, single track, and cost over £32,000 ($155,200). The track as for horses cost £11,000 ($53,350) and it belongs to the Blackpool Corporation. The remaining cost, defrayed by the street railway company, was for conversion to electricity. The revenue is sufficient to pay 6½ per cent. as rent to the Corporation and 7½ per cent. dividend on the company's capital. Considering that Blackpool is not a large town, this is very good. But it will be noticed that the capital is not large. The local circumstances were highly favorable to conduit construction, and admitted of a cheap method quite suitable for the place, but quite unsuitable for a large city. This method has not been adopted elsewhere.

Another electric line, that of Barking Road, London, has just closed its existence as such, for the horse has again come into use. It is a section of the North Metropolitan Tramways Co.'s system, and is a little over a mile in length. Some three and a half years ago the General Electric Power & Traction Co., Ltd., London, undertook to work the line with storage batteries, in order to show what could be done in that way. As it offered to do the work for nine cents per car mile for traction charges, including drivers' wages, and as the corresponding charge on the extensive horse system of the North Metropolitan Co. was nearly twelve cents, the offer was accepted. But only five cars were required, and with such a small installation the Electric Traction Co. found it would require a larger allowance. Accordingly it asked and got a rise to eleven cents, and this year, probably finding that expenses were increasing as time went on, it asked for fifteen cents. This was more than the North Metropolitan Co. could stand and the request was refused. Some disputes followed ; resulting in the North Metropolitan Co. putting on horse cars in the end of July. That company complained that it had never been furnished with what it actually cost the Traction company to carry on the service. Had matters turned out more favorably, the managers were prepared to extend the system to others of their lines. Indeed they would have done so a year or more ago, but the local authorities held a power to stop the electric cars whenever they chose on twenty-four hours' notice. This difficulty was never got over.

The accumulator used was the pasted leaden grid type manufactured by the Electric Power Storage Co. and widely and favorably known in other fields of electric work. We believe the manufacturers maintained the cells for four cents per car mile, but, perhaps, they found this not sufficient. Still they are prepared to guarantee their maintenance on large systems for two cents per car mile.

There is no doubt this matter of the cost of repairing and meeting depreciation on storage batteries is still the great point of difficulty in England in getting an independent motor car. It has, however, to be considered, as the Electric Power & Traction Co. pointed out to us in a recent communication, that the failure from a financial standpoint of

a small installation of five cars as compared with the cost of an establishment of thousands of horses and hundreds of cars, is no more an augury of the failure of the accumulator system on an extensive scale than the enormous cost of the first small installations of electric light a few years ago, compared with that of huge installations of gas light augured the failure of electric lighting.

A similar tale of failure of accumulator traction, for the time being at any rate, is just to hand from Birmingham, where the only other notable experiment with storage batteries is in progress. It is now two years since the system was installed on the Bristol Road section of the Birmingham Central Tramways Co. The road is three miles long, double track, and from seven to twelve heavy eight wheel cars have been in use. Like the London route, the gradients are very slight, and accumulators of a similar type to those on the Metropolitan line have been in service. In the first year's working the line showed a credit balance of $14,647, the receipts being $42,350 and the total expenses $27,703. Per car mile run this was 30.3 cents and 19.8 cents respectively. In the year ending June last there was a sad change. The receipts rose to $50,547, but the expenses mounted to $58,690, showing a loss of $8,143. Per car mile the receipts in cents were 26.5, and the expenses 30.78. Every item except car repairs shows an increase, but the greatest differences are for machinery and permanent way and buildings. The former shows a rise from .58 cent per car mile to 8.06 cents. Here is where accumulator maintenance is beginning to tell. The charges for permanent way and buildings have risen from .28 cent to 3.44 cents per car mile. This increase, Mr. Carruthers-Wain, the managing director, explains is due to the exorbitant changes now made by the corporation (to whom the track belongs) for its maintenance. The actual maintenance cost would be very much less. Had the company been able to maintain the traffic as was expected, instead of a deficit there would have been a profit of $5,000 on the line. He also refers to an enormous strain put on the rolling stock and batteries, by the track being an inch or more wider in the gauge than the cars. The Birmingham company seems to have got out of the difficulty of maintenance of the batteries in the meantime, as it has just concluded a contract with the makers of a new style of storage battery, whereby after the company buys the cells the makers will maintain them, at a fixed charge of two cents per car mile run. So long as this is carried out there will be no further difficulty of the Tramways company as to maintenance. The new form of accumulator is the invention of Mr. L. Epstein, who has been working at storage batteries for years. He believes he has now succeeded in producing a cell which is much lighter, more durable and heavier in the discharge than any other. The plates are still of lead, but there is no pasting, the active surface being "formed" as spongy lead on the face of the plate itself. It is to be hoped that the new venture will be a success, the more especially as failure with storage batteries would probably mean a return to horse traction on the Bristol Road. It is an aristocratic residential locality where, we are afraid, the trolley wire would not be tolerated, and where, probably, the cable would not pay.

The only other place in Britain where accumulator cars are being run is Croydon, to the south of London. Here the cars are operated by an electric syndicate, and the local tramway company does not seem to know or care what the operating expenses are. The syndicate pays a fixed sum which the company considers sufficient for the privilege of running the cars.

The only electric tramway in Britain on the overhead conductor method is that at Leeds, some four miles or so in length. For the most part it is suburban, and was started in the summer of last year as an experiment. The line was leased from May, 1891, to October, 1892, to Mr. Graff Baker, of the Thomson-Houston Co., and he has since been showing the benighted Britisher how they do it in America. The equipment is that of the Thomson-Houston Co. with American appliances in almost every detail. Needless to say, the service has been very efficient, and the Leeds people seem highly pleased with it. Extensions of the system are probable should the conflicting interests of the local corporation and Tramways company not stand in the way. The first cost and the operating expenses have not been divulged, so far as I have yet learned.

This exhausts the list of existing electric street railways in Britain. The cable system of haulage is little better represented. The Highgate line in London was opened in 1884, but it is only three-quarters of a mile long. It has worked satisfactorily at a cost of about 50 per cent. of the receipts. Then come the Edinburgh lines with two and three-quarters miles of double track and very heavy gradients. The traffic here is light, and the speed allowed is only six miles an hour. The headway of cars is, generally, considerably over five minutes, and heavy loads of passengers are the exception. Yet under the management of Mr. W. N. Colam, C. E., the expenses run little above 60 per cent. of the receipts.

It is not necessary to say so much about these cable lines as the system has now got so far beyond the experimental stage that minute examination either of efficiency or finances is superfluous. But by way of a contrast we may pause a little over the Birmingham cable line. Here the company works three miles, double track, of cable road, or the same distance as it operates by electric accumulators. Running from the heart of the city in a northwest direction till it joins the South Staffordshire street railways, the road is a very hilly one, and there is a fair traffic. The service is a three minute one, and the cable speed on the town half is seven miles an hour, and on the suburban nine. The total receipts for the year ending June, came to $153,187, and the total expenses to $77,600. This means that the receipts per car mile run stood at 24.2 cents, and the expenses 12.36 cents. Comment is unnecessary. It may only be noted that the steam cars, horse cars, omnibuses, cable cars and electric cars of the company ran between them 2,657,145 car miles during the year, of which the cable cars ran only 621,210. Yet out of a total profit of $179,586 the cable cars contributed no less than $75,582. Since the steel rope was inagurated in 1888 it has been a continued success. The directors have such faith in the cable system for heavy traffic that in order to meet growing corporation charges for lease of lines, and to abolish the enormous expense of the steam cars, they propose to convert another section of their system to cable. It should have been noted that none of these Birmingham figures include allowances for depreciation, as a special fund is set apart to cover that.

This completes the record of street lines in Britain operated by electricity and cable. There are, of course, many steam lines, but these are meeting with growing disfavor, owing to their heavy cost and disagreeable character. Looking to the immediate future, both electricity and the cable are to have further tests under British practice. The trolley wire method has been adopted for nine miles of road in South Staffordshire, superseding steam. The track runs from town to town in that thickly populated district, and all the circumstances point to success. The Electric Construction Corporation of Wolverhampton is carrying out the work. Some sixteen cars will be used, and the cost over all—the permanent way being already in existence—is stated at over $14,550 per mile of road length. The track is partly single and partly double. Side poles with brackets will be used, while the trolley pole will rise from the side of the car roof in bracket form to meet the wire. Mr. Thomas Parker has superintended the construction, and operation is expected to begin shortly.

The Brixton Road, London, cable line is also just about to be opened, and indeed it may be operating when this article is in the hands of readers. It has been a conversion from the horse system, and cars will run on a two minute headway. The road is three miles long, double track, and grip cars will haul the horse cars from three converging lines over it. Provision has been made for an extension, and everything indicates a great success. For the first time in Britain we shall have the cable really in its element, namely, dealing with an enormous traffic in the city district. Mr. W. N. Colam is the engineer.

As to the future, matters are more or less uncertain. Many towns are talking of electricity, but nothing definite has yet come of it. A short experimental trolley wire line was recently run in Bradford to demonstrate that the heavy inclines in that town could be successfully overcome, but a doubt arose as to whether the section subsequently to be installed could be operated profitably with the traffic there is upon it. Mr. Graff Baker has been negotiating with the Coventry Corporation with the view of stringing the trolley wire in that ancient city, but the conclusion has not yet been come to. There is a talk of an important line in the Midlands being converted to cable, and Bristol is thinking on the same means of operating a hilly route there. Glasgow is in a peculiar position. The street railway tracks there have all along belonged to the Corporation, and the local tramway company worked them on lease. The lease expires in 1894, and the corporation has resolved to operate the lines itself. Since coming to that resolution—a very unwise one from an American point of view—the corporation has been studying the question of mechanical motors. It, however, recently failed to come to terms with the tramway company for the purchase of its rolling stock, horses, stables, etc., and it can get no control whatever of the lines till the expiration of the lease. The Corporation has now determined to begin with horses, and to this end a horse establishment is to be equipped. Although much is said by the Corporation to the contrary, I consider this may mean the postponement of the introduction of mechanical power on an extensive scale for a considerable time. But I learn that as far as possible no time will be lost in beginning the experiments after the tramway company's lease expires two years hence. A year or two ago the members of the Corporation were very strongly in favor of the accumulator system, but as a result of closely watching the operation by that method in London and Birmingham they have now abandoned all idea of it. Not only do they find the cost of maintenance too heavy, but that the longer the batteries are in use the more frequently they require to be charged. This reaches a point where charging is required every hour or two, and obviously such a state of matters will not suit Glasgow.

The Corporation's committee is now, we learn in response to inquiry, getting estimates for the equipment of a few miles of the city's northern lines on the trolley wire method, with a view to getting an experiment started as soon after the lease expires as possible. There are some rather stiff gradients on these lines, and only this system or the cable could work them. Looking at local circumstances, the Corporation will probably have to adopt the cable on some of the crowded central routes. In Edinburgh the local corporation is about to buy the lines, which at present belong to the tramway company, but it will lease the working. Many of the routes are very hilly, and, with the example of the present local cable roads (which belong to a separate company), rope haulage is first favorite.

A word of reference may be made to the elevated electric railroad which has been under construction at Liverpool for some time. Though it is not a street railway and does not even follow the lines of streets to any considerable extent, it has this in common that motor cars are to be used. Eight wheel cars, each forty-five feet long, mounted on two bogie trucks, will run in trains of two cars. On the bogie at each end of the train will be fixed an electric motor of from seventy to 100 H. P. The rearward motor for the time being will alone be in action. The railroad, which has been frequently described in the trade journals of late, will be operating in the beginning of winter.

There is no doubt that recent events in London and Birmingham have struck a severe blow at the progress of accumulator traction in Britain. The strong objection to overhead structure in many quarters, however unreasonable it may be, makes the storage battery system very desirable, but the question is who will step forward and try to show that it can be operated economically on an extensive scale. Birmingham at present is the only chance, and the scale there is not very

extensive. The independence of the car, compared with other systems is another attraction. The trolley wire will, however, I am convinced, make progress, especially in manufacturing districts, and the only obstacle, ultimately, to the cable will be the first cost. Still, many busy cities will come, and indeed are coming, to see that for their dense traffic it will pay them in the long run to convert their busiest horse to cable lines. More of the expense than might at first be thought can be recouped out of sales of horses, buildings and lands no longer required. If the new electric road in South Staffordshire and the new cable road in London operate successfully from a financial point of view—and there should be little doubt of this—there will be a rush in a year or so for mechanical power. Public opinion being once roused, the present obstacles, which have been referred to above, will be speedily swept away. The dry bones are coming to life, and a "boom" both in electricity and cable is at hand.

Legal.

Street Railways—Improvement of Streets—Alteration of Tracks—City Council—Resolution of. This action was brought on a writ of *mandamus*, to compel respondent street railway company to make alterations in its tracks. The writ was granted and the company appealed.

Held. 1. That the permission given a street railway company by a city to occupy streets is subordinate to the city's statutory and corporate powers respecting the use, control and regulation of streets.

2. That under the statutes (How. sec. 3,554) authorizing city councils of cities in which are street railroads to establish, "by ordinance or otherwise," such rules and regulations in regard to the same as may be required for the grading, paving and repaving of streets, a city council may require the removal of the projecting ends of the ties of a street railroad when it deems that they will injure a contemplated concrete pavement by jarring the same and disturbing its stability; and such requirement may be made by resolution, and need not extend to railroads other than that occupying the street intended to be improved. Affirmed. *City of Detroit* v. *Ft. Wayne, etc., St. Ry. Co.*, Mich. S. C., March 18, 1892.

Injury to Passenger—Boarding Moving Car—Instruction. In an action against a street railway company for personal injuries, plaintiff's theory was that she motioned the driver to stop the car; that he stopped it, and, that while she was getting on, the car suddenly started and threw her, causing the injury. Defendant's theory was that while the car was in motion at a place where, by the rules of the company, the driver had no right to stop, plaintiff rushed from the sidewalk toward the car; that the driver called out to her not to come near the car; that she paid no attention to the warning, but attempted to seize the forward part of the car; that a passenger standing on the front platform, stepped on the step of the car, and put his arm out to prevent plaintiff from seizing the car; that she ran against his arm and was thrown down, and did not touch the car at all. The court charged that, if plaintiff attempted to get upon the car while it was in motion, the car not having been stopped for her to get on it, and the motion of the car threw her down, she assumed the risk, and was not in the exercise of due care if she was injured thereby. The jury were also instructed that, if the car was stopped for her to get upon it, and she stepped on the step, and then, while she was in the act of stepping, the car was needlessly started, so as to throw her down, the company would be responsible.

Held, That the instructions were not given in abstract propositions of the law that a person was not in the exercise of due care who attempted to get on a horse car while it was in motion, but were given in connection with the two theories of the case, and were correct. Judgment for defendant affirmed. *Galligher* v. *West End St. Ry. Co.*, Mass. S. J. C. March 29, 1892.

Condemnation of Land for Elevated Street Railroad—Evidence—Incorporation. In an action upon petition to condemn land, on appeal the court

Held. 1. That under Act 1875 (Rev. Stat. 1891) which authorizes the organization of companies for the purpose of constructing elevated ways or conveyors under the general incorporation law, does not prohibit the organization of companies for the construction of elevated railroads under the act in relation to the incorporation of railroad companies.

2. That a corporation organized for the purpose of building a "railroad," between certain points, in pursuance of Act, March 1, 1872 (2 Starr. & C. Ann. St. 1,907), which provides for the incorporation of associations "for the purpose of constructing and operating any railroad in this state," has a right to condemn land for the purpose of constructing an elevated railroad in a city.

3. That evidence as to the value of the land to be taken should be limited to the date of filing the original petition, and not to the dates of subsequent amendments.

4. Where in an action to condemn land for the use of an elevated railroad a stipulation has been entered into by the petitioner to the effect that the road should only be used for passenger traffic, that no soft coal should be used on its locomotives, and that its motive power should be fully equipped with the best modern devices, to render it noiseless and smokeless, it is proper to allow the jury to consider such stipulation in assessing the damages. Affirmed. *Dieberman* v. *Chicago & S. S. R. T. R. Co.*, Ills. S. C., March 24, 1892.

Time of Running Cars—Validity of Ordinance—Regulating Same. 1. Where a horse railroad charter provides that its cars "shall run as often as the convenience of passengers may require," and the road "shall be subject to such reasonable rules and regulations in respect thereto as the common council may, from time to time by ordinance prescribe," an ordinance requiring the several street surface roads of this city to operate their roads "not less than one car every twenty minutes between the hours of 12 midnight and 6 o'clock A. M., each and every day, both ways for the transportation of passengers," will be presumed to be a reasonable and valid exercise of the legislative power of the city, until evidence rebutting such presumption is adduced by defendant road prosecuted for the penalty provided for the violation of such ordinance.

2. That in such a case the convenience of passengers, and not the cost of the defendant of running the cars, is the test of the reasonableness of the ordinance, which is a question of law for the court. But, the rejection of evidence offered by defendant for the purpose of showing that, with respect to one of its branch lines, such ordinance is unreasonable is ground for reversal. Reversed. New trial ordered. *Mayor, etc., New York* v. *The D. D., etc, R. R. Co.*, N. Y. C. A., April 17, 1892.

Entering Moving Car—Contributory Negligence. In an action to recover for a death caused by the negligence of the defendant company it is

Held, that it is not, as a matter of law, negligence for a passenger to attempt to enter a street car while the same is moving, irrespective of the rate of speed or other qualifying circumstances. It is presumptively negligent to do so if the car is moving at its ordinary rate of speed, or with accelerated speed, and especially if the attempt is made between cars, or at the front instead of the rear of the car. It is ordinarily a question for the jury, depending upon the circumstances of each case.

Right to use Streets—Public Highways. The proviso in the general railroad law of Pennsylvania, to the effect that it shall not authorize any corporation to enter upon and occupy any street in any incorporated city without the prior consent of such city, does not confer the right to enter upon public highways or city streets by virtue merely of such consent. *Penna. Ry. Co.* v. *Philadelphia Belt Line R. Co.*, Pa. Com. Pleas Court. March, 1892.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

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A Cordial Invitation is hereby tendered to all in attendance at the Cleveland Convention to call and register at our headquarters, at the Hollenden Hotel. We value the honor of being enrolled among the number of those engaged in developing the street railway business, and welcome all the fraternity, while we view with delight and with pride the marvelous strides which this industry is making.

The Situation in England as it relates to the street railway industry is graphically and clearly portrayed in an article by our special correspondent printed in another column. Many, judging by the proverbial conservatism of the English, predict that the introduction of mechanical traction must necessarily be slow and of limited extent, but we are of opinion that electric power will so act upon the people that they will be galvanized into new life, so that the demand for rapid transit facilities on the part of the general public will break down the barriers, and that the business will make as rapid strides in the near future as it has already done in this country.

A Proper Steam Line Crossing was one of the incidental subjects discussed at the recent meeting of the Massachusetts Street Railway Association. The subject is one in which nearly all the street railway companies of the country are interested, and one in which they should assert their rights, for in nearly all cases the steam lines assume to dictate what kind of a crossing shall be employed, and usually refuse to allow the rails to be notched to provide for a smooth crossing for electric cars. It was clearly shown in the report that the street railways transport a larger number of passengers than do the steam lines, and from this view of the case, it would naturally seem that the rights of the street railways in this matter should be more justly treated. With the advent of mechanical traction the jolting of the cars from any cause tends to injure the trucks and motors, and we can see no good reason why the electric lines should not be accorded as smooth a crossing as steam lines. We are glad to know that the matter is receiving attention, and that a memorial will be presented at the next meeting of the American Street Railway Association calling the attention of that body to the matter and suggesting plans of action.

Advance Copies of the reports of special committees at the coming Convention are to be furnished to all applicants, so that there will be an opportunity for all who so desire, to prepare themselves for taking part in the discussions which will follow. This is a new departure from the ordinary methods of the Association, and we believe will add largely to the value of the proceedings and facilitate the dispatch of business; but in order to derive the largest benefit from the new arrangement, it will be necessary for the chairmen of the various committees to send copies of their reports to the secretary in time to allow for printing and distribution, and that interested parties obtain them and use them as designed. We have, from the first, favored this method of conducting the Association's business, and trust that it may not fail through any neglect on the part of the committees. There will now be no excuse for those who style themselves diffident men for not taking part in the discussions, as they will have ample time for preparation, and since such men are usually possessed of a large share of good hard sense, they can doubtless impart a great deal of valuable information. As opportunity offers, we shall expect to hear, in the coming meeting, from a large number of such men, and we believe that the proceedings will be correspondingly more interesting. We believe that it is the duty of every one to contribute to others' good whenever he is able to do so, for in so doing he will multiply his own power for useful work.

"I am Entirely Indifferent to the anathemas which the daily press continue to hurl against the trolley system and those of us who were instrumental in its introduction," said a prominent street railway president recently, "and so is the public, now that our lines are in operation and an opportunity has been given to the people to ride in our cars. They begin to appreciate the improved facilities, and no amount of newspaper criticism seems to move them." This is a condition of affairs which we have anticipated, and we doubt if the history of journalism presents a parallel in which the daily press (usually on the side of right and in favor of public improvements) has made so many grave mistakes or suffered a more inglorious defeat. This senseless opposition has, however, served one good purpose, as it has given the managers of certain street railway lines an opportunity for the display of a degree of courage and perseverance in the face of bitter opposition that heretofore has been accorded only to soldiers or prominent reformers. This final victory should serve as an incentive to the managers of other railway lines in our large cities to do likewise, for there is a sure prestige of ultimate success and the promise of enjoying, as others now do, the proud consciousness of having taken a wise course in the matter. The attitude which the local papers in our large cities have taken in reference to the introduction of mechanical traction, emphasizes the fact that the technical press, in matters

pertaining to public improvements, is a much safer guide than the more popular publications.

A Defective Memory Epidemic seems to have broken out among street railway conductors in nearly every direction, as we read of several lines being compelled recently to discharge a number of afflicted men. This disease, or mental aberration, which manifests itself principally in neglecting to register fares, is a very contagious one, and unless promptly quarantined and the patient retired is apt to cripple the resources of a company. It is strikingly apparent that we need the labors of a Dr. Koch in this country to discover, if possible, the particular germ or bacteria which is the origin of this disease in order that a suitable remedy may be devised. One peculiar feature of this malady is that it is frequently accompanied by an abnormal development of an ability for trickery and a skillful manipulation of the register and reports to deceive the company and prevent the disease from being discovered. So prominent is this feature that the skill and ingenuity displayed by certain conductors in this direction surpass that of the executive officers in the management of the road, and could it be expended in the direction of useful and honest work would place many of these men in the front rank of successful street railway managers. While there is a field for improved street railway appliances in almost every department of the service, there is none so important or desirable as a class of trusty and reliable conductors with good memories, and who will not be partial to their friends. Such a class will be more readily developed when the general public takes an interest in such matters and observes whether the conductors on the cars on which they ride collect their fares and those of their neighbors, and promptly register the same.

"I Cannot Find Time to Read Street Railway Papers," said a street railway manager recently. Such an admission on the part of an executive officer of a street railway company argues one of two things: Either that he has failed to organize his forces so as to relieve himself of burdensome details, or that his directors are imposing upon him too heavy burdens which will eventually result in an inferior service. We admit that there are periods in the administration of the affairs of a company, such as the re-equipment of the lines for mechanical traction, or building extensions, when the details are all-absorbing ; but when such is the chronic condition of the manager, we instinctively feel that he is likely to lose ground and be outstripped by some of his less prominent neighbors who read and take advantage of the practical suggestions that constantly appear in the journals devoted to this particular industry. He is not the most successful manager who does all the work himself, but rather he who holds his subordinates responsible for details while he gives himself ample time for research and improvement. The manager of the former type will soon wear himself out in the service of the company, while he flatters himself that he is making a great sacrifice for his employer ; but the other will prolong his period of activity and enjoy the confidence and favor of his directors because of the constantly increasing dividends which he is able to earn. We know of men at the head of comparatively small systems who are always overburdened with details, while others who control a much larger mileage and an enormous traffic, are never overburdened and manage their business with comparative ease. The sooner a manager learns to appreciate the situation and to govern himself accordingly, in so much less time will he reach the highest standard in his profession and gain an enviable reputation among his fellows.

The Introduction of the Trolley in the annexed district of New York City is an event fraught with tremendous possibilities ; for it is reasonable to expect that the people of this city will readily appreciate and adopt this method of traction, as have the citizens of other places where the trolley cars have already been in operation ; for not in one single instance, we are assured, would the people of these places submit to the removal of the cars. Hence, we predict that as soon as the New York people become acquainted with this method of transit, and their causeless fears regarding the danger element are allayed, they will demand its extension in such positive terms that neither the public press nor the municipal authorities will be able much longer to block its universal introduction. We congratulate the Union Railroad Co. on its splendid success and increased receipts so far, and the residents of the annexed district on having so admirable a system of rapid transit. In this connection the fact should not be overlooked that while the Union Railroad Co. were the prime movers in this enterprise, yet its execution has been largely in the hands of one man. Mr. L. H. McIntire, chief engineer of the company, has not only arranged all the mechanical details and superintended their execution, but upon him has devolved the duty of seeing the city officials frequently, and also the objecting property holders along the line, and of outgeneralling the mobs in the outlying districts which have repeatedly torn up his tracks and even threatened him with personal violence. Hence the credit of the work is largely due to his ingenuity, skill, industry and patience, and we have no doubt will eventually be thus recognized.

The Saratoga Convention of the New York State Street Railway Association, although not largely attended, was very fruitful in results. The fact was emphasized in the report made by the attorney that the efforts of the Association had resulted in checking state legislation that would have been hostile to street railway and other corporate interests. The statement was made that over 100 bills had been introduced at Albany at the last session, which, had they been allowed to pass, would have materially crippled the street railway interests of the state. Another fact was emphasized that it would be to the advantage of the smaller companies of the state to become members of the Association, for they could materially aid, by their influence with the local legislators, in shaping legislative action. We have, heretofore, referred to this matter, and we are quite sure that any company which will give attention to this subject and learn how great are the advantages to be derived, would not delay to enter the organization. In the paper and discussion following, it will be seen that there is a demand for a number of better appliances in some of the minor details of car building, particularly as regards the method of lettering and signs and night signals to indicate the routes over which the cars operate. There is a field for the exercise of inventive genius in this direction, and any person who will solve the problem satisfactorily will no doubt receive ample reward for any improvement in signals. The rail and joint question was also incidentally

discussed, but very little light, however, was thrown upon the subject. It is interesting to note from the discussions that on single track lines where the cars run in both directions the joints do not give as much trouble as they do on double track lines. From these facts it would be inferred that the life of a track would be greatly increased if the cars could be run alternately right and left handed, but owing to the confusion that would result, probably this practice can not be followed. The organization of a supply men's association was, in our opinion, a wise step, and we believe that it will result in mutual good to both the street railway and material men, and it is hoped that at the coming Cleveland convention a similar association will be formed.

The Approaching Convention is an event in which every street railway man should feel a deep interest, whether he is able to be present at Cleveland or not. If not present he will read the proceedings as reported in the technical papers, and will no doubt be benefited, but the advantages of being present are sometimes overlooked, and some of these advantages we wish to emphasize. These are, first, the social features, which give the men from widely separate localities an opportunity of becoming acquainted and of gaining that confidence that comes from being a part of a great organization to which one can look for support and sympathy in times of trouble or serious opposition. A second advantage would come from an inspection of the various appliances which will be placed on exhibition by the manufacturers and dealers in street railway supplies, as well as making the acquaintance of the same dealers, which perchance would be of advantage in future business transactions. The third advantage in the present case will be the opportunity of visiting and inspecting the street railway systems of the city, which embrace the various methods of mechanical traction, and on which a deal of experimenting has been done, the results of which are excellent systems which will serve as models for imitation. There will also be an opportunity of visiting the local electrical and other industries devoted to the production of street railway appliances of which the city is justly proud. We are aware that there are but few active street railway men who do not already appreciate all the advantages that we can name; but there are many who cannot be present because their directors have neglected to make provision for a vacation and also to provide the funds necessary. We should like to gain the ear of all such directors and suggest that it would be a graceful act on their part to offer a vacation to their faithful heads of departments, and provide liberally for meeting the incidental expenses of a trip to Cleveland, and to say that such an investment would, no doubt, prove a profitable one. A soldier, were he required to engage in battle alone, would make but a sorry attack or defense, but if he can feel the touch of elbow with comrades on the right or left, finds his own courage increased and his capacity for doing useful work more than doubled. The same is true of an association of allied industries; there is a confidence born of union, that adds greatly to one's productive power. In reviewing the history of the Association, and noting the names that have been prominently connected with it from its early history, we find that in most cases they are the same parties who now control or manage the most important street railway systems of our large cities, and who are ever ready to witness to the advantages they have derived, by participating in the proceedings of the Association. In conclusion, we are confident that it will pay in more ways than one for every street railway company in the country, as well as those firms engaged in the manufacture of street railway appliances, to be represented at the Cleveland meeting.

Compensation for the Use of Streets.

When a town or city is young, the authorities are frequently puzzled to know what to tax, and at the same time cause the least inconvenience; that is, the least popular opposition. To this end methods are employed calculated to conceal the way in which the people pay such taxation, by taxing a corporation or something of that kind, which act requires the corporation to impose a higher rate of charges on the public in order that it can get its tax back again. By such means the town politicians escape the onus of the act, and put it on the shoulders of the corporation; although, as a matter of fact, the people only are the ones who pay the tax. But the subterfuge of the tax makers is shortsightedly successful in its purposes, and all the wrath due to the cost of the tax is transferred away from them upon somebody else.

In no department is this tendency of the politicans more marked than with street railway service; in such cases the street car corporations are special objects of attack, and commonly they are made to pay dearly for their privileges. From the standpoint of a city's best and most rapid development—and usually that is one of the chief objects of political management—this course of action defeats its own purpose; for the simple reason that it adds to the cost of residence in one of those ways which attract the home seeker's attention, next to rent itself. One of the first questions asked by the new or contemplating resident is: What is the cost of travel between the home and the place of business, and what kind of service is obtainable? This question answers itself, so far as a public policy is concerned; that town which affords the best street car service, and at the lowest cost, other things being being equal, grows the fastest. In fact, it is well appreciated among steam railway officials that a low priced, frequent and comfortable service has built up a good many cities in this country, which to-day could have made no such showing if that service had been absent. The rule holds equally well in the case of street railways, for the methods of getting from one part of a town to another are as important to the resident as to get to the town at all. Either want failing of attainment, means a proportionate reduction in a town's development.

Probably there is no one feature more calculated to develop a town—therefore the nation—than a first class means of intercommunication between the people; this assumption is easily verifiable by noting the slow growth and general business idleness of the people in European cities where for ages such intercommunication has been almost absent, or so inconvenient that commercial and other intercourse has been attended with too much cost and delay to produce a general prosperity.

For these reasons it becomes self evident that if the politicians really have their town's best interest at heart, they must encourage by practical aid, rather than suppress, efforts which have for their end and aim the improvement of local transportation facilities. And consequentially, if the granted right of way really possesses a large value independent of that which the transportation company develops by its own enterprise, all such advantages should go in the direction of reducing fares rather than increased taxation, whatever its forms, which is a practical premium upon the non-development of the interested locality. The whole interests of the people are inwrought with the transportation problem; consequently any action of the people against the fair interests of transportation is practical suicide, so far as the desired results of intercommunication are concerned.

The Safety of the Trolley System.

The trolley system has been and is now being attacked in several cities with a virulence and bigotry which is uncommon and seems greatly out of place in this Nineteenth Century. These attacks, it is interesting to note, are being made in cities which have had no practical experience with the system. After the cars are in operation, and their advantages over horse cars become understood, the general abuse stops, showing that the benefits conferred more than outweigh any supposed drawbacks in the new power. But no amount of experience of other cities in this line seems to be of benefit in checking this spirit of opposition against the unknown electric car. The desirability of the electric system may be shown, and the fallacy of the arguments used to oppose it may be proved, but the same unreasoning prejudice exists and manifests itself on occasion.

This prejudice seems based upon two alleged grounds, viz., that the overhead structure required for the operation of the cars is objectionable from an æsthetic standpoint, and that maintenance of the system itself is attended with danger to passengers and occupants of the streets.

The first charge might, perhaps, have been made with some sort of propriety against the early electric railways. The pole lines on many of these roads were built to sustain a greater weight in the streets than is now necessary, and the entire method of construction was crude and of a less expensive type than now. But later improvements have greatly changed the appearance of the overhead portion of an electric line. Wooden poles have been replaced by those made of iron, manufactured especially for the purpose, unobtrusive and tasteful, while the number of wires absolutely required has been reduced to one trolley wire for each track, and two guard wires (not always necessary) with the proper span wires for holding these in position.

In regard to the alleged danger attending the employment of electric cars, we have repeatedly shown the groundlessness of charges of this nature, and it seems almost unnecessary to devote any further space in this paper to the subject. But since the opposition to the system is avowedly based largely on its supposed danger, and since in cities and among individuals ignorant of the practical workings of the electric system this idea has become widely accepted as truth, a further examination of the subject may not be without value.

The advantages gained by the use of electric cars is rarely taken into consideration in these attacks upon the system as a whole. By omitting this feature and assuming that the public gains nothing in the discontinuance of horse cars by cleaner streets, the removal from the centres of cities of extensive stables, quicker transit and better cars, let us see whether as viewed from a danger standpoint alone the electric cars are more objectionable than horse cars. The electric current, from its mystery, is supposed to conceal a death dealing power, dangerous alike to passengers and passers-by, and reports of accidents on several electric railways have been exaggerated, until a strongly founded belief has been created in the minds of many that such a danger exists. This is only another instance that a falsehood long persisted in becomes often accepted as truth. As a matter of fact we have yet to learn of a single instance of any passenger or other person other than an employe of the railway company, being permanently injured, still less killed by the current of an electric railway. All alleged accidents from this cause have been investigated and found to have been either fictitious or traceable to some other origin than the railway circuit.

The maximum voltage used on an electric railway has been settled by universal practice to be in the neighborhood of 500, never rising above this figure. In only one or two instances in the entire history of electric railroading have fatal results to employes followed a shock from this voltage, and in these, the circumstances under which the accident occurred were such as could not occur to any passenger, while there is no reason to believe that heart disease was not the cause of death. The danger to passengers or passers-by, in any event from this source, is absolutely *nil.* A person can only receive a shock by touching the overhead wire and ground at the same time, and this cannot occur while the trolley is in its place eighteen or twenty feet above the track. In this position it is very firmly fastened, the poles and supports being especially designed to resist the greatest strain which can come upon them, while the guard wires carried above the trolley wire prevent any electric light, telephone or other wires falling on the trolley wire from above. But in case the trolley wire should at any time become broken and fall to the ground, the section of the line in which that point is situated is instantly cut out of connection with the generators by automatic safety catches, making the broken trolley wire perfectly safe to handle.

The second charge brought against electric cars, is that owing to their greater weight and higher speed they cannot be quickly stopped, and, consequently, they cause a large number of street accidents. An electric car can, of course, be run at the slow speed of a horse car, if desirable, and whether under these circumstances the opponents of the electric system consider them more dangerous than horse cars, we are unable to state; but even at the rate of speed at which electric cars usually run we consider them no more dangerous to occupants of the streets than cars drawn by animal power. The reason of this lies in the fact that the electric car, though heavier, can be stopped much more rapidly than a horse car, and within a shorter distance. With horse cars, only hand brakes are available. With electric cars, on the other hand, power brakes can be used by which the car, while running at a speed of ten miles an hour, can be stopped within a distance of about fifteen feet, depending upon the condition of the rails. In cases of emergency the current in the motors can be reversed by the motorman without changing his position, as has often been done, thereby stopping the car within a very much shorter distance.

Now, having considered the charges against the electric car, let us see who speaks in its favor. How has the introduction and use of the electric cars been regarded by the general public in the cities where electric power has been adopted? Do the people who live where these cars have been in use for a considerable time and who use them daily, regard them as dangerous and objectionable, and do they desire to return to horse cars? This question is easily answered. The verdict is unanimously in favor of the electric car. Every city in which electric cars have been introduced has pronounced with no uncertain voice in their favor. The improved method of transit has bettered the centre of the city, by the removal of a large number of horses from the streets, and by bringing the city into closer communication with the suburbs, thereby allowing those whose business requires their presence in the city during the day, to establish their homes at some distance. It has also helped the suburbs by raising the price of property and by bringing rapid transit in comfortable modern cars and in a way never accomplished and impossible with horse cars.

In answer to a circular letter recently sent by a metropolitan daily to the mayors of each city in this country in which electric cars are in operation, asking the popular opinion of them, many answers were received, all unequivocal and all favorable. In none of these cities would a proposition to return to animal power receive respectful consideration. In other words, the electric railway has come to stay, and its wider adoption cannot be prevented by the unimportant and weak objections brought against it. It has won the approval of the citizens of those cities where it has been installed, and while the future may bring improvement in details, it will not alter the favorable opinion in which electric cars are regarded by those who have actual acquaintance with them.

The Ford-Washburn Storelectro Co., of Cleveland, O., are progressing satisfactorily in the development of their storage battery system, and will have a car in operation on one of the Cleveland lines during the Convention, when all will have an opportunity of witnessing the result of the experiments thus far conducted by this company.

The Power Stations of the Brooklyn City Railway.

The electrical equipment of the lines of the Brooklyn City Railway Co. which operates 180 miles of track in that city, is being pushed rapidly forward. The company have decided upon the construction of two main power stations. One of these will be located, as has already been mentioned, near the site of the present temporary power station on New York Bay at the foot of 52d Street, South Brooklyn. The other station, known as the Eastern Station, will be located at the corner of Kent and Division Avenues, Williamsburgh. The ultimate capacity of the former will be about 12,000 H. P. The foundations for the machinery have all been placed in position, and by the time that this reaches our readers the roof girders will probably be in place, and the stack nearly, if not entirely, completed.

The power station is of brick with blue stone trimmings and measures 98×378 ft. outside dimensions. The boiler room is in the western part of the building and is 93 ft. 10 ins.×138 ft. Fig. 1 shows a cross section of this portion of the building, and Fig. 2 the plan of the building. The boilers are twenty in number of 250 H. P. each, and were supplied by the Babcock & Wilcox Co., of New York. As will be seen, the flues, which are of large dimensions, are below the boilers and on the floor line, obviating the necessity of the heavy supports which would be requisite if the flues were above the boilers. The steam pipe from each boiler is connected directly with the duplicate mains, shown in the figure, and supported from the roof. The connections are such that any boiler at any portion of either of the mains can be cut out without interfering with the operation of the plant. The ashes from the boiler pass through a chute into an ash car whence they are taken away. All the handling of both fuel and ashes is done by mechanical conveyors.

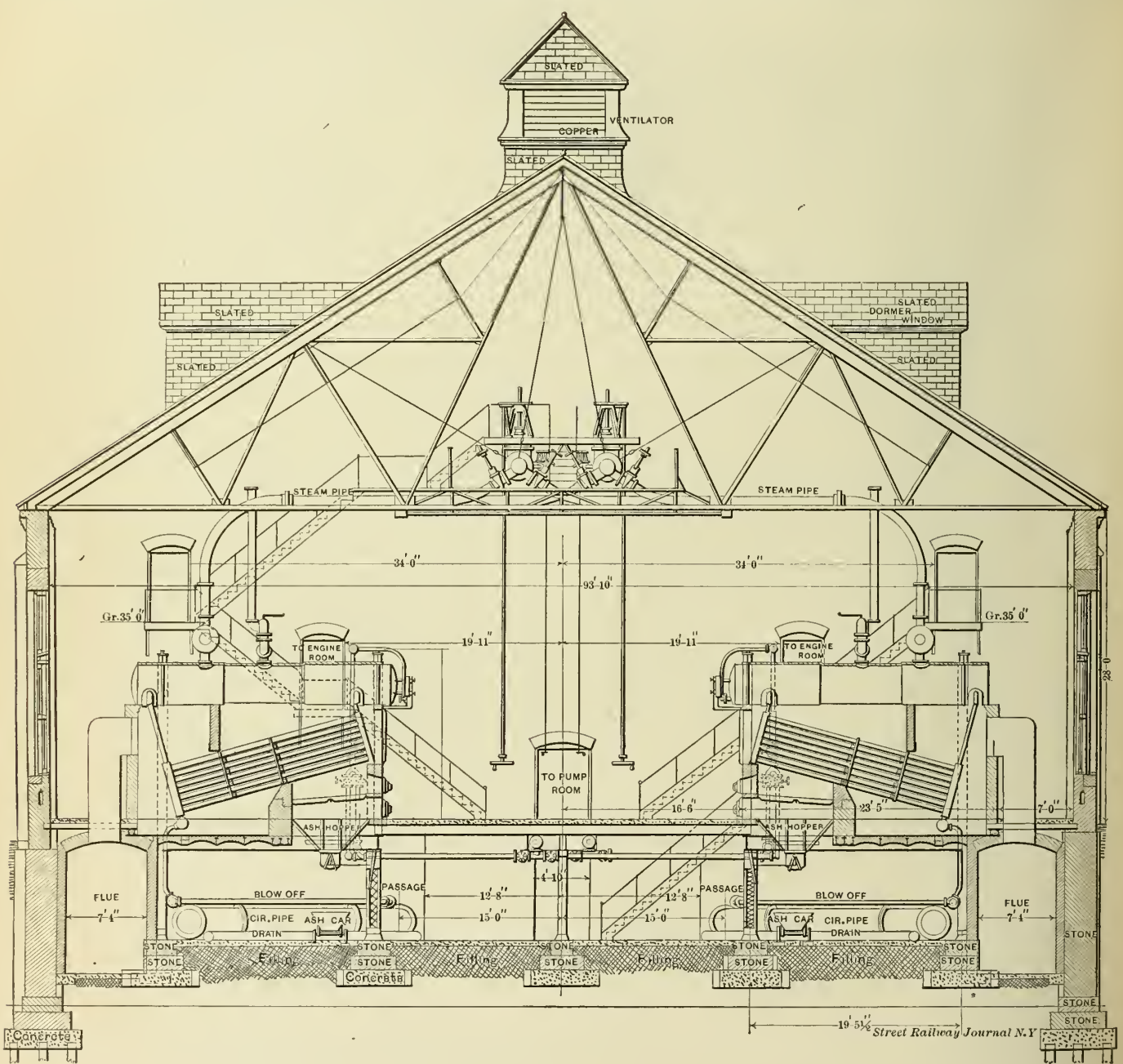


FIG. 1.—SECTIONAL VIEW OF BOILER ROOM—SOUTHERN POWER STATION, BROOKLYN CITY RAILWAY CO.

Fig. 3 presents a cross section and Fig. 4 the plan of the engine room, and these diagrams show very accurately the duplicate system of piping and also the arrangement of the engines and generators. As will be seen, the method of driving adopted is worthy of attention, and somewhat different from that employed in other large stations of this character. The generators are mounted on an elevated platform, and are connected in pairs, the armature shafts being in line. A pulley shown in greater detail in Fig. 5, is mounted between the two generators with friction clutches and belted directly from the engine. By means of these either or both generators can be run or not at the option of the engineer. The engines were manufactured by the E. P. Allis Co., who are the contractors for the entire machinery at the station. They

are cross compound, condensing, and their cylinder dimensions are twenty-six inches and forty-eight inches by forty-eight inches stroke. Four of these will be placed in position within the next month, and the four others, which will complete the station, will probably be installed during the next six months. These engines were designed

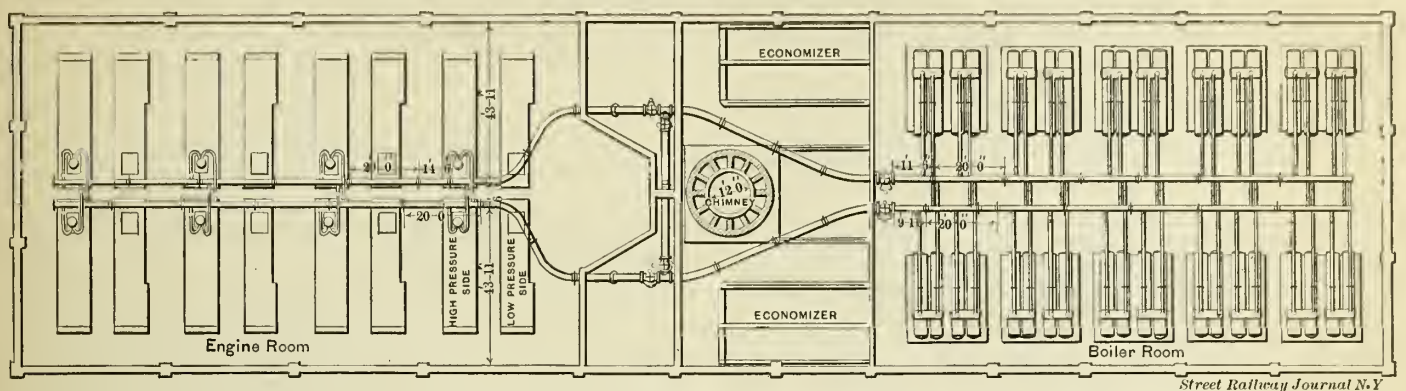


FIG. 2.—GENERAL PLAN OF STEAM PIPING—SOUTHERN POWER STATION, BROOKLYN CITY RAILWAY CO.

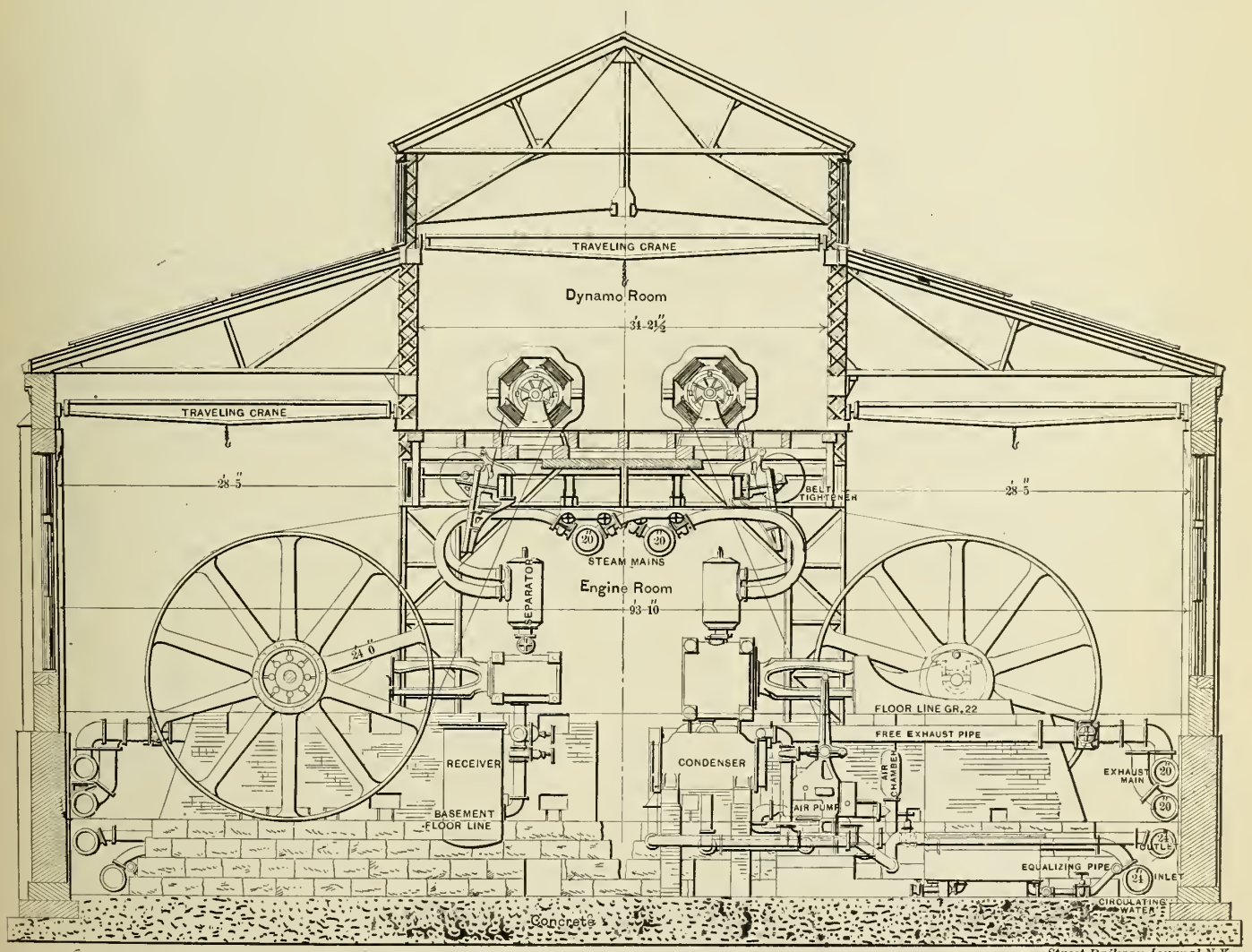


FIG. 3.—SECTIONAL VIEW OF ENGINE ROOM—SOUTHERN POWER STATION, BROOKLYN CITY RAILWAY CO.

to develop 900 H. P. each under the most economical conditions and to work up to 1,500 H. P. each. The iron work in the station was supplied by and erected by the Boston Bridge Co. The generators are of the Thomson-Houston M. P. type and of 500 K. W. capacity. The interior walls of the engine room, to a height of eight feet from the floor level, are wainscoted with enameled brick of red and cream color, allowing this portion of the room to be kept clean from grease and oil. The roof will consist of two inch hard pine, laid upon the purlines and rafters, and covered with slate. The engine room will be kept well lighted, and skylights have been arranged over each engine. The four belts already ordered are seventy-two inches wide, 114 ft. long, three-ply, and will be furnished by Chas. A. Schieren & Co., the Monarch Belting Co., the Charles Munson Belting Co., and Fayerweather & Ladew. The switches, arresters, etc., will be located in a special "controlling room" shown in the plan.

The stack, which will be located between the engine and boiler rooms, will be 200 ft. in height and will have a flue twelve feet in diameter. The foundation of the stack consists of a layer of concrete four feet in thickness and sixty-two feet square, resting on piles. Above this is eleven feet of granite. The base of the stack is square for a height of twenty-five feet, then the corners are stepped in until an octagon is reached from which the stack is carried up in circular form. Fig. 6 shows the arrangement of the flues at the base of the stack. The gases from the engine are first carried through economizers which reduce the temperature of the gas to about 300 degs. The damper doors at the entrance to the stack are 16×11 ft. 8 ins. and it was quite a problem how these could best be oper-

ated. The plan adopted is the same as with the West End power station at Boston. The damper doors are hung by chains from bolts passing through the sustaining arc of the stack, and the doors are then worked by a rod from the outside. The floor of both engine and boiler rooms consists of concrete, four feet in thickness, and this rests entirely on sand, the stack and walls being the only portions of the building for which piles had to be driven.

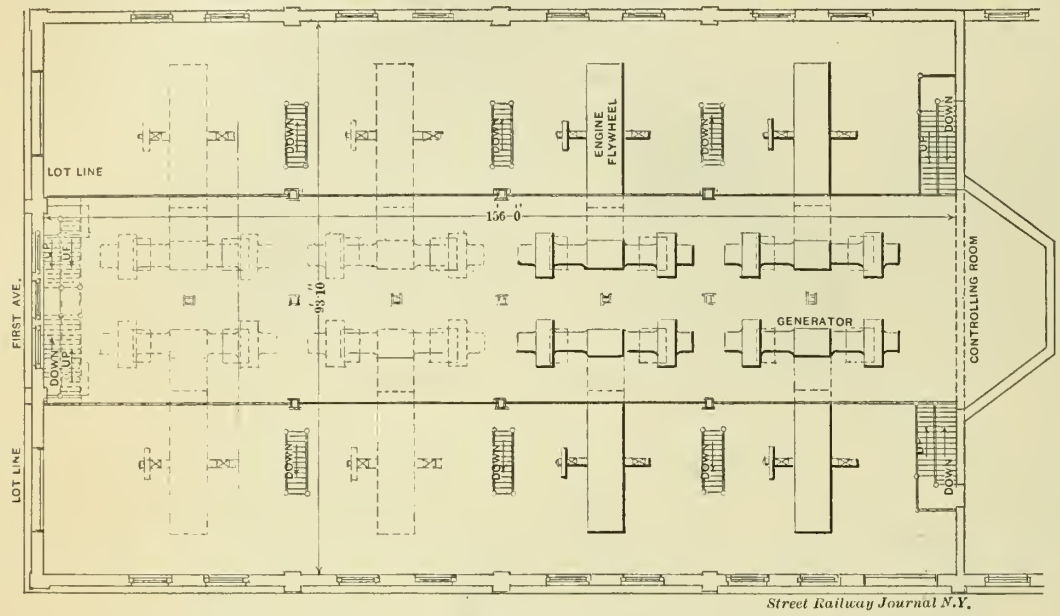


FIG. 4.—PLAN OF ENGINE AND GENERATOR ROOM—BROOKLYN CITY RAILWAY CO.

The location of the station being on the bay, the best facilities are secured for the receipt of fuel and for securing water for condensing purposes. The managers of the company have built a pier 700 × 200 ft. in size, from which coal will be landed directly from barges and taken to the station by machinery.

THE EASTERN STATION

which will be located at the corner of Kent and Division Avenues, Williamsburgh, will have an ultimate station capacity of 24,000 amperes. The engines will be cross compound condensing engines; cylinder dimensions forty-two and sixty-two inches by sixty inch stroke, manufactured by the E. P. Allis Co. Each pair of engines will be directly connected to one monster generator of 4,000 amperes capacity. These generators are being built by the General Electric Co., of New York, from designs furnished by F. S. Pearson, consulting engineer of the road, and W. H. Knight of the General Electric Co. These machines will have twelve poles and a commutator seven feet in diameter.

The boilers will be furnished by the Babcock & Wilcox Co., of New York, and will have a capacity of 250 H. P. each and 180 lbs. steam pressure. The boiler room will be in two stories; eighteen boilers will be located on the lower floor and the same number on the upper floor. The chimney will have a seventeen foot flue and will be 330 ft. in height.

Electric, Cable and Miscellaneous Notes from Providence, R. I.

The Pawtuxet electric line (Thomson-Houston equipment) which was put in operation on the 20th of January last by the Union Railway Co., of Providence, R. I., continues to operate in a highly satisfactory manner. Twenty-two of the cars are mounted on the Robinson radial trucks, and the superintendent, A. T. Potter, told us that he felt he had made no mistake in adopting this type of truck, as in so far that it had required no repairs and was sustaining all the claims made for it. The car bodies, most of which were manufactured by the Newburyport Car Manufactuing Co., are giving every indication that they will have a long life, and are looking as well as when first put in service. A large portion of the track over which the electric cars operate is laid with the Providence girder rail, and though it has been in service seven years, the joints are standing up remarkably well, so that the wheels pound but little. This rail has had a very poor record in Boston and some other cities, but in Providence it is giving creditable service owing to the thorough manner in which the line was originally constructed. The superintendent is of the opinion that for horse car traffic there is no better track construction.

The company have adopted the new Thomson-Houston controlling device for the operation of their cars, and are satisfied that its use results in a large saving of power. In going through the car house we were much interested in the new and novel transfer table which was designed by M. Rounds, formerly with the Union Railway Co., and it is giving most excellent satisfaction. The table is long enough to receive a ten ton radial truck car, and operates so easily that one man can easily move it across the car house. The table runs upon six wheels which are about two feet in diameter, all having trip roller bearings. There are three tracks, and the middle wheels are flangeless, but are provided with a starting lever, having a rack and dog, so that one man can easily start the load and then can push it along with comparative ease. The company have ordered of the Union Street Railway Supply Co., of Mansfield, Mass., a number of electric snow plows, modeled after a machine which was in operation on their lines all last winter, and which was designed by the superintendent and Mr. Rounds, and which was operated through all the storms of the past winter with great satisfaction to the management. The plow is operated by two S. R. G. 30 H. P. motors, and the motor shaft is geared to the axle by a pair of ordinary split car gears, thus obviating the use of a sprocket chain

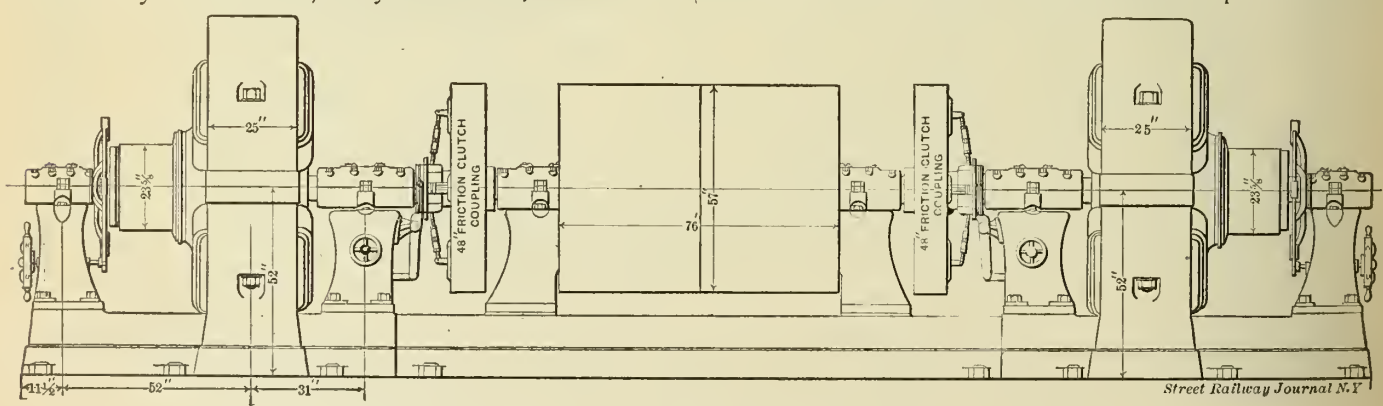
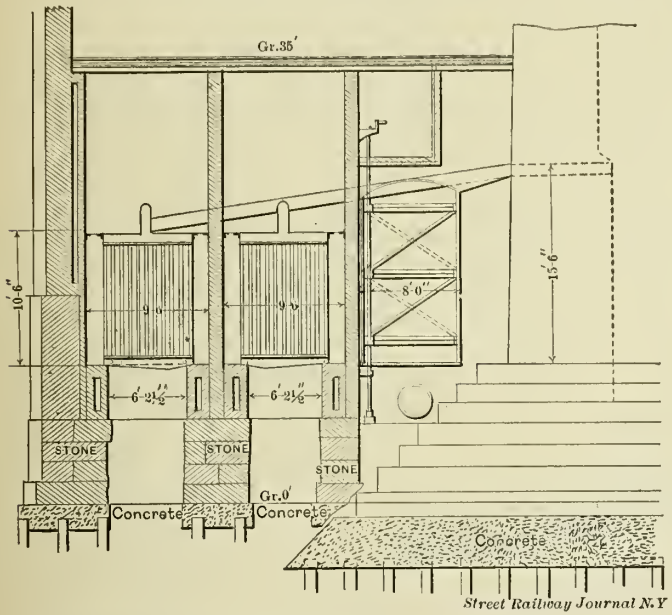


FIG. 5.—GENERATOR PULLEY AND CLUTCH COUPLING—BROOKLYN CITY RAILWAY CO.

which seldom gives satisfactory results. A system of simple levers operates the wings of the plow, and the steel track scraper is also readily raised or lowered as the conditions may require. The plow is a double ender, and works in either direction. The mechanism is covered with a plain cab, with windows for sufficient light. Mr. Potter informs us that he never operated a track cleaner with so good results as this home made plow gives. The company have recently removed the track brakes from their cable



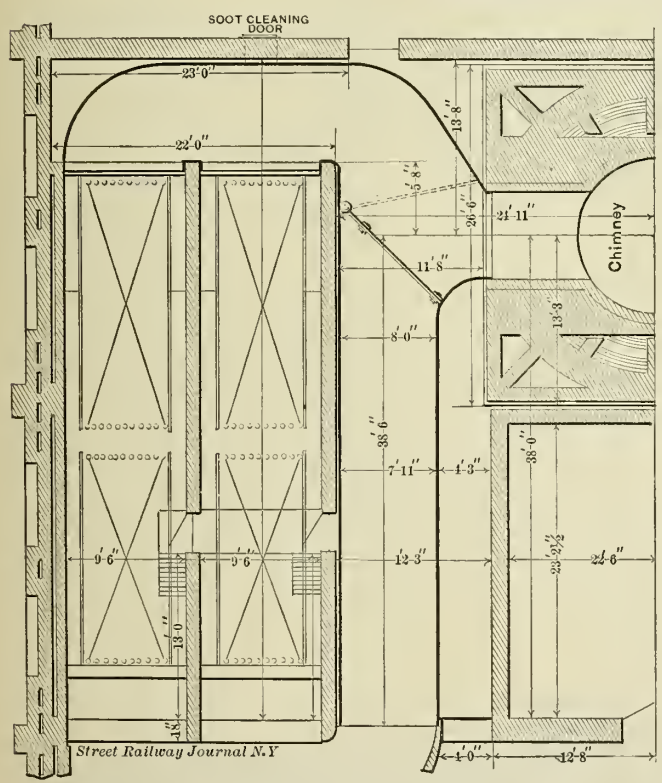


FIG. 6.—HALF PLAN AND ELEVATION OF ECONOMIZERS, FLUES AND CHIMNEY—BROOKLYN CITY RAILWAY CO.

grip cars and substituted the Kane brake, which has heretofore been used with satisfactory results on their horse car lines, and which we have before illustrated.

The success had with electric traction thus far in Providence has prompted the Union Railway Co. to make application to the Common Council for the privilege of operating the balance of their lines with electric power, but, unfortunately, the city authorities are inclined to impose upon the railway company very exacting requirements in regard to the extension, paving and grading of streets, besides a direct tax upon their income, which the company feel they cannot accept, so that the further development of electric traction in the city is likely to be delayed for some time.

The cable line operated by this company continues to give an excellent service, but some slight repairs have been necessary on the track owing to the rail, which is only thirty-five pound girder, being too light. The company have recently bought of the Roeblings a Lang lay rope which will soon be put in operation, and from which good results are expected. Owing to the increased traffic on the line, it has been found necessary to put a new and larger cylinder on the smaller of the two engines with which the lines are operated.

The Union Railway Co. have recently moved from their quarters on Market Square to the second floor of the Merchants' National Bank Building. The receiver's office, however, remains in the transfer building of the company on the bridge.

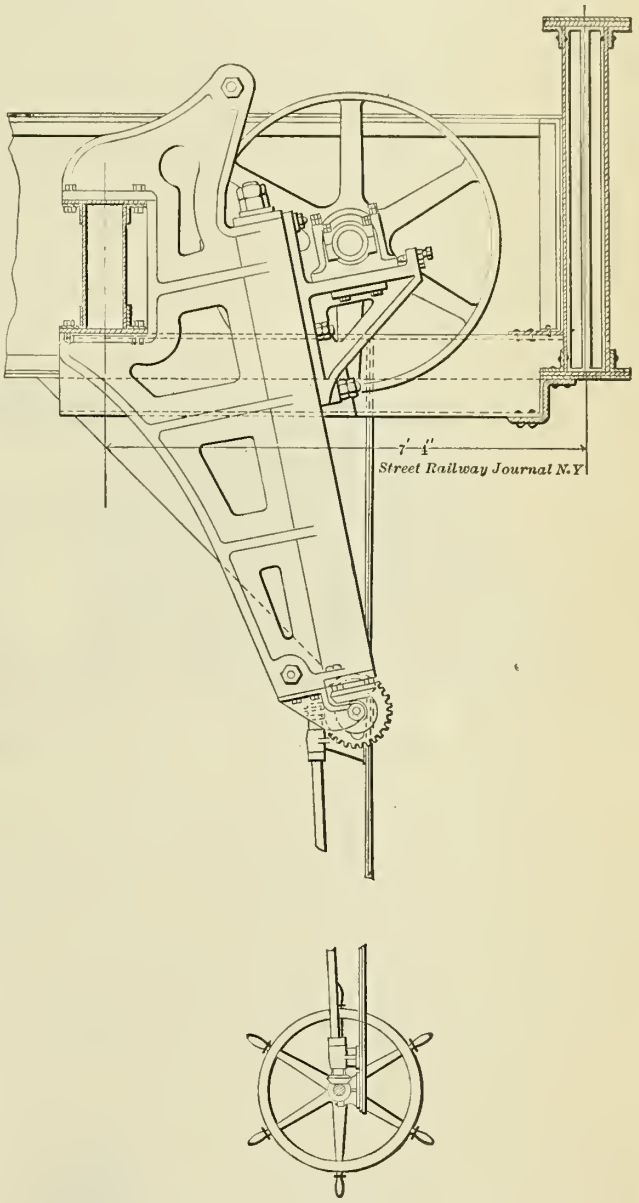


FIG. 7.—ENGINE BELT TIGHTENER AND OPERATING MECHANISM—BROOKLYN CITY RAILWAY CO.

The charter of the Union Railway Co. requires that they sell school tickets for one fare to all children who are obliged to ride on two lines in order to reach the High school. These tickets are supplied to the principal of the school from whom the pupils purchase them and at the same time are required to sign a statement that they will not use the tickets unlawfully or dispose of them to other parties. It is found, however, that in many cases very little regard is paid to this agreement, for the tickets are frequently presented on other than school days, and in some cases are disposed of by the pupils to parties who present them on all occasions, and to the conductors who turn them in as full fare in making their reports. This is another striking commentary on the indifference of the public, not to say dishonesty, in reference to dealing with street railway companies.

Woodland Avenue & West Side Street Railroad Co., Cleveland.

The Woodland Avenue & West Side Street Railroad of Cleveland hoped to be able to operate their cars by electricity during the present month, but a combination of circumstances has conspired to cause delay. It will be several weeks at the least before electric cars will traverse the tracks. As the company have embodied in their plans a number of radical departures from conventional lines, it is believed that a description of their new equipment will be of interest.

In their track construction the company have for the most part used Johnson rails, the weights of which are ninety-eight pounds and eighty-two pounds. One mile is laid with the Wharton rails, nine inches in height, and weighing ninety pounds. In the case of the Johnson rails the heavier are spiked to the ties, and the others rest on chairs. Oak ties, 5 × 8 ins., are laid at distances of two and a half feet from centres. It has been decided to suspend the joints, and a tie is laid within eight inches on each side of the joints. Special attention has been paid to tamping, and this work has been thoroughly done. The pavement is the ordinary Medina sandstone.

Each rail is wired by a No. 00 galvanized iron wire, and the joints are bonded on both the inside and outside of the rail. To provide a good ground in even the driest weather, the wire is run into the soil about twelve feet at points about 1,000 ft. apart, and connection is made with a sewer pipe, or a coil of wire is left in the earth, if no metallic connection is found.

Side pole construction is adopted for the entire line, and metal poles will be used throughout the system. On forty foot streets the three sections of the latter are four, five and six inches, standard sizes respectively; on the sixty foot streets and on curves the sizes are five, six and seven inches, extra heavy. The poles are treated with a coat of paint inside and outside, and the section which is to be buried receives a second coat. Their length is twenty-eight feet, of which six feet is underground. The poles were furnished by the Electrical Construction & Supply Co. of Pittsburgh.

The pole top is that of the Railway Equipment Co., of Chicago, who furnished the entire overhead equipment, with the exception of the wire, including hangers, glass insulators, etc.

The trolley wire is of the best Lake Superior copper, and the gauge is No. 0. B. & S. Most of the feed wire has a cross section of 500,000 circular mils. The entire wire and feeder contract was awarded to the McIntosh-Huntington Co., of Cleveland, who purchased their supply of the Western Electric Co., of Chicago.

The company decided to start with forty electric cars, and the order for the bodies and trucks was given to the J. G. Brill Co. The length of the bodies will be twenty-one feet, with platforms four feet six inches, making the cars thirty feet over all. They are to be finished in mahogany, with birch decorations for the ceiling. Doors at the side near the step are provided to facilitate getting on and off. Plate glass will be used in the windows, and cut glass in the ventilators. The latter will be of a new design, similar to those used in steam railway coaches. Wilton carpet will cover the seats. Illumination will be provided by ten incandescent lamps, one on each platform, and four each on two chandeliers within the car.

The power house, which is well under way, will embody a number of features which will render it of especial interest. The management determined upon departing from the ordinary practice only after extended study, and they believe their plant will show a marked economy in working. The building is located on the west side about 200 ft. from the Cuyahoga River, from which water is brought for condensing purposes in an eighteen inch main. The building has a frontage of 160 ft. and a depth of 140 ft. It is one story in height, and is built of brick with stone trimmings (Fig. 1).

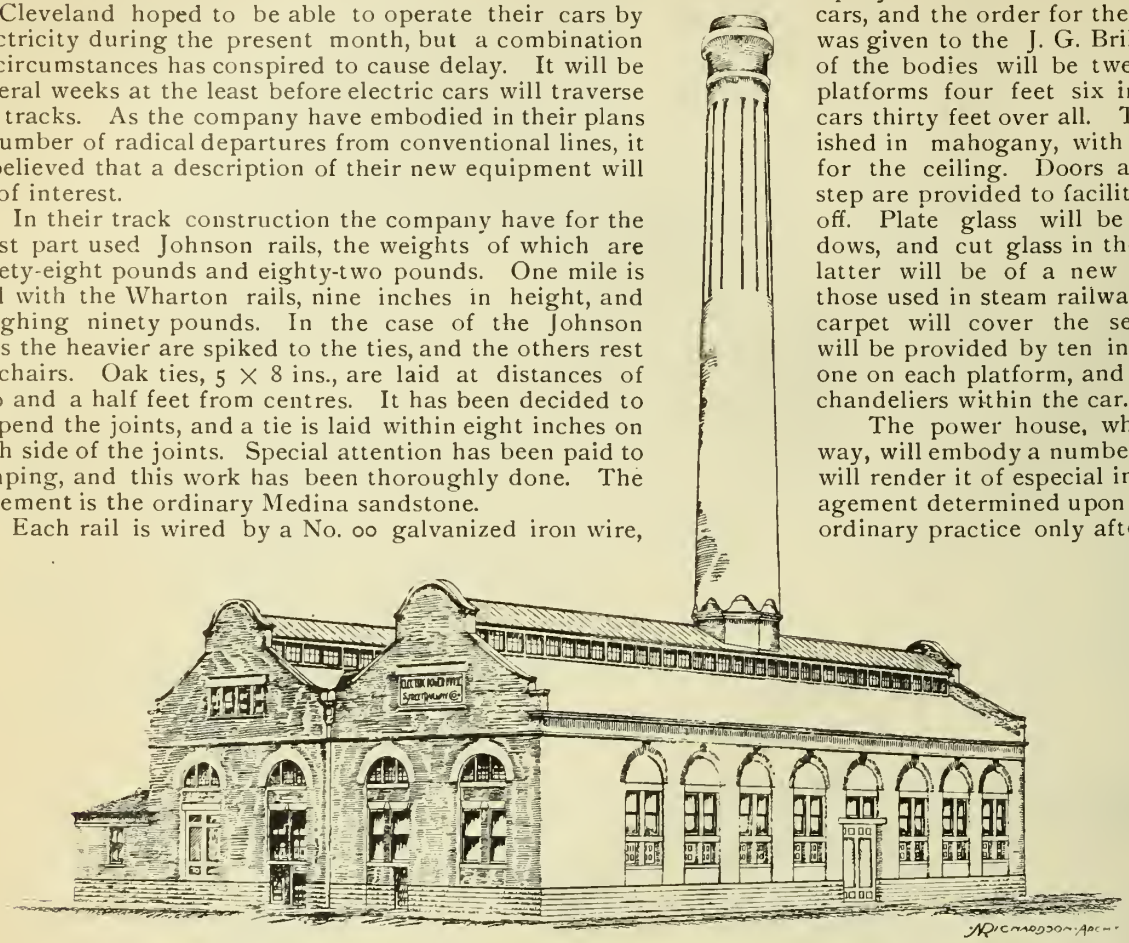


FIG. 1.—EXTERIOR OF POWER STATION—WOODLAND AVENUE & WEST SIDE RAILWAY.

The structure is covered by two separate roofs, one over the boiler room, and the other over the engine and generator room. The smoke stack rises to a height of 175 ft. and rests on a foundation built on piles.

To provide an abundance of air, a space of five feet will be left under the flooring; the latter will be constructed of I beams with arches of tile and covered with cement. Steam will be generated in three boilers of the Scotch marine type of a capacity of 500 H. P. each. The engines will be three in number, of the marine type and triple expansion. They will run with two foot stroke and 140 revolutions, making the piston speed 560 ft.

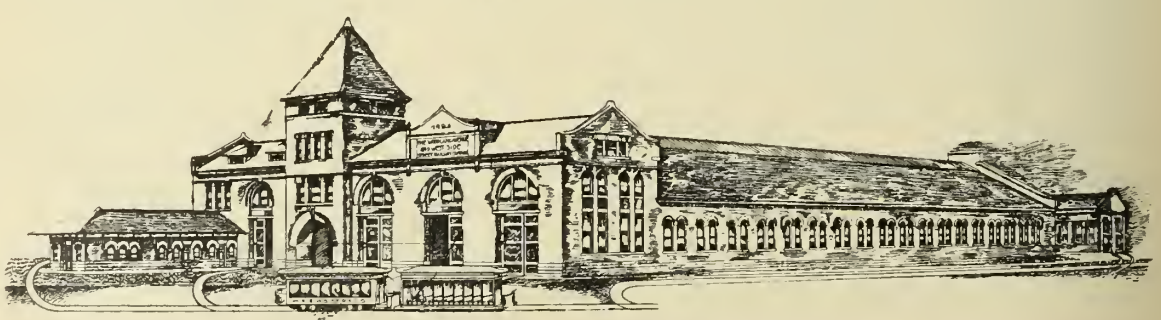


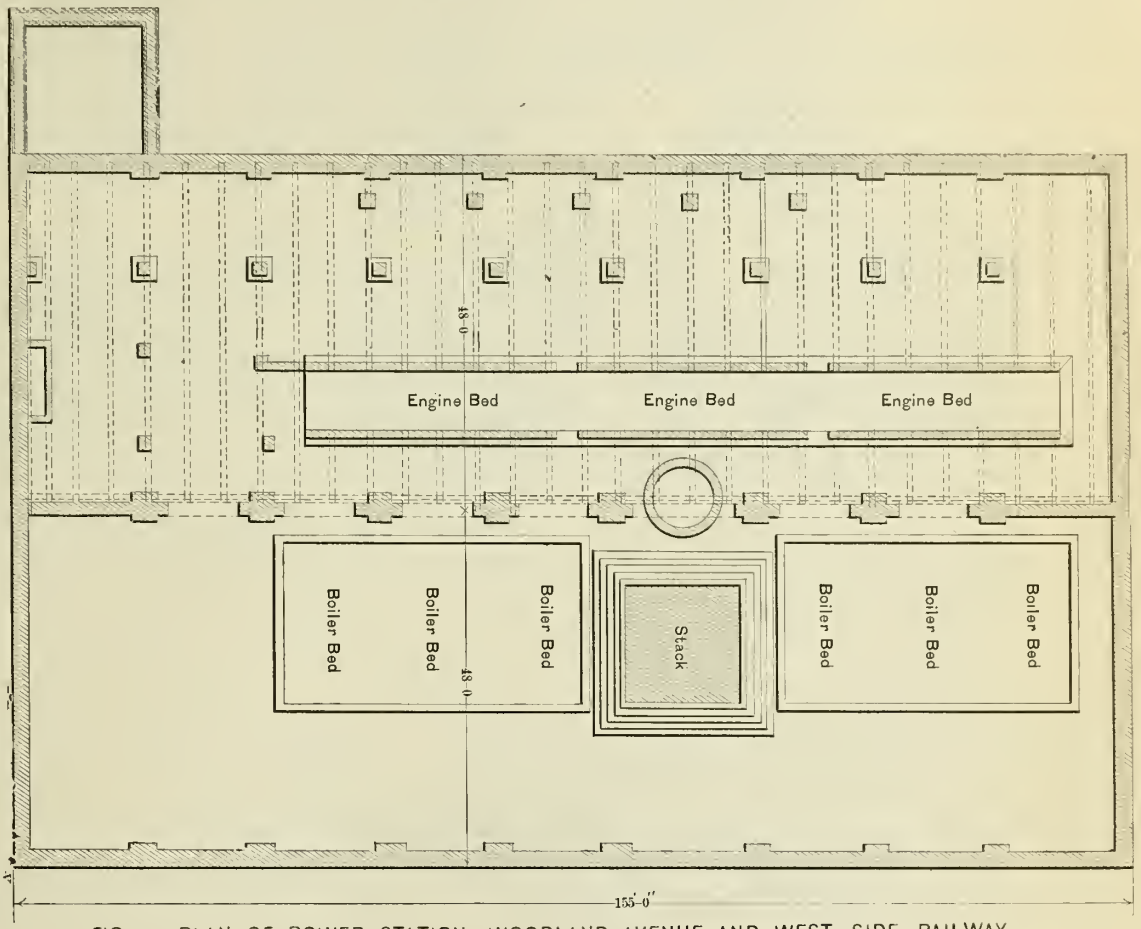
FIG. 2.—NEW CAR HOUSE—WOODLAND AVENUE & WEST SIDE RAILWAY.

Coupled to an extension of the engine shaft at each end will be a Westinghouse multipolar generator of 250 H. P., designed to run at 140 revolutions. The direct connection of triple expansion engine and generator has certainly not been attempted in this country heretofore, but the company are confident that the best results will be accomplished. The engine and boiler were constructed

by the Globe Iron Works Co., of Cleveland. The engine was originally designed for marine service, but the company consider that it embodies a number of substantial points of excellence for street railway service.

The switchboard will be of novel construction. The foundation will consist of a series of pillars on which will rest an I beam. On the latter will be laid a course of tarred wood, from which will rise a solid brick wall forming the switchboard. The face and ends will be built of enamel brick set very close. The brickwork will be ten feet six inches in length, and will be completed by an ornamental framework of antique oak, making its total length thirty-six feet. The measuring instruments, which are to be of Westinghouse type, are to be bolted through the brickwork, and connections through it will be made by means of rubber tubing.

In charge of the electrical installation is F. W. Waterman, of the Westinghouse company, of Pittsburgh, who has been most successful in designing much of the work, and who is responsible for a great many details which will be thoroughly appreciated when the system is in operation.



Foundation Plan

FIG. 3.—PLAN OF POWER STATION—WOODLAND AVENUE AND WEST SIDE RAILWAY.

The company have built an extensive new car house and shops at the corner of Lorain Avenue and Henley Street, about four miles from the down town terminus. The structure is brick withstone trimmings, and will be complete in its arrangement and equipment (Fig. 2).

The illustrations present a perspective view and a ground plan of the structure which is divided into two buildings, joined at the front by a tower rising to a height of seventy feet (Fig. 3). The total is 372 ft., and the frontage is 160 ft. on Lorain Street. Back of the tower the shops and car house are separated by a fifteen foot alley. The terminal loop is a track passing about the buildings and through an inspection room at the rear, equipped with pits and overhead platforms for inspection purposes. The cars stop at the waiting room for passengers, shown at the left in the perspective view. The arrangement of tracks is shown in the ground plan, a centre light designating each track. Cars may be readily switched at three points from the main track in front into the car house, and by a system of switches to any point in the building (Fig. 4).

They can in the same way be switched from the building at the rear. For 150 ft. at the rear of the car house the cars are run over pits, the tracks being supported on I beams. The shops will be fully equipped when finished with all of the most approved machinery for repair work.

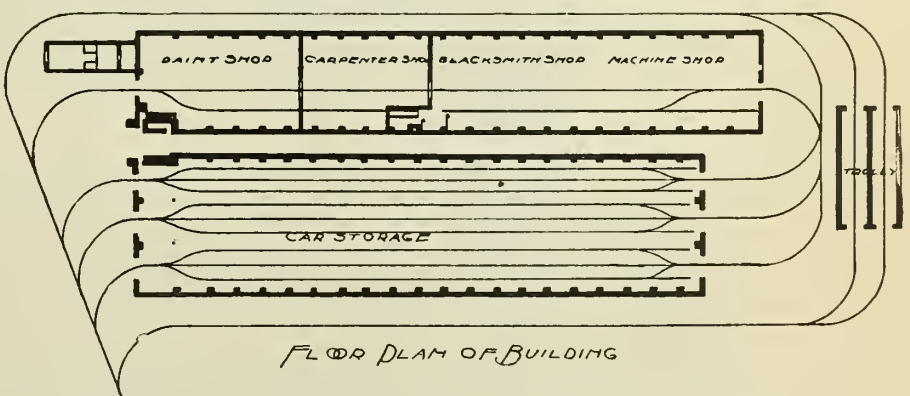


FIG. 4.—PLAN OF CAR HOUSE—WOODLAND AVENUE AND WEST SIDE RAILWAY.

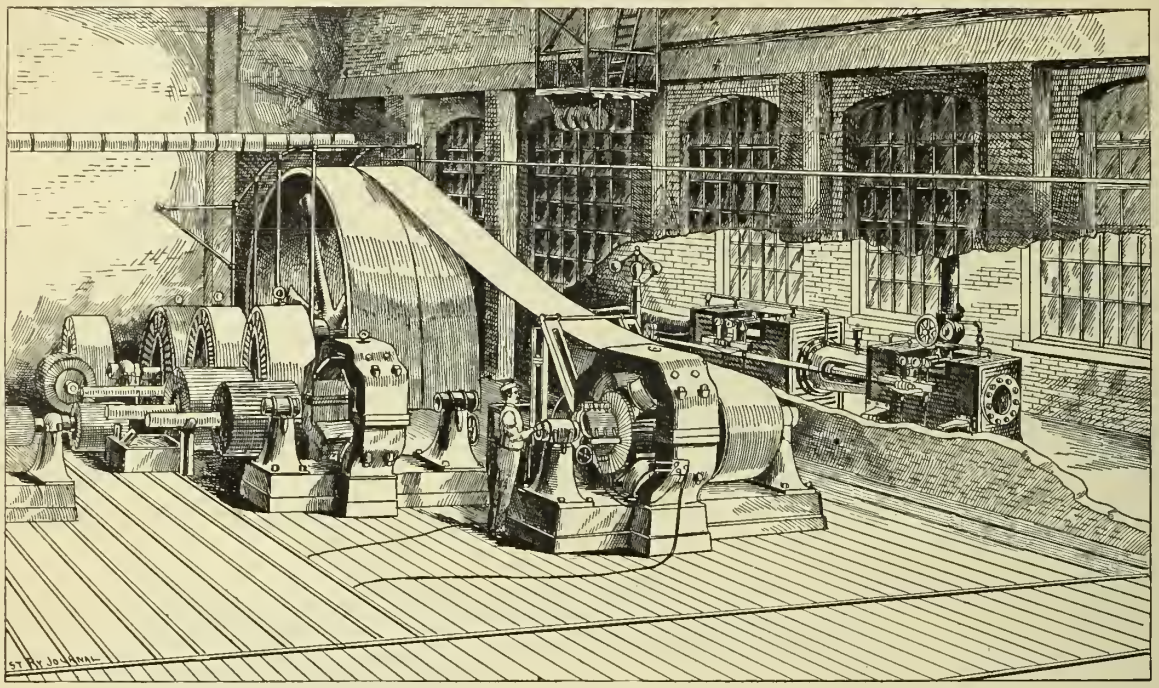
The Improved Greene Engine.

In describing the method of practice as found in the Thomson-Houston Works at Lynn, Mass., in our last issue, we noted the fact that a 1,000 H. P. Greene tandem, compound engine was employed for generating the power in the testing department. The engraving on the next page represents this engine in position, with the flywheel coupled direct to one generator and by belt to another. As will be seen from the illustration, the valve gear of this engine differs materially from the ordinary compound engine. The steam valve motion is of the detachable type, the valves being closed by steam pressure on the ends of the large valve stems, insuring a quick and positive cut-off under all conditions of speed.

The exhaust valves are operated by an independent eccentric, thus allowing of adjustment without interfering with the steam valve mechanism. Both steam and exhaust valves are of the flat slide or grid pattern.

The governor is supplied with a device to automatically stop the engine should the governor belt run off or break, and also a special appliance by means of which the speed of the engine may be changed through a range of

twenty revolutions while it is in motion. This was rendered necessary by the peculiar duty the engine is called upon to perform in the testing of dynamos and generators. The cylinders are respectively seventeen and a half and twenty-eight inches in diameter by forty-eight inches stroke, and is designed to run at 108 revolutions, with an initial steam pressure of 150 lbs. The flywheel is eighteen feet in diameter with a five foot face, being of sufficient width to receive two belts, and weighs about 67,000 lbs. The cylinders are lubricated by a Nathan compound lubricator and also by an oil pump placed in the spreader between the cylinders. All the wearing parts are provided with sight feed oilers, which may be filled or adjusted at any time while the engine is in motion. The low pressure cylinder is made of sufficient strength for a steam pressure of 100 lbs. per square inch, and the whole engine is of very substantial construction. The piping is so arranged that the high pressure cylinder may be disconnected, steam admitted direct to the low pressure cylinder, and the engine run single.

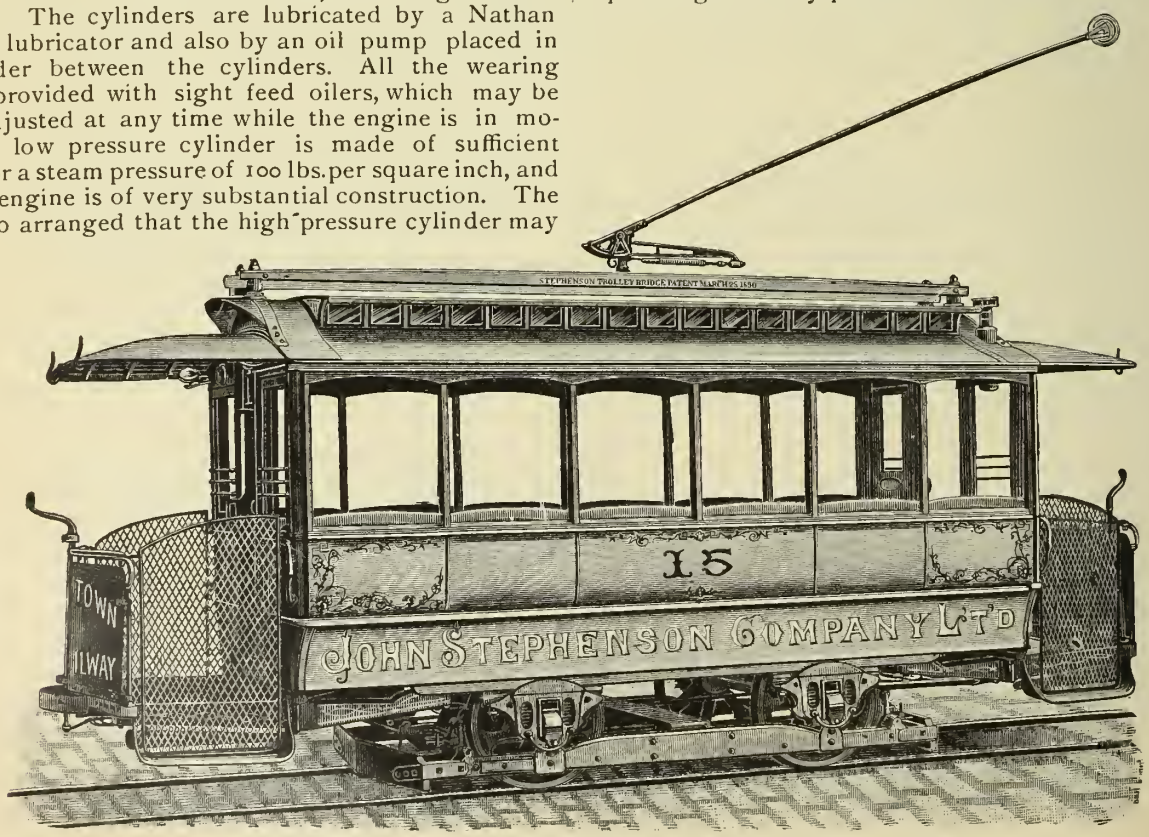


1,000 H. P. TANDEM COMPOUND ENGINE—THOMSON-HOUSTON ELECTRIC WORKS, LYNN, MASS.

The engine has given excellent satisfaction, so much so that a second 500 H. P Greene engine has also been installed in the works. The engine is manufactured by the Providence Steam Engine Co., of Providence, R. I.

New Stephenson Car and Truck.

The accompanying engraving shows a car recently built by the John Stephenson Co., Ltd., for Johnstown, N. Y., and mounted on the new Stephenson electric motor truck. The framework of this truck is of wood reinforced by iron, insuring durability and elasticity, and it is supplied with outside bearing brakes which are self equalizing and very powerful. The location of the brake gear outside of the wheels affords the maximum amount of room for the electric apparatus. Easy riding is secured by the regular Stephenson superspring gear.



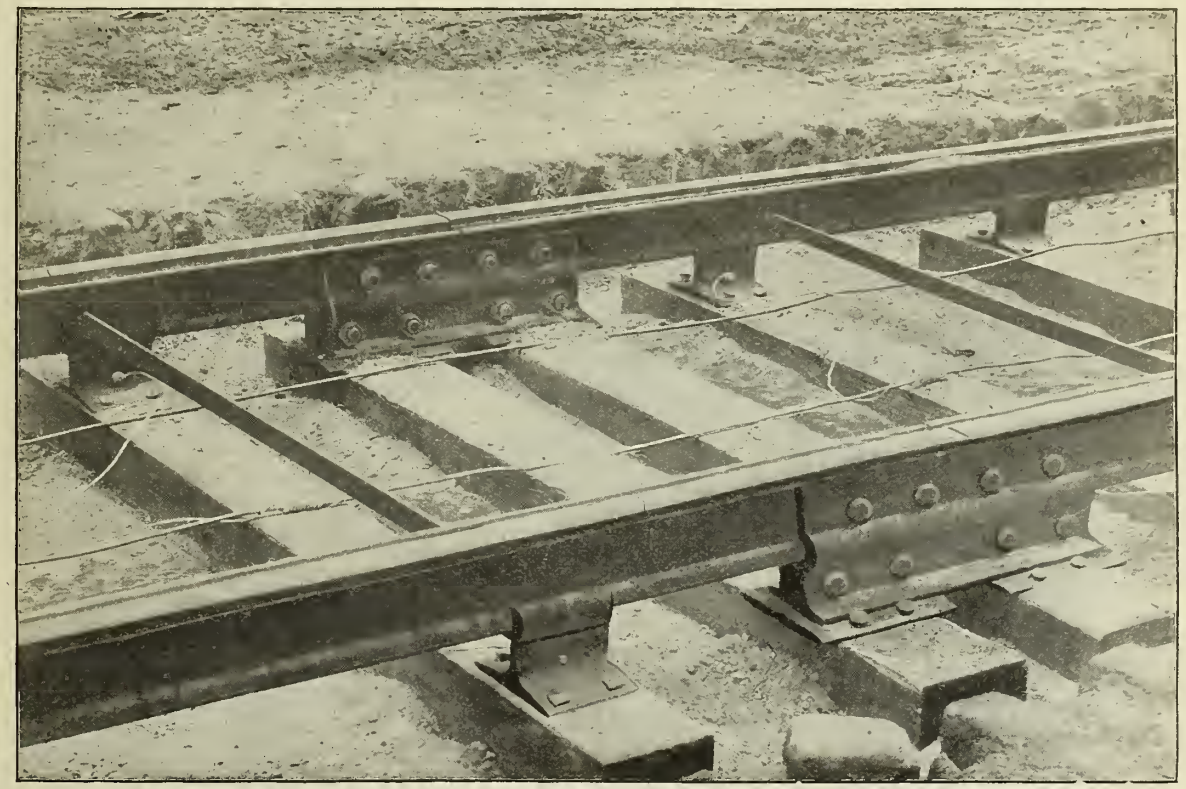
NEW STEPHENSON CAR AND TRUCK

The Stephenson standard trolley bridge is also an important feature of the car. This has been widely used and has everywhere given good satisfaction.

Recent Practice in Boston.

The West End Street Railway Co. have recently been relaying a portion of their tracks on Washington and Milk Streets, and on the former are using a seventy-two pound Johnson girder rail with chairs electrically welded, as shown in the accompanying illustration. The ties are laid on a six inch concrete foundation. A seventy-two pound Wharton girder is employed on Milk Street, and is laid on a 5 × 6 stringer. On some portions of the line, where a large number of electric cars pass a given section, they are putting in five No. 0 return wires thoroughly bonded to the rails. In some places, to improve the return circuit, the return wires are mounted on poles the same as the feed wires, and are connected with the rails about every 150 ft. by proper bonds which are led up the side of the pole. In order to meet this extra demand for feed wires, the company have recently purchased 320,000 lbs. of copper wire. The company have adopted a form of truck modeled somewhat after the Robinson radial type, but with all the parts much heavier than in former practice, and they are now building 200 of these trucks in their own shops. These trucks differ somewhat from the original model, in having a double set of springs and a cast iron bolster which is connected by arms to the middle truck. The intermediate wheels, which are twenty-two inches in diameter, have outside bearings, and the end wheels are thirty inches in diameter. The brake shoes are applied to both sides of the wheel, and are so hung that they require very little play. The centre portion of the truck is unobstructed, allowing ready access to the motor. Two twenty-five horse power motors are employed in winter, but in summer only one. The company have built 250 four wheel trucks of their own design for sixteen and twenty foot cars, and they are now building 200 more. These trucks have two sets of springs, one in the box to relieve the truck from shock and the other under the body. In all these trucks the Bemis box is used, and the axles are three and seven-eighths inches in diameter with a three inch journal bearing.

The mechanical department of the company has recently been reorganized, and Mr. F. S. Pearson, as chief engineer, has charge of car, truck and track repairs, the office of master mechanic having been abolished. L. S. Dumoulin is superintendent of the electrical department, and L. J. Hirt, superintendent of power stations.



RECENT TRACK CONSTRUCTION IN BOSTON, WITH ELECTRICALLY WELDED CHAIRS.

Chicago South Side Elevated Railway.

It has been stated heretofore that one of the great obstacles to the complete success of the Chicago & South Side Rapid Transit Co. lay in their inability to secure a right of way into the downtown section of the city. At present the road terminates at Congress Street, which is the extreme southern limit of the business district. To meet the requirements of passengers, an extension of the elevated structure, at least half a mile northward, is necessary. To such a course property owners have expressed themselves as unalterably opposed, and the problem has seemed to be an insoluble one, but it has just been announced that a route has been selected which meets all the demands of the public. It is a loop, and the line from the present terminus is as follows: Congress Street to Wabash Avenue, to Lake Street, to Clark, to Jackson, to Plymouth Place and to the starting point.

New cars and locomotives are being built for the road, and a special type of car will probably be used for World's Fair service. The sides of these cars will consist of an ornamental wire grating, having eight or nine gates through which the passengers enter, and which are opened and closed by a lever worked from the platform. They are centre aisle cars with seats for seventy people, and are so much lighter than ordinary "L" cars that an engine can haul one-third more cars in a train than ordinarily.

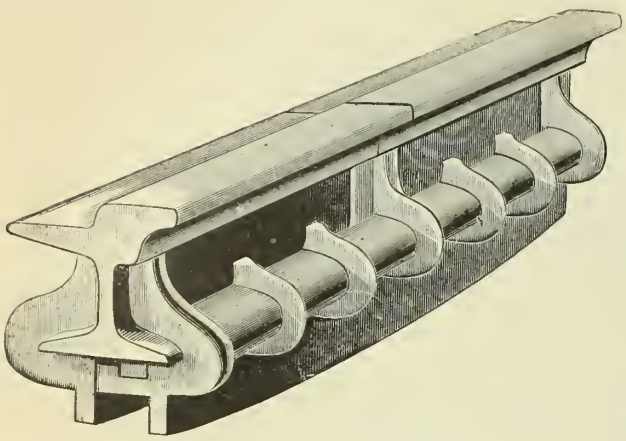
Electric Road for New Brunswick, N. J.

After some six months' negotiating, Edward J. Wessels, of 35 Wall Street, New York, has succeeded in purchasing a controlling interest in the New Brunswick City Railway Co. This is a horse road operating fourteen cars with forty horses. It is Mr. Wessels' intention to convert the road into an electrical road without delay, and it is expected that electric cars will be running before the end of December. The conditions are very favorable for good business.

The city itself has a population of some 21,000, and extensions will be made to Milltown and Highland Park, and surrounding towns. At a special meeting of the Board of Trade, held on September 23, resolutions were unanimously passed pledging the support of the entire Board in favor of the new road. It is expected that there will be considerable freight carried.

New Rail Joint Bridge or Suspended Joint.

A novel rail joint bridge or suspended joint, in which the use of bolts is entirely dispensed with, has been recently put on the market by the American Rail Joint Co., of Marion, Ind., and is illustrated in the accompanying engravings. The bridge or joint is of malleable iron, and, as will be seen from the engravings, is in two parts which can be easily fitted together without disturbing the position of the rails if they are already in place. It tightens on the wedge principle and fully accomplishes the purpose for which it is intended. The removal of the bridge or joint is an equally easy matter and requires only a few blows of a sledge.



FIGS. 1 AND 2.—NEW RAIL JOINT BRIDGE—SHOWING METHOD OF ATTACHMENT.

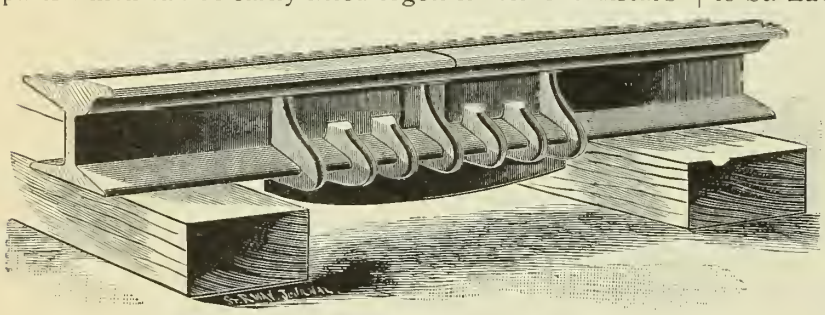


FIG. 3.—RAIL JOINT BRIDGE IN POSITION.

We understand this joint has been tested in actual use for some months and is highly spoken of by street railway men.

The device is equally adaptable to old construction and new work, and to all types of rail. The total length is from twelve to eighteen inches according to the work.

The Norwich (Conn.) street railway is in operation by electric power.

The Montreal Street Railway.

It is surprising to see what energy and push can do when they are placed in operation together. Montreal is a good example of both at the present moment. One month ago the franchise for the placing of an electric street railway in this city was given to the Montreal Street Railway Co. by the Council, and to-day there are nine miles of road in operation by that motive power. This can be placed to the credit of the new management, Messrs. James Ross, president; H. A. Everett, managing director, and Wm. McKenzie, president, Toronto Street Railway.

Although there were many difficulties to contend with, the managing director and his assistants succeeded in getting the following belt line finished in time for the Exposition, a distance of five miles around, starting from the corner of Bleury and Craig Streets, along the latter to Amherst, to Rachael, to St. Lawrence, to Mount Royal Avenue to Park Avenue, which being the same as Bleury Street completes the quickest five miles of road ever built in Canada, considering the difficulties that were continually being thrown in the way.

The new cars are models of workmanship, and the admiration of all the citizens. They were purchased from the Newburyport Car. Co., Mass., Amesbury Car Co., Mass., Crosen Car Co., Cobourg, Ont., and the St. Charles Omnibus & Car Co., Belleville, Ont. The motors in use at present are the Royal Electric, Edison, and Westinghouse.

Improved Radial Geared, Cantilever, Extension Truck. No. 5 A.

The accompanying engravings illustrate the accumulated experience of several years devoted to truck building, and the truck is claimed, by the inventor, to embrace all the most desirable features that experience has shown to be the best adapted for all conditions of electric service.

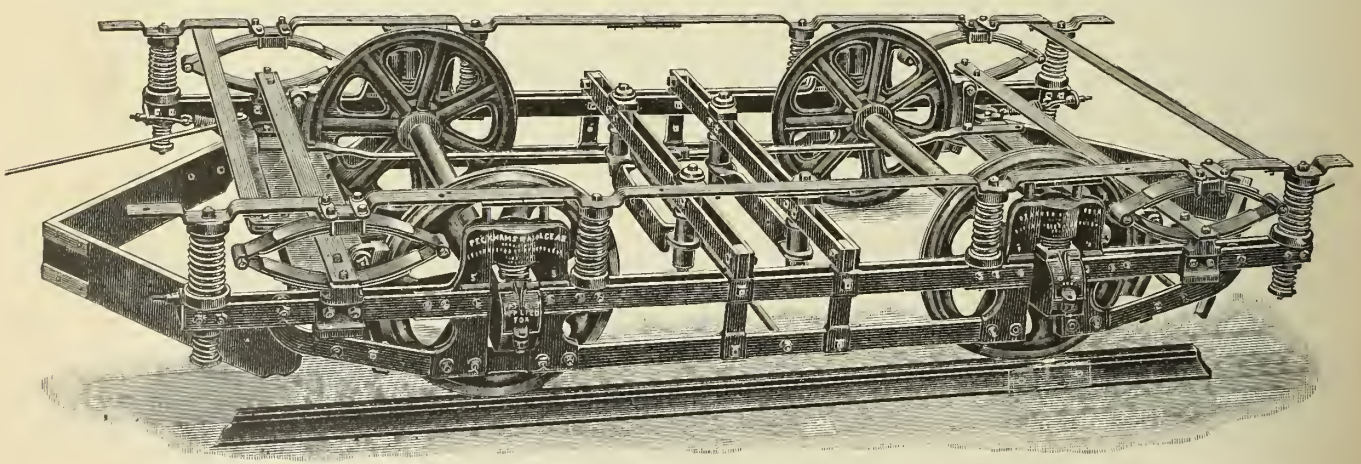


FIG. 1.—NO. 5A CANTILEVER EXTENSION TRUCK.

It is the invention of Mr. Edgar Peckham, of the Peckham Motor Truck & Wheel Co., of Kingston, N. Y., and though modeled somewhat after the type of the non-oscillating truck heretofore manufactured by this company, has a number of features which differ decidedly from the former type of truck. The cantilever principle of

supporting the ends of the frame is still retained, but the shape of the side bars is changed, and in place of the bolts the parts are firmly connected by rivets which were upset while hot, preventing the loosening of parts and dropping of bolts. The principle of the radial motor hanger is retained, but elliptical springs have been substituted for the spiral springs employed over the main bolster, while a graduated double spring is employed at the ends to prevent teetering.

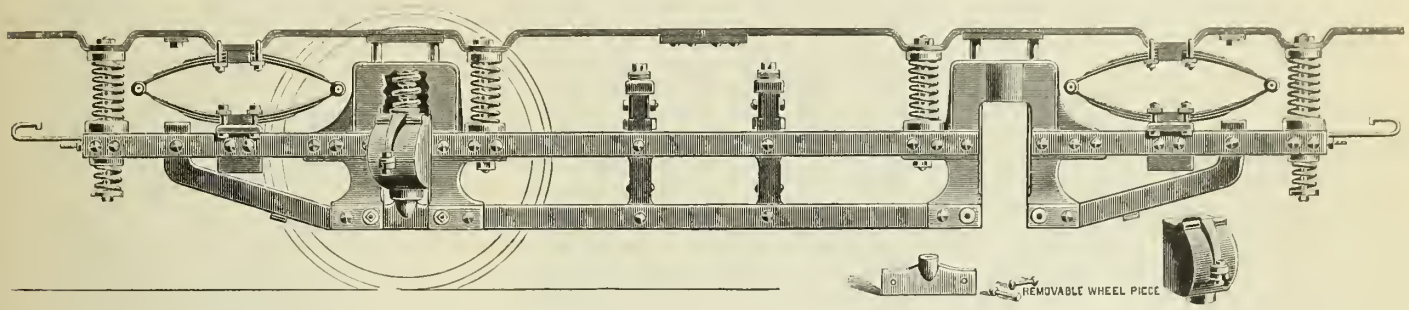


FIG. 2.—SIDE FRAME OF CANTILEVER EXTENSION TRUCK, NO. 5 A.

The radial box heretofore employed is retained with a few minor changes, and a double graduated spring is placed above the journal box to receive the shocks, which lesssens the wear on the truck very materially. A great deal of attention has been given to the design of the journal box, and the radial principle employed relieves the draft very much on curves and permits of electrical cars of from twenty-six to thirty feet being easily operated. The truck illustrated herewith is specially adapted to the Thomson-Houston W. P. equipment, but can be modified to suit any type of motor. It will be noted that there is no obstruction over the motor, so that it can readily be reached for inspection without the removal of any part, and the method of hanging insures the proper adjustment of gears under all conditions.

The inventor expresses himself as satisfied with this

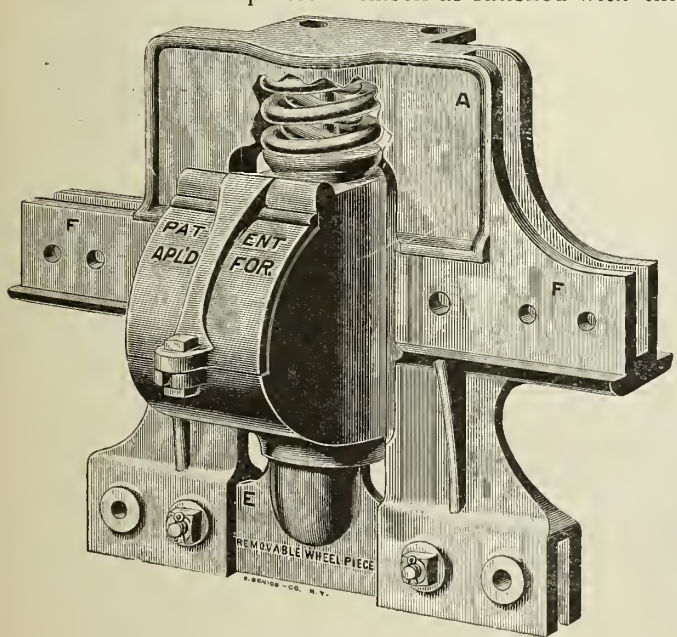


FIG. 3.—RADIAL GEAR, NO. 5 A TRUCK.

design and says that he has solved the problem to his entire satisfaction. The trucks have seen considerable service, ten of them having been in use on the Brooklyn City Railway lines for some time, and are also in use on the new cars being operated by the Union Railway Co. of New York.

The Brockton & Holbrook Street Railway was put in operation September 19, the first car leaving the former town at 6:45 in the morning. There was a large celebration at Holbrook over the affair. The whole town was decorated, fireworks were displayed in abundance and there was much speech making. The affair terminated with a hop in the evening.

Brooklyn Tower Wagon.

A considerable portion of the line of the Atlantic Avenue Railroad Co., of Brooklyn, N. Y., extends under the elevated railway structure in that city, and necessitated the use of a special type of tower wagon, which could be adjusted in height to the distance of the trolley wire above the ground. The company have, in consequence of these conditions, built and have in use two wagons somewhat different from any heretofore empoyed, as will be seen by reference to the engraving on this page.

The lower part of the tower is rigid, and is about seven feet three inches in height by four feet three inches square at the base, and is made up of angle iron. The upper part is of wood and fits into the iron part like a telescope, so that it can be raised to any height or lowered at will by means of a crank and windlass, one of which is provided on each side. Access to the tower is afforded by a ladder at the end.

Each wagon carries in addition two extra ladders,



ATLANTIC AVENUE RAILWAY TOWER WAGON.

two boxes of tools, wire, insulators, etc. The wheel gauge is a few inches wider than the track gauge to facilitate turning the wagon from the track to allow a car to pass. The wagon is nine feet long, and is drawn by one horse.

The new station of the Duluth Electric Railway has been put in operation. The engines here were furnished by the E. P. Allis Co., of Milwaukee, and are of 1,000 H. P.

It is stated that Messrs. Jarvis and Conklin of Kansas City, have sold out their interest in the Salt Lake City Railway Co., to Messrs. K. C. Chambers and A. W. McCune.

The Safety Steam Boiler.

In the accompanying engravings Fig. 1 shows a battery of Gill safety water tube steam boilers, manufactured by the Stearns Manufacturing Co., of Erie, Pa. The boilers

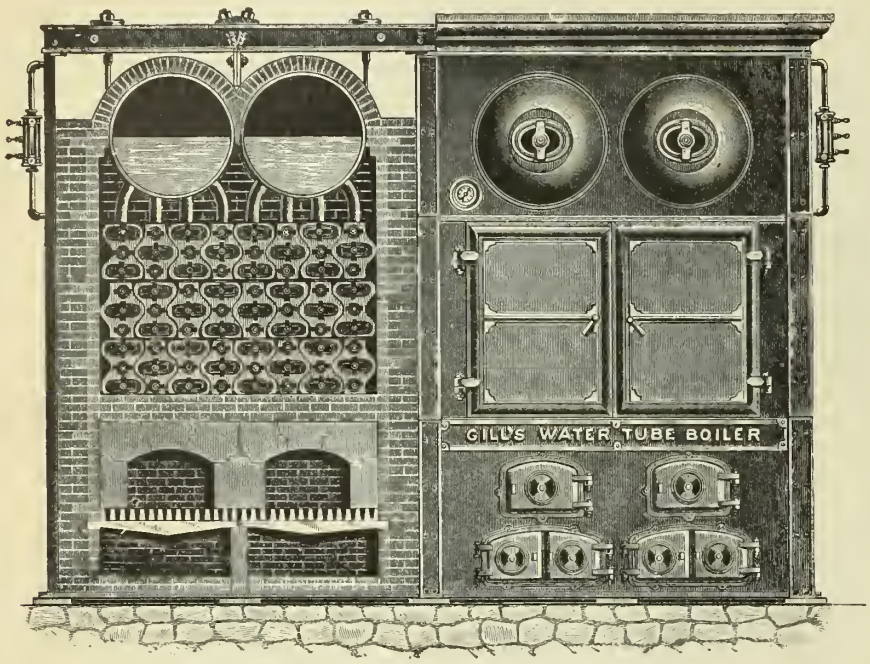


FIG. 1.—END VIEW—SAFETY WATER TUBE BOILER.

illustrated are of 200 H. P. each, and that on the left has the front removed. Fig. 2 is a longitudinal section of the same boiler, and gives a good idea of the arrangement of the different parts. The water tubes are four inches in diameter, and are inclined at an angle of about fifteen degrees from the horizontal, the tubes inclining upward from the rear toward the front of the boiler. Each nest of four or five tubes is expanded into a cast iron box or header at each end, and the tubes are placed about three inches apart and staggered. The connection between the headers and with the steam water drum consists of short tubes which are expanded into the top of the headers and into

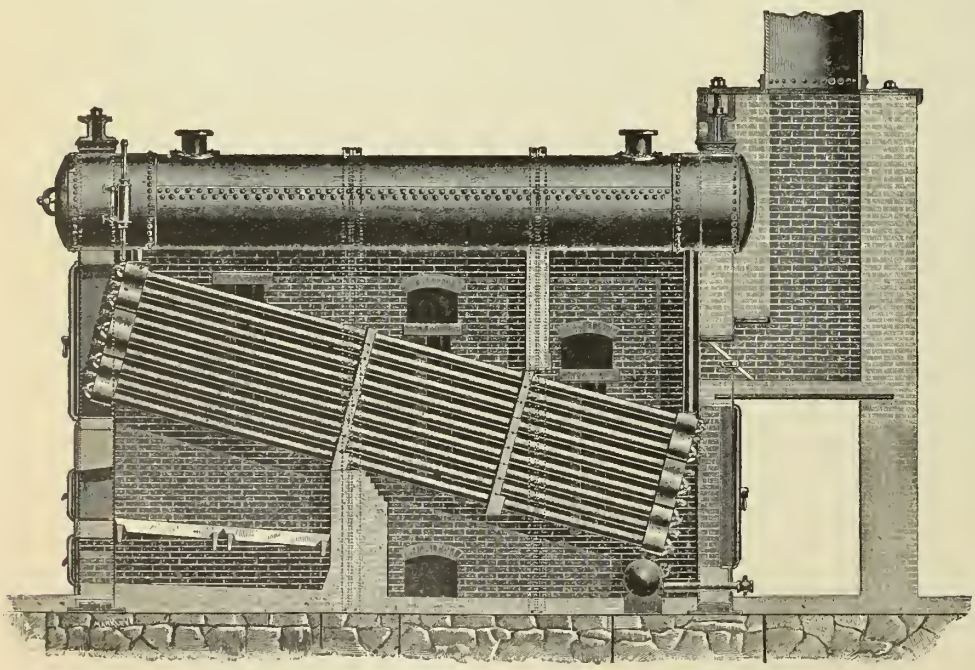


FIG. 2.—LONGITUDINAL SECTION—SAFETY WATER TUBE BOILER.

the drum, entering the latter radially, for which purpose they are curved to the proper form. The drums are of the best steel, vary in diameter from thirty to fifty inches, and have a thickness proportioned for the highest pressure desired, with ample factors for safety. Fig. 2 shows a bank of headers and a steam drum in detail. The column at the left hand shows headers of five and six holes, with the caps removed. The column at the right gives the appearance of the same headers, with the caps, bolts and dogs in place. The middle column shows headers of four and six holes, in section at the middle of the headers, and explains the manner of connecting the headers with each other and with the steam drum. A section through three headers and four tubes is shown at the base of the figure.

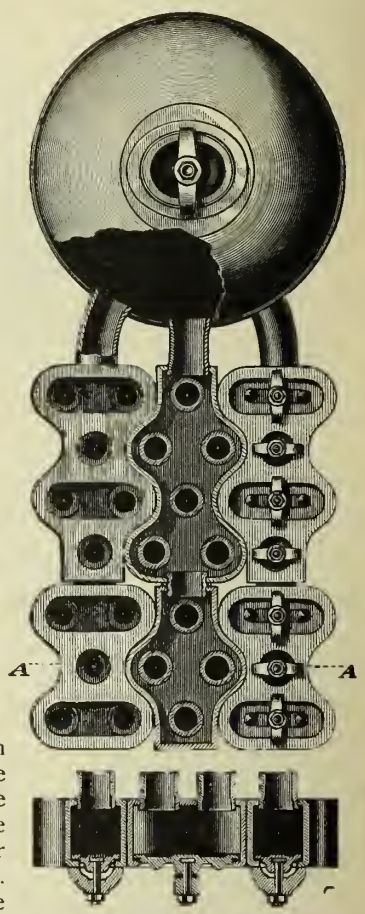


FIG. 3.—SECTION OF BANK OF HEADERS AND DRUM—SAFETY WATER TUBE BOILER.

Every part of the boiler is easily accessible, making the matter of repairs and cleaning simple. Access to all the points can be had by opening the large doors at the front or rear of the furnace. Narrow cleaning doors are also built in the side walls of the brick setting, through which a hose with a steam nozzle may be inserted for the purpose of blowing off any dust which may settle on the tubes. Two or three manholes are also built in the side walls, which allow the operator to enter the furnace above and below the tubes, if necessary. The boiler has been used extensively by electric light and street railway companies, and has given excellent satisfaction.

The Third Avenue Railway Co. of this city have recently purchased 400 horses from the Washington & Georgetown Railway Co., of Washington, D. C., and are still in the market for additional stock, as it is not expected that the cable line will be in operation before February or March of next year. The Third Avenue company have lost a large number of horses during the past summer, owing to the excessive heat and the increased labor imposed upon the animals in hauling their heavy cars over the grooved rail of the cable construction.

A Live Steam Purifying Filter.

It is well known that some scale forming impurities are retained in the feed water of a boiler at a temperature of 212 degs. in the feed water heater, but are liberated when the water becomes heated to the temperature of the steam in the boiler, say to over 300 degs. To prevent all such impurities becoming incrusted on the interior of the boiler is the object of the live steam purifying filter shown in the accompanying engravings, and manufactured by E. G. T. Colles & Co., 22 S. Jefferson St., Chicago.

The feed water, as will be seen, after leaving the heater passes into the steam space of the boiler by the feed pipe and falls over a spray feeder. This feeder is a hollow fluted cone with its apex directly under the mouth of the feed pipe, so that the water is spread, and soon becomes heated to the temperature of the steam in the boiler. The water falls from the spray feeder into a receiver placed just under the water line and thence passes into the filter, taking with it the surface water in the boiler which is thus continually being skimmed automatically.

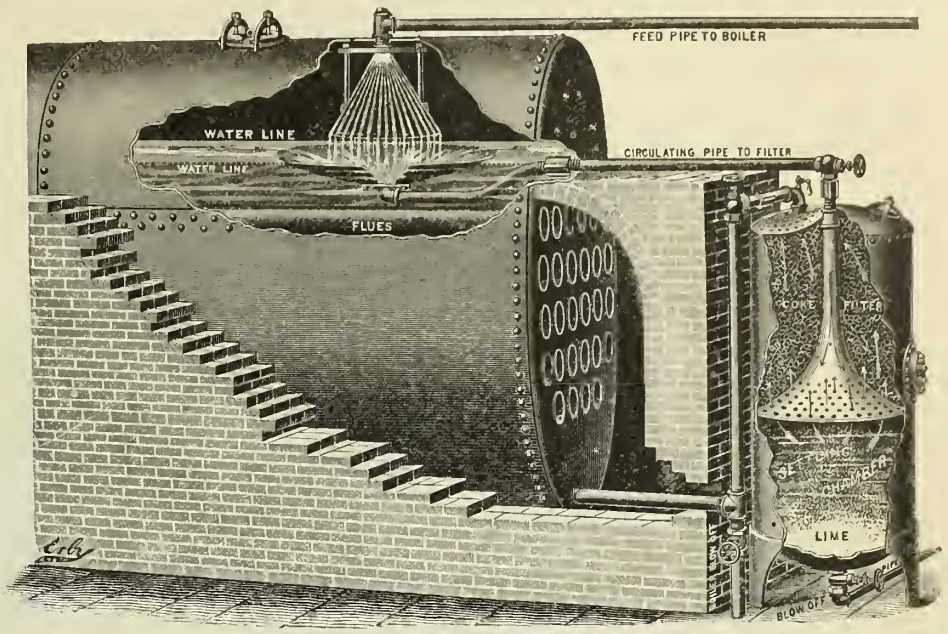


FIG. 1.—LIVE STEAM PURIFYING FILTER NO. 3.

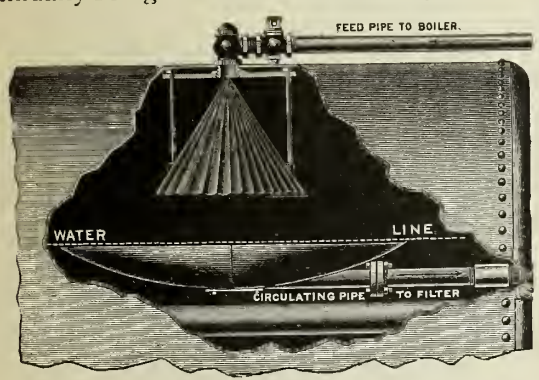


FIG. 2.—SPRAY FEEDER AND RECEIVER.

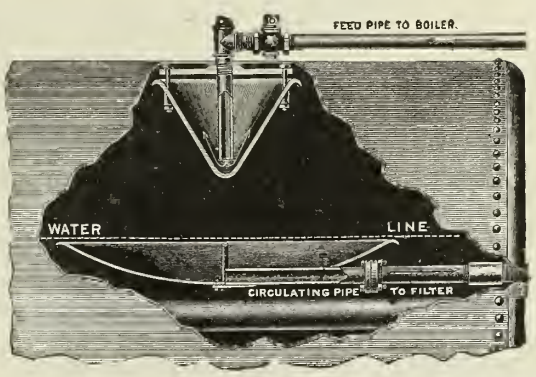


FIG. 3. WATER SEAL SPRAY FEEDER AND RECEIVER.

In its passage it gathers any impurity which may be separated and left behind in the boiler by evaporation. This water then passes through the filter inlet which is in the form of an inverted funnel, as shown, so that the downward circulation will not agitate the water in the settling chamber. The upper half of the filter is packed with common coke for filtering material, and as the area of the coke is 200 times that of the circulating pipe, the water passes up through the coke 200 times slower than through the circulating pipe, allowing ample time for its purification. The perforated plate above the filtering material serves to prevent the circulation from carrying the coke into the return pipe above it and thence to the boiler. The coke can be cleaned by closing the valve on the pipe between the filter and the top of the boiler and by opening the filter blow-off, so that the pressure of the steam in the boiler will drive the water down through the filtering material, washing it thoroughly. In this way the filtering material will last for years without changing. The coke can also be removed and replaced within a short space of time. Fig. 2 shows the spray feeder and receiver in detail, and Fig. 3 shows another type in section.

If desired, the filter can be used without the spray feeder and receiver, and under these circumstances the method of connection is that shown in Fig. 4. The return pipe from the purifier is shown entering the end of the mud drum, or it may enter the front head of the boiler as indicated by the dotted lines, or it may be connected to the boiler blow-off pipe as in Fig. 1.

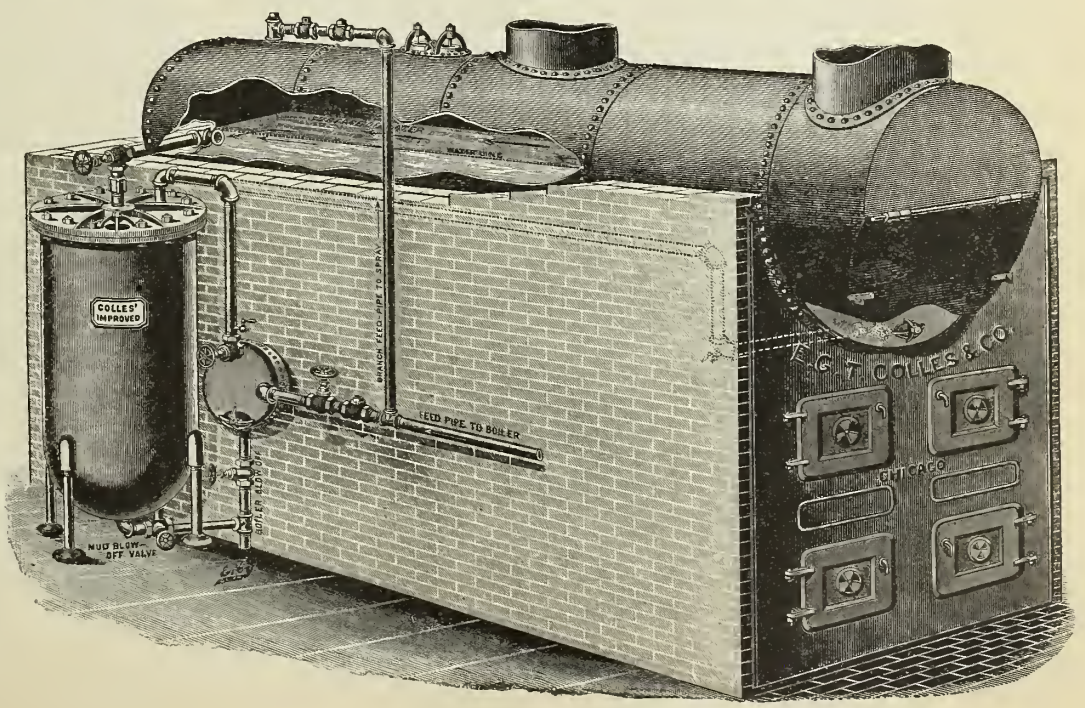


FIG. 4.—LIVE STEAM PURIFYING FILTER NO. 2.

New Vertical Triple Expansion Engine.

The engine shown in the accompanying illustrations, has been designed to meet the demand for a compact machine suitable for electric dynamo driving, and for other purposes where it is desirable to economize space, to secure economy in fuel, and to utilize the higher ranges of expansion, either as a condensing or non-condensing engine. As there are many places where it is not practicable to use a condenser on account of the scarcity of water, this engine has also been built to secure about the same economy with very high steam pressure without condensation.

A peculiarity of the design is that the engine is self contained and balanced. The reciprocating parts of the two sides have simultaneous opposite movements, the cranks being 180 degs. apart, and thus in a manner balancing each other. In consequence of this and the fact that each side is independently balanced by a counter weight on the crank, less foundation is required, and more quiet running produced than would otherwise be the case. This is very important in buildings where jarring from engines is very annoying. If it is desired that the engine shall be absolutely noiseless, it can be placed upon a foundation insulated on the bottom by cork from the foundation of the building, while on the sides packing or other material can be used that will not transmit noise or vibrations to the walls.

To meet the requirements of an engine using steam of 180 to 200 lbs. pressure, piston valves have been selected for the high and intermediate cylinders, and gridiron slide valves for the low pressure cylinders. By this means frictionless valves for the high and intermediate cylinders, where the pressure is high, are secured. In those cylinders the matter of clearance is comparatively unimportant.

In the low pressure cylinders, however, small clearances are very necessary for economy, and are brought about by the use of the gridiron valves in the cylinder heads.

The piston valve of the high pressure cylinder is actuated by a block sliding in the well known Fink link, so designed as to give it a perfectly equal lap and lead, and at the same time equal cut-offs at both ends of the cylinder. The position of this block, and, therefore, the cut-off, is con-

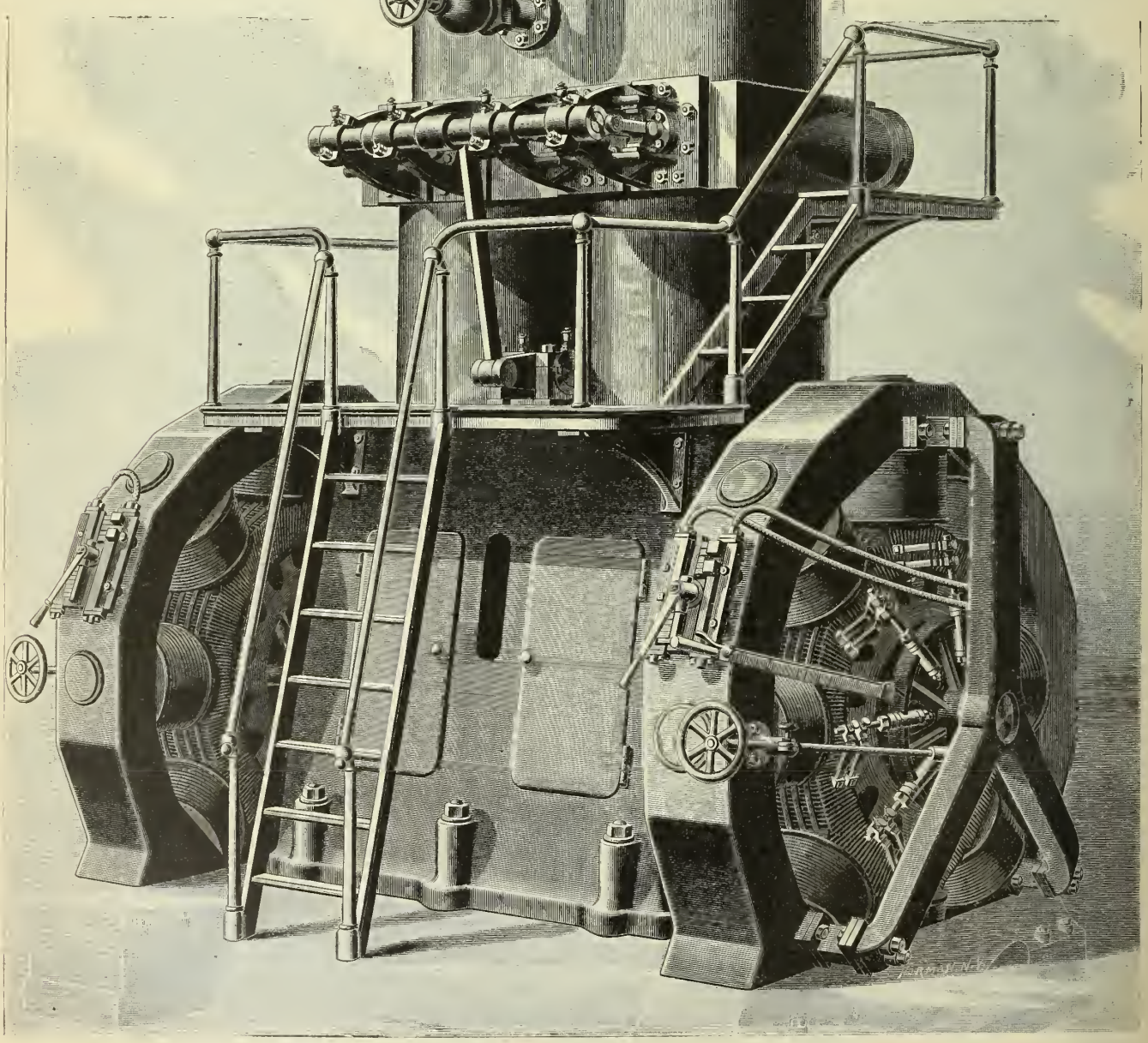
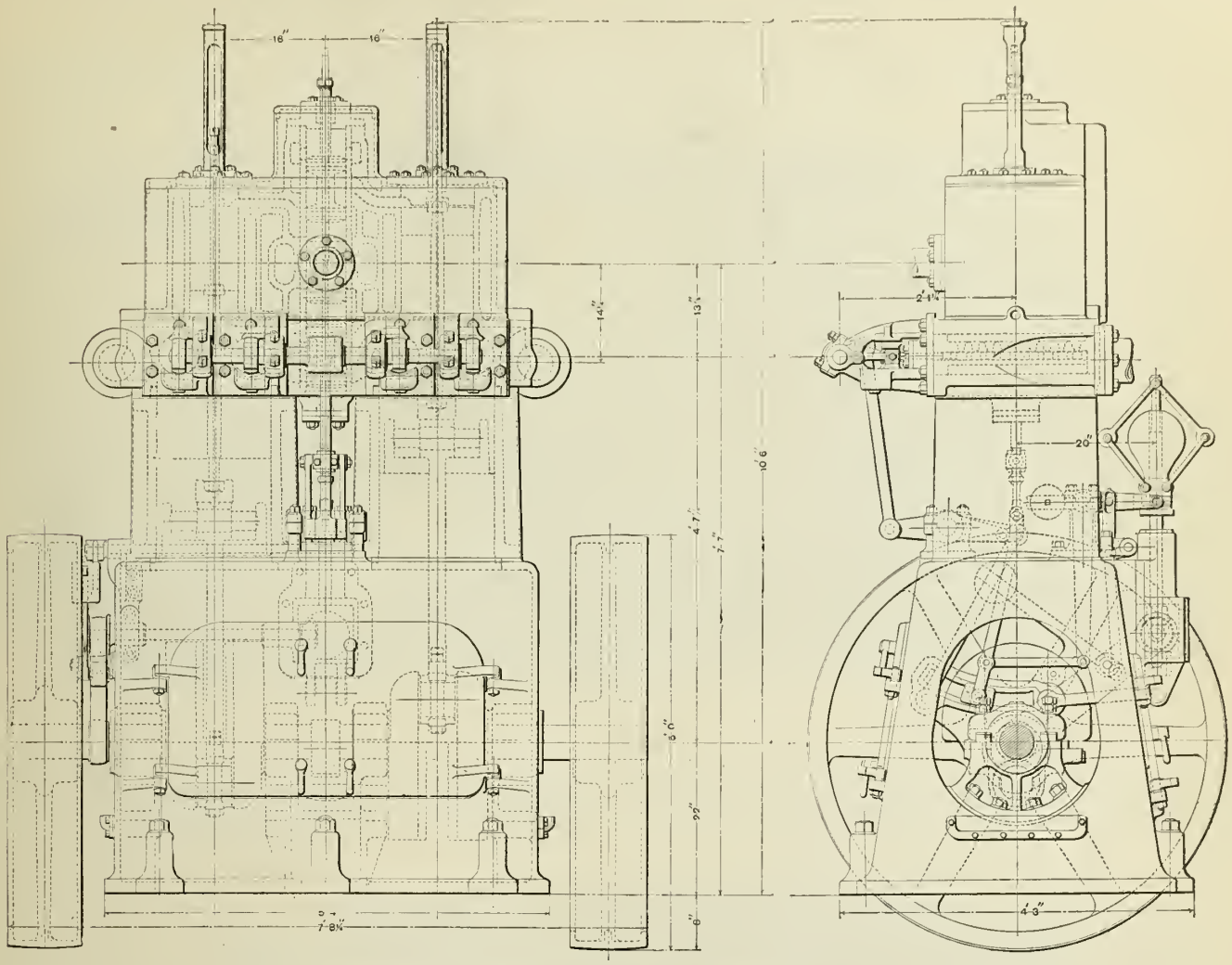


FIG. 1.—NEW VERTICAL TRIPLE EXPANSION ENGINE AND DIRECT CONNECTED GENERATORS.

trolled by a sensitive high speed governor, the resistance to the movement of which is very slight. The exhaust of the high pressure cylinder, and the admission and exhaust of the intermediate cylinder, are controlled by a connection to a fixed point at one end of the link. These valves have a fixed travel and point of cut-off. The movements of the low pressure valves, both inlet and exhaust, are produced by the connection of the Fink link, and are such that when these valves are unbalanced they are motionless. All pins and bushings in the valve gear are of hardened steel, thus reducing the wear and rendering replacement easy.



FIGS. 2 AND 3.—NEW VERTICAL COMPOUND ENGINE

The governor is provided with a safety device, so arranged that in case the governor belt breaks, the arms of the governor will be elevated and the link block thrown to an extreme position, thus cutting off the supply of steam and bringing the engine to a stop.

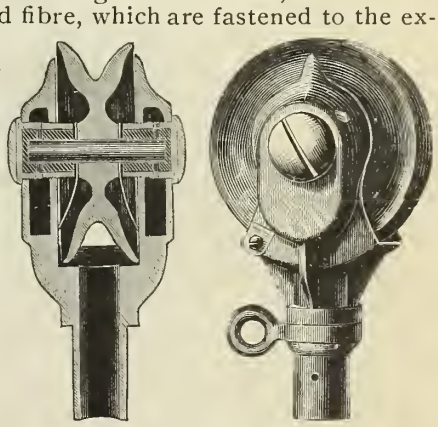
The crank shaft is forged from a solid steel ingot, and the counter weight is bolted on. The pedestals are bored and turned on their bases to fit the bored seat in the bed plate or frame of the engine, to which they are secured by ream bolts. The seats for these pedestals are bored by a single setting of a boring bar and are consequently in perfect alignment.

Two sizes of this engine are shown in the accompanying illustrations, one (Fig. 1) being of 250 indicated H. P., and the others (Figs. 2 and 3) are 150 indicated H. P. The first runs at a speed of 225 revolutions per minute, and the second at 300. It is the intention of the builders to manufacture these engines in sizes up to 2,500 H. P.

The engine described is the invention of Geo. S. Strong, of 45 Broadway, New York, and is manufactured by the Providence Steam Engine Co., who build the well known Greene automatic cut-off engine. This company believe that they are filling a long felt need for an economical high speed and high class steam engine. The details of the engine have been worked out under the supervision of F. W. Dean, of 53 State Street, Boston, Mass.

New Self-Oiling, Dustproof Trolley.

The advantages of a trolley which is self-oiling and completely dustproof will be readily recognized by street railway managers, and one for which these claims are made has been recently patented by E. M. Doig, of Denver, Colo. The accompanying cuts readily explain the method of construction. The frame or fork is made with two hollow chambers through which the bearings pass. These bearings are of brass, and contain bushings of vulcanized fibre, which are fastened to the exterior brass shell so that it does not revolve. The wheel is held fast on the shaft by a steel pin; the chambers in the fork are packed with wool and filled with oil which lubricates the interior of the bearing through holes drilled in the fibre. The current is communicated to the fork by strip washers riveted to the fork. The wheel will run about two months without re-oiling, and the fork shaft and bushing will last six to eight months. This device has been in use about eleven months on the West End Street Railroad of Denver, Colo., where it has given good satisfaction.

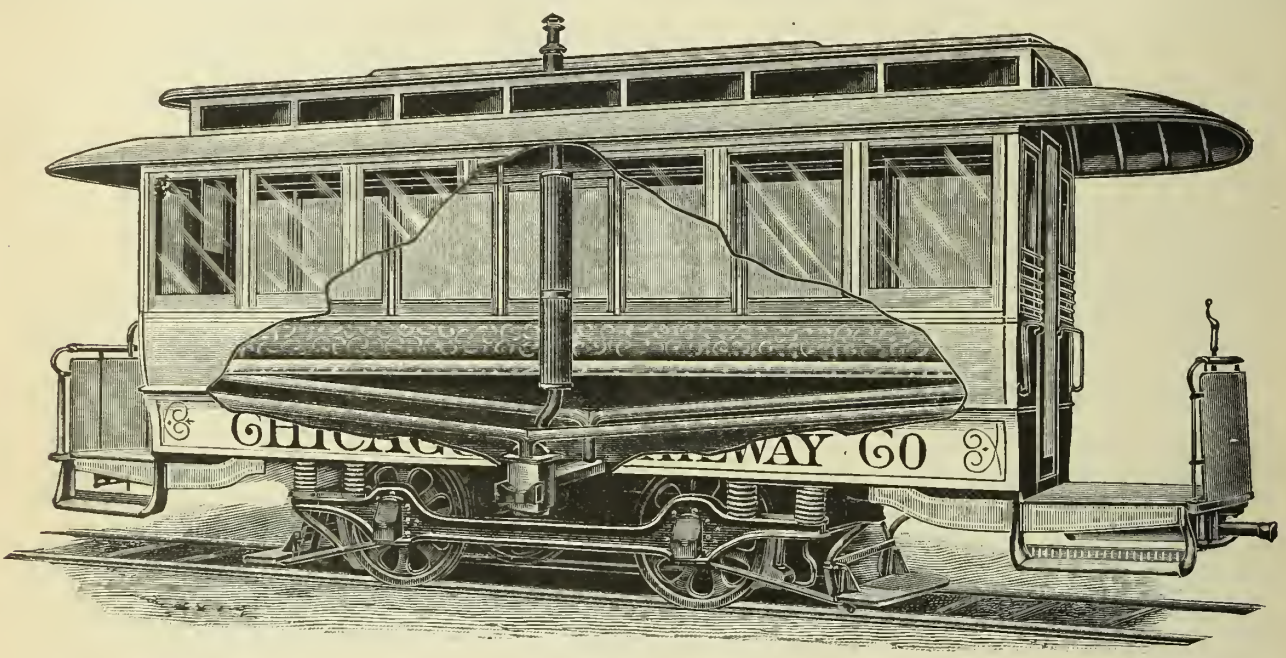


FIGS. 1 AND 2.—SELF-OILING DUST PROOF TROLLEY.

The Fiftieth Street, Astoria Ferry & Central Park Railway Co., of New York, have applied for right to operate several crosstown lines.

New Street Car Heater.

By using the heater shown in the illustration, it is claimed that both ends and both sides of a car may be comfortably warmed, while at the same time the temperature in the immediate vicinity of the stove is not raised to too high a point. The standard size is fifteen inches wide and deep, and extends thirteen inches below the floor, and four inches above it. Its location may be arranged as preferred, as the system of pipes makes it possible to distribute the heat uniformly throughout the car. The smoke pipe, which with its casing occupies only six inches, may be located either outside or through the middle of the seats, passing through either the upper or lower deck as desired.



NEW STREET CAR HEATER.

The heater is a self feeder, and requires only one damper in the pipe, which will control the fire satisfactorily. It is made of cast iron, and weighs 130 lbs. The grate is removable and can be replaced in a few moments without taking the heater apart, although this is a simple operation, as four bolts hold it together. The outer casing contains two separate air chambers, one for each side of the car, directly surrounding the firepot and combustion chamber. The heater, which is the invention of Lawrence Haas, is manufactured by the Haas Distributing Car Heater Co., of Grand Crossing, Ill.

Improved Ammonia Motor Car.

The ammonia motor system for street car propulsion, invented by P. J. McMahon, of Chicago, and described in our issue for January, 1892, has been recently modified and improved in a number of important particulars. The appearance of the latest car designed by Mr. McMahon, and now being built by the Railway Ammonia Motor Co., of 280 Broadway, is shown in the accompanying illustration. The most important change, as will be seen, from the car illustrated nine months ago is in the location of the ammonia and absorption tanks. These are now placed under the car floor, and therefore occupy no space available for passengers. A re-arrangement of the driving machinery, necessitated by this change has also been made.



AMMONIA MOTOR CAR.

The principle upon which the operation of the car

depends is the evaporation of liquid anhydrous ammonia which gives at 60 degs. Fah. 100 lbs. pressure, at 80 degs. 150 lbs. pressure, and at 115 degs. 225 lbs. pressure. The ammonia cylinder, charged with liquid anhydrous ammonia, is surrounded by an exterior tank, which is charged with warm water, one charge being sufficient, under ordinary conditions, for a car run of thirty miles. The outer tank, which also partially surrounds the engine cylinders, contains water heated to about 80 degs. Fah. and is, course, of connected with the exhaust. The absorption of the ammonia gas by the water in the tank is so rapid as to relieve the engine of all, or practically all, back pressure, while the heat generated is sufficient to prevent any freezing from the expansion of the ammonia. On the return to the charging station the diluted ammonia is withdrawn from the outer tank, and a new charge of anhydrous ammonia and warm water is substituted in both tanks, an operation requiring about two minutes' time, when the car is ready for another trip.

The cost of preparing the anhydrous ammonia for use at the charging station, the manufacturers state, is less than one cent per mile of car run, and the entire cost of operation per car mile for the system only one-third that of the horse car system. The cost of installation, it is claimed, is less by half for the same number of cars and traffic than with the electric system, the entire equipment for a ten mile line, with fifty cars and plant, being considerably under $200,000.

Works of the Falls Rivet & Machine Co.

The beautiful village of Cuyahoga Falls, O., has for its principal industry, the works of the Falls Rivet & Machine Co., which forms the subject of the accompanying illustrations.



FIG. 1.—VIEW OF FALLS RIVET & MACHINE CO.'S WORKS.

The company was established in 1874, for the purpose of manufacturing rivets, and to-day is the largest concern of the kind in the country. The growth of the company can almost be followed in the view showing the buildings this company now occupies. One by one they were added, until now they stretch out in single file down the tracks of the C., A & C. railroad for a considerable distance. The foundations shown in the engraving are for the new storage warehouse which the company is erecting.



FIG. 2.—VIEW OF PULLEY ROOM—FALLS RIVET & MACHINE CO.'S WORKS.

The Esmond Street Rail Co., of 106 Broadway, New York City, will exhibit at the Cleveland Convention sections of their jointless rail for street and steam railways. They will also exhibit the Esmond four and six wheel swing bolster truck for electric and steam cars.

In 1884, the company commenced the manufacture of patent pulleys, and the excellent reputation their goods attained brought increased business, so that they have gradually enlarged their facilities for manufacturing,

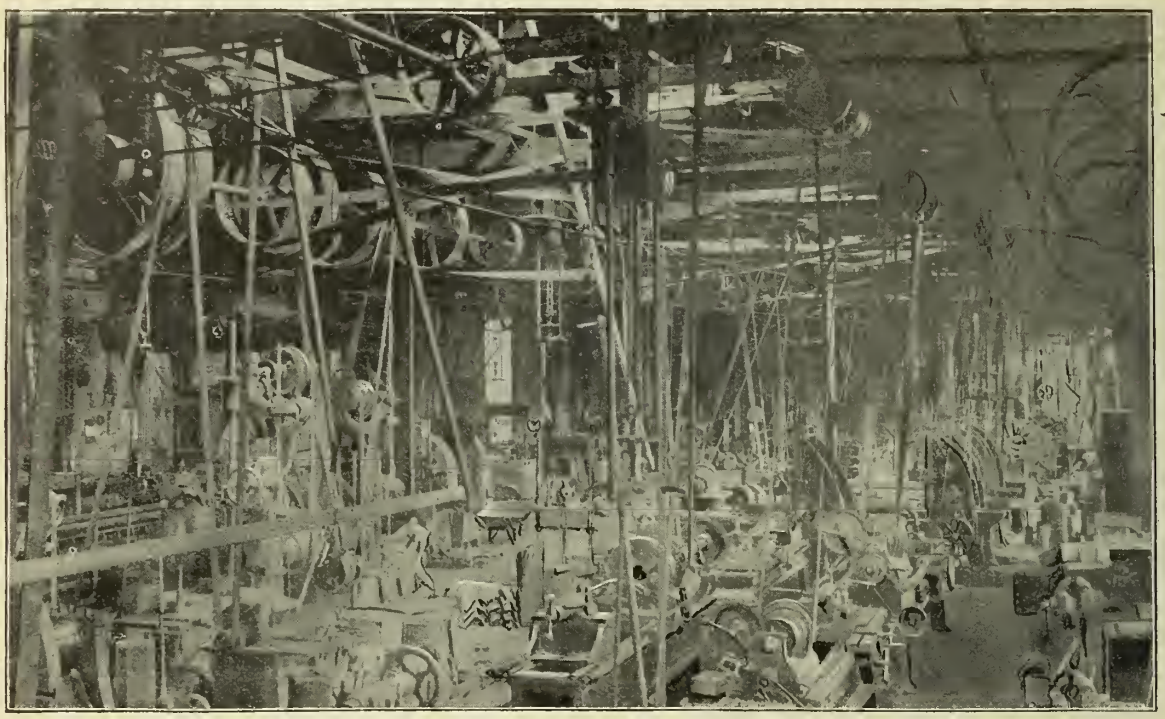


FIG. 3.—MACHINE SHOP—FALLS RIVET & MACHINE CO.'S WORKS.

until they have, to-day one of the most complete plants of the kind in the country.

The wide adoption of the electric railway has caused a demand for a special line of work in pulleys, clutches, shafting, etc., and the company was among the first to appreciate the extent of the new field and its requirements. Their clutch pulleys and cut-off couplings are well and favorably known and are used in all parts of the country in many of the largest electric railway and electric lighting plants.

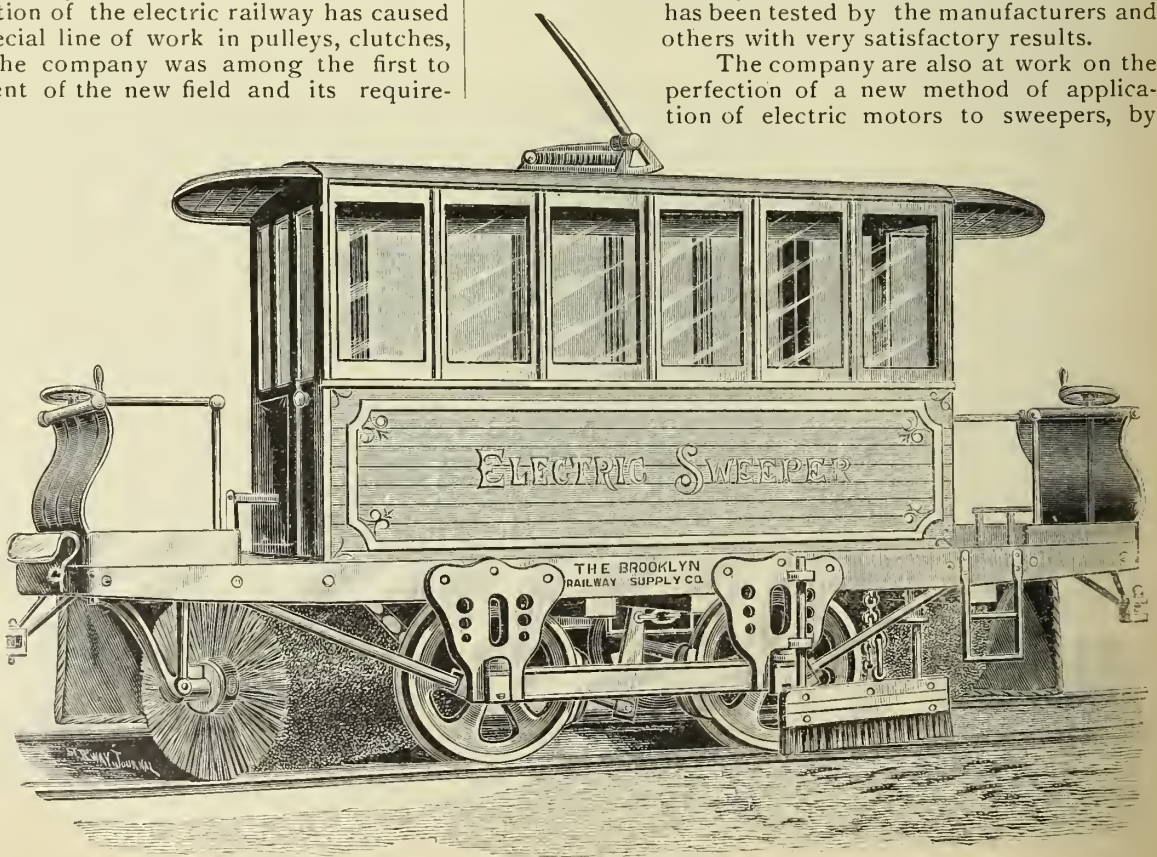
Fig. 2 shows the pulley department, and Fig. 2 portion of the general machine shop. Each of the shops is fitted up with the most improved labor and time saving machinery and the equipment of the foundry is no less interesting.

The electric railway of the Companhia Ferro Carril do Jardin Botanico, of Brazil, has been put in operation. The motors are of the Thomson Houston type. McIntosh & Seymour compound engines are employed, and the boilers were supplied by the Babcock & Wilcox Co. The cars were built by the John Stephenson Co. The railway was installed by James Mitchell, of the Thomson-Houston International Electric Co.

New Snow Sweeper.

A new electric snow sweeper, built by the Brooklyn Railway Supply Co., of Stamford, Conn., and recently placed by them on the market, is shown herewith. The mechanism is simple and compact, and the sweeper has been tested by the manufacturers and others with very satisfactory results.

The company are also at work on the perfection of a new method of application of electric motors to sweepers, by which one motor can be entirely dispensed with and the connection be made in a most direct manner. This company have recently enlarged their works, and with their long experience in the manufacture of street railway appliances have every facility for turning out an excellent line of goods.



NEW ELECTRIC SNOW SWEEPER.

Combined Safety Ground Brake, Spring Fender, and Electrical Cut-Off.

A novel combination brake and fender for electric and cable cars, which has shown good results upon severe trials in the city of Boston, is illustrated in the accompanying engravings in longitudinal and transverse elevation. The device is attached to the car under the platform immediately in front of the wheels. The brake fender is supported on an iron cross bar, and consists of a number of parallel steel spring rods coiled around the cross bar at the upper ends in the form of a helical spring, and in appearance resembles somewhat the teeth of an ordinary hay rake. The lower ends of these springs are curved, and then are covered with a leather hood or apron. In case of accident the brake fender is dropped upon the roadway by means of a lever operated by the motorman. The springs clutch tightly to the paving, thereby producing sufficient resistance or friction to stop the car in the short space of twenty feet. Owing to its flexibility, the machine accomplishes this result without sudden jar. At the same time, being in contact with the pavement, it absolutely prevents any body or other obstacle passing under the wheels.

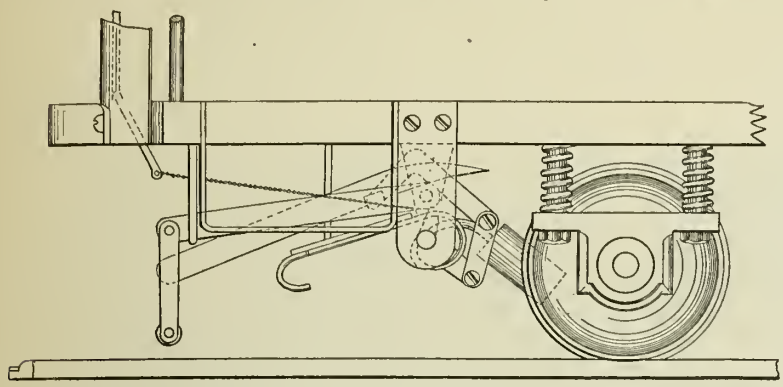


FIG. 1.—LONGITUDINAL ELEVATION—COMBINED BRAKE AND FENDER.

The fender, when not in use, is held away from the track by a pawl which is operated by a lever on the platform, under the control of a motorman, as already described. It may also be operated automatically, when an obstacle is encountered, by means of a light swinging tripper placed immediately under the dashboard, as shown in the illustration. By a cut-off device, not shown, the motor circuit is broken when the fender is dropped upon the paving. During the tests recently made in Boston, a loaded car running at a speed of about ten miles per hour was stopped by its agency, without the assistance of the ordinary brake, within the short space of twenty-one feet.

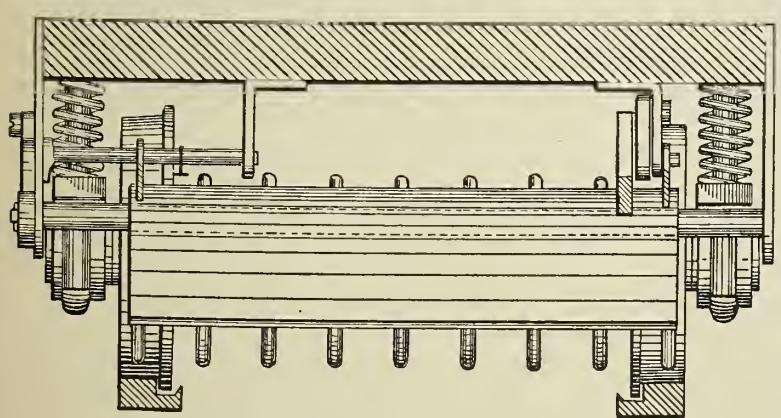


FIG. 2.—TRANSVERSE ELEVATION—COMBINED BRAKE AND FENDER.

Upon steep grades this appliance may become of great value to street railways in cases where accidents are brought about by reason of defective or broken brakes. The general manager, Mr. Francis M. Eppley, of 140 Nassau Street, New York City, states that the company is meeting with great encouragement in the introduction of this device.

Automatic Cable Grip Release.

An automatic releasing device for cable grips, the invention of A. D. & F. W. Smith, of St. Louis, has recently been given a rigorous test upon the upper loop of the St. Louis Railway Co.'s cable road, with a view to its adoption. The result of the test was thoroughly satisfactory, and has fully realized the expectations of the inventors.

The claims made for the device are its simplicity and its perfect adaptation to the work to be done. It does not in any way interfere with the ordinary handling of the grip, it is equally adapted to the side or bottom jaw pattern or grip, and the inventors claim to be able to follow the construction of grips which are operated from the end platform of grip car.

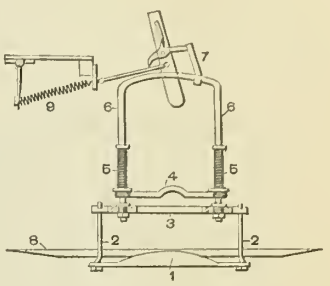
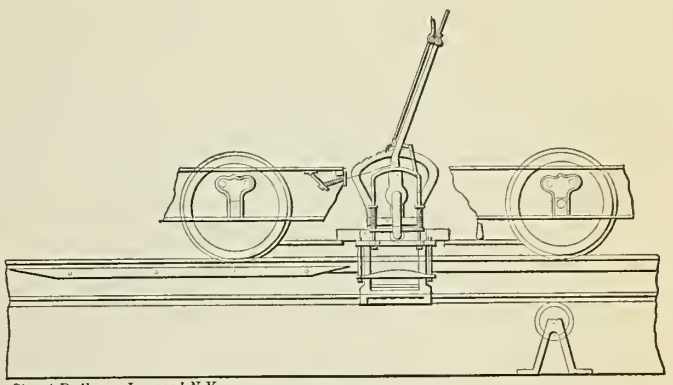


FIG. 1.

In Fig. 1, 1 is the frame or shoe passing on both sides of the grip below the slot rail and connected at the ends by the upward rods, 2, which pass up through the slot rail in front and rear of the grip and connect with the U shaped bar, 3. 4 is a bar passing on the inside of the eccentric leg, with loops on the end to encircle and guide the upright pieces of the frame, 6, and also forming with the grip the base for the springs, 5, which restore the frame to its normal position after passing the wedges. 6 is the vertical frame connecting with a short bar, 7, which lifts the dog out of the grip ratchet when the frame is depressed by the wedges in the subway. These wedges or bars, 8, are about sixteen feet long, and are placed one on each side of the conduit, and are attached to the slot rails or yokes.



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FIG. 2.—AUTOMATIC CABLE GRIP RELEASE.

The device has no permanent attachment to the grip, and can be removed from it in a few minutes by the loosening of a single nut.

Should the claims of the inventors be substantiated, this device will prove a boon to managers of cable roads, as it is intended to do away entirely with the possibility of cutting, kinking or stranding of ropes at crossings and wheels, by reason of the failure of the gripman to let go at the proper time.

The invention is controlled by the Automatic Cable Grip Release Co., of St. Louis.

The Street railway lines in Washington, D. C., were taxed to their uttermost capacity during the meeting of the Grand Army posts last month and accomplished wonders. The new cable line of the Washington & Georgetown company, especially, carried a large number of passengers, who were on their way to Arlington, and it is estimated that on the the first day alone at least 50,000 veterans took this trip. The Soldier's Home railway was also largely patronized.

Siemens & Halske Railway Generator.

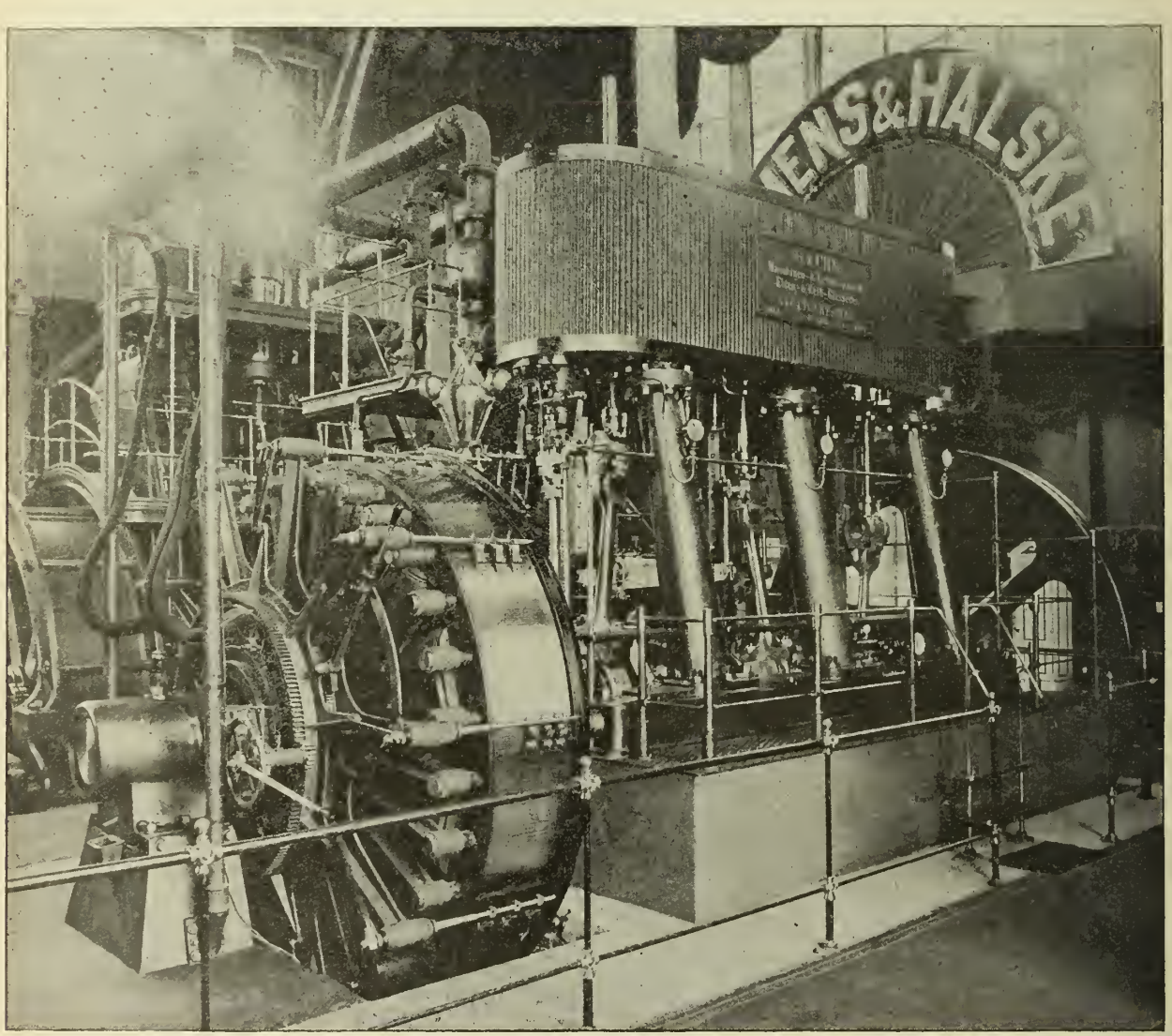
The work accomplished in electrical construction abroad by the Siemens & Halske Electric Co., of Germany, has been carefully watched on this side of the Atlantic, and now that this company have established a branch in America, a description of any of their apparatus will prove of even greater interest than before.

This company believing that large dynamos, coupled directly to the steam engine shaft, are bound to be the machines of the future, turned their attention to the designing and construction of such machines, and have gone from 500 H. P., to 1500 H. P. then to 2000 H. P. The wisdom of building large dynamos has been questioned by electrical engineers, and many arguments pro and con have resulted. Among others, Silvanus P. Thompson has expressed his preference for large generators, not through any admiration for mere bigness, as he says, but because he believes that the large machines may be made more efficient than the small in proportion to their cost, and in the same direction Kapp has showed that the output of generators in large sizes should vary very nearly as the square of their cost. The results found by the Siemens & Halske Co. tally very closely with these conclusions.

Their direct current railway and lighting generator, built in voltages of 100 to 700, is of the inside pole ring type, which class has from four to twelve poles. The poles are placed in the form of a star inside the rotating armature. The brushes, which are always of the same number as the field magnets, take off the current from the outside of the armature winding.

The armature itself consists of an iron ring wound with copper segments. The machine shown has ten poles and an output of 746 K. W. The loss of volts in the armature being only 2 per cent. with maximum load, and only 1½ per cent. of the power being required for exciting the field magnets, the electrical efficiency of the machine (746 K. W. size) is about 96½ per cent. It is shunt wound and has surface velocity of fifty feet per second.

The works of the Siemens & Halske Electric Co. of America are located in Chicago. They receive all drawings from Berlin and will duplicate the construction that has resulted from the vast experience gained by Siemens & Halske during the half century of their existence.



SIEMENS & HALSKE 746 K. W. DIRECT CONNECTED RAILWAY GENERATOR.

Improved Steel Truck.

Realizing that trucks should combine great strength with least weight, the Robinson Machine Co. of Altoona, Pa., have put on the market their improved "Standard" truck, built entirely of steel, and as bolts and nuts are liable to work loose, they have used rivets in its construction wherever possible, and in all vital points. Another important factor cared for in this truck is its ability to pass curves easily. The yokes, in which the journal boxes ride, are made of steel, which lends to them great flexibility, so that the truck passes through curves smoothly and without any disagreeable jarring, and at the same time does away with all rigidity and possible breakage.

Under the yoke rests an equalizing bar, to which is hung the life guard. By removing a bolt in each end of this bar it can be detatched together with the life guard, when wheels and axles can readily be removed without

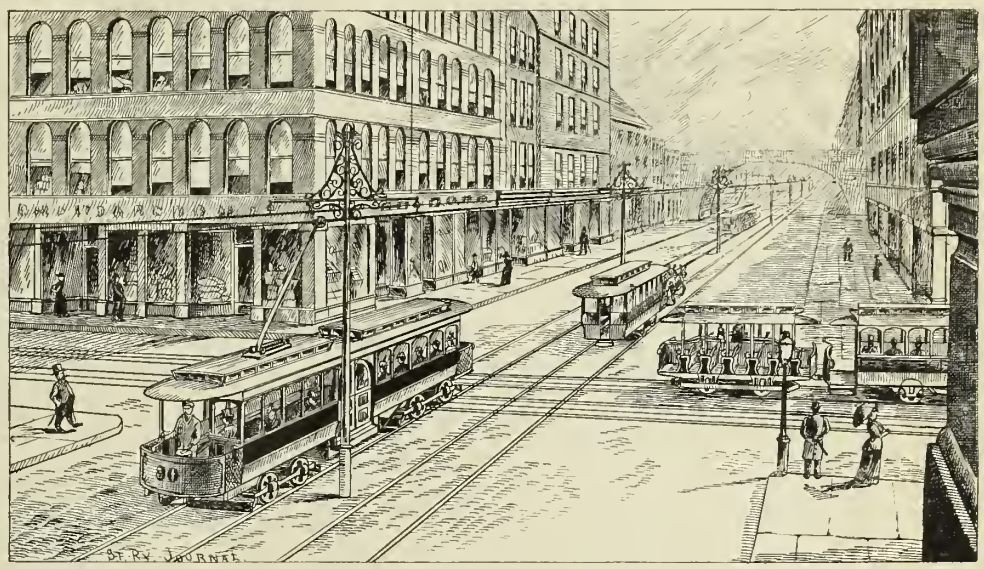
the necessity of jacking up both ends of the car. The brake is adequate to all demands made upon it, can be operated from either end, and clutches the wheel simultaneously. The mechanism of the brake lies overhead, or close to the bottom of the car body, so that it is out of the way of the motors—a very good feature. Brake shoes can be changed by pulling out a split key at the top, where they set in the brake head, an operation which can be quickly performed. The extending side arms of the yokes give an unusually extended spring base, overcoming all oscillation, and as twelve uniform springs are used, an easy riding car is secured. Upon the top of these springs runs a bar of steel well braced, so that a sixteen foot car body is supported its entire length ; this adds materially to the life of the car, as all strains are eliminated. Fewness of parts and simplicity of construction reduce the expense account for repairs to a minimum.

Another very desirable point, and one which will be readily appreciated by electricians and motormen, is the abundance of room on the sides of the trucks, allowing easy access to the motors. The journal boxes are dust and water proof, of simple design and built for wear.

The Robinson Machine Co. will have one of these "Standard" trucks on exhibition at the coming railway convention.

The Old and the New in St. Louis.

The accompanying illustration presents a view of Broadway and Washington Avenue, St. Louis, looking to the east. At this point, the most important street railway crossing in the city, two lines of electric cars and one line of horse cars run east and west ; one cable road runs north and south, and three electric lines run north. A continual line of wagons and pedestrians crowds the streets to such an extent that a watchman is kept on duty to signal the cars. Some 425 cars cross here every hour, or about 7,600 a day. A good idea of the development of rapid transit may be found by comparing the relative sizes of the bobtail car with its two little mules and the large combination electric car. The illustration shows a Broadway cable train, which also presents a striking contrast to the bobtail. These bobtails, however, have been consigned to the woodpile, and were replaced by elegant electric cars, equipped with Thomson-Houston S. R. G. motors. The centre poles may be seen in the centre of Washington Avenue. Contrary to expectations, they have not proved an obstruction to the traffic, but have added to the beauty of the street.



THE OLD AND THE NEW IN ST. LOUIS.

The Buffalo Railway Co. have recently awarded contracts to the J. G. Brill Co. for 100 four wheel trucks of their latest design ; to the General Electric Co. an order for 100 motor equipments of the S. R. G. type, and six generators of 200 K. W. capacity ; to the Standard Underground Cable Co. an order for four miles of underground cable, and to the National Conduit Co. the contract for a large amount of underground conduit. The contract for the new rail equipment was awarded to the Johnson Co. the rail to be of a semigroove girder pattern, nine inches in depth with a six inch base, and weighing ninety-three pounds per yard. The joint plates are to be thirty-two inches, to be clamped to the rail with twelve one inch bolts, the bolt holes being punched from a sixteenth to an eighth larger than the bolt. An additional equipment of engines is soon to be installed, but the contracts have not yet been let. No new car equipment will be ordered at present.

St. Louis Notes.

A bill has been introduced into the City Council authorizing the Forest Park & Bridge Railway Co. to construct and operate an electric railway from Third and Carr Streets on several streets including Washington Avenue to Grand Avenue, using the right of way of the Lindell Railway, Delmar Avenue, Pope Avenue and Florrissant Avenue.

The Lindell Railway Co. have determined upon capturing a large share of the suburban railroad travel entering the city by way of the Missouri Pacific Railroad. At the intersection of Chouteau Avenue and the railroad tracks the street railway company are constructing a very fine suburban station of cut stone. The building measures about 75 × 25 ft., and is being put up by a prominent St. Louis architect. The necessity of this station will be appreciated from the fact that as soon as the new Union passenger station is completed suburban travelers will, on arriving there, be so far from their places of business that it will be necessary for them to take the street cars. The point at which the station is being erected is about the most convenient at which the change from railroad to street cars can be made.

A bill has been presented to the City Council providing for an electric railway loop line commencing on Fourth and Olive Streets, and running east on the latter street to the river front, thence north to Locust Street, west to Fourth Street, and south to the point of beginning. The purpose of the road is chiefly to cater to the steamboat excursion traffic on the river during the summer months. The promoters intend to operate the line, if the bill is passed, in either of three ways, viz., to charge a five cent fare going to or from the river front, to establish a system of transfers with other companies, or, under special arrangements, to allow the cars of other companies to use the tracks of the proposed line. There are two very steep gradients on the route, but only one will have to be mounted on account of the line being of the loop type.

Several reports have been afloat that the St. Louis (Broadway) and Citizens' cable roads were thinking seriously of adopting storage battery cars for "owl" cars, instead of the slow going horse cars. Substantiation of these reports could not be obtained.

An arrangement has at last been arrived at between the managers of the Broadway cable road and of the St. Louis & Baden Railway, whereby passengers will be carried through on both lines for a five-cent fare, transfers being issued at the joint termini of the lines. Heretofore, the fare on the Broadway line has been five cents and on the Baden line ten cents. The Baden company has always been unwilling to enter into a transfer arrangement pre-

vious to the present time. An ordinance authorizing the change has been drafted, also allowing an extension of the company's franchise for thirty-five years. The Baden line is to be equipped electrically, and will derive its power from an electric plant to be established in power house No. 1 of the Broadway cable road, at Broadway and Salisbury Street.

From power house No. 2, at Broadway and Lami Street, electricity is to be supplied to the South Seventh Street branch of the Broadway road. This line has not commenced operations with any form of motive power as yet. Captain McCulloch, manager of the Broadway system, does not think it will pay until the City Council consents to give it a southw stern outlet, for instance, Tower Grove Park. He says that very likely the line will be connected at its northern terminus with the Cass Avenue system.

The latter has submitted plans to the City Council for changing the location of its tracks in certain localities and for erecting the necessary poles. The work of reconstructing this system, which includes the Northern Central, Cass Avenue and Union lines, is progressing satisfactorily, the downtown portion of the Union and Northern Central lines being finished. If, however, the contractors do not move more rapidly they will find themselves by the middle of next Summer with the lines unfinished. Work has not yet been commenced on the power house, which will be a large undertaking in itself. However, the contract for the electric equipment has been let, and the General Electric Co of New York is the lucky bidder. There are to be three large generators of 800 H. P. capacity each, and they are to be direct coupled, and will run at ninety revolutions per minute. The car equipment will consist of eighty-five cars, and each is to be equipped with two twenty-five horse power W. P. motors.

Work on the Clayton & Forest Park Electric Railway will be commenced in a few days. All construction is to be done by the Fruin-Bambrick Construction Co. The road will be completed and in running order about March or April of next year.

Mr. J. E. Sweeney, of the City Central Electric Railway Co., has recently offered to pay the entire cost of the Eighteenth Street bridge, if the city authorities will allow his road to use the bridge and give it the franchise asked. Mr. Sweeney has offered to make a deposit of $10,000 as a guarantee of good faith on the part of the corporation he represents. The company have already made several concessions to the City Council, but the latter has not yet granted the franchise asked.

The Sportsman's Park, Cemeteries & Madison Railway Co. have applied to the City Council for a franchise. The bill includes the adoption of electricity and a fare of five cents.

The reports of the St. Louis street railways for the second quarter of 1892, showing the number of trips made and the passengers carried are herewith presented :

	TRIPS.	PASSENGERS.
Baden & St. Louis	5,155	43,720
Cass Avenue & Fair Grounds	54,650	845,650
Fourth Street & Arsenal	2,528	5,760
Jefferson Avenue	45,794	503,790
Northern Central	41,084	550,674
Mouned City	82,432	1,126,494
St. Louis & Suburban	29,806	1,766,119
Union Depot	142,956	2,310.629
Bellefontaine	36,306	801,090
Citizens'	101,346	2,487,289
Lindell	169,958	3,333,839
Missouri	278 430	3,842,071
People's	58,058	1,260,725
St. Louis	204,240	3.127,456
Southern	70,186	1,232,885
Union	50,870	415,202
Total trips	1,373,799	
Total passengers		23,653,393

The car sheds of the St. Louis & Suburban Railway, which were destroyed by fire about three months ago, are being rapidly rebuilt, and will be completed about December 1. The company have just completed their car repair shops, which are models in their way. They consist of two buildings, the wood and iron working shop, and the paint shop Each has two tracks capable of holding twelve or fourteen sixteen foot cars at one time. In the wood and iron working shops are some fine lathes, made by the Lodge company of Cincinnati, also the latest types of wood working machinery. S. L.

Meeting of the Massachusetts Street Railway Association.

The usual monthly meeting and banquet of this Association was held at Young's Hotel, Boston, on September 21. The most important feature of the proceedings was the presentation of a paper on "Rail Sections and Special Construction," by Geo. W. Mansfield, which reads as follows :

Gentlemen :—I have long held the opinion that the great multiplicity of rail sections existing to-day is unnecessary. I have come to the conclusion that in so far as the street railway companies are concerned, six sections are sufficient, each one of which has in one form or another lived long enough to demonstrate its good features. I am aware that there are several patented forms and metallic systems on the market. As yet I have not been convinced as to their improvements. What I shall say in this brief paper, is not necessarily final. It will be a commingling of experience and present conclusions. I also am speaking only in cases of construction for investment.

In all street railway construction, others than the owners have to be taken into consideration. All municipalities have the inherent right to demand any section they please. The limitations, therefore, under which railway companies build their tracks, are, first, the requirements of the municipality ; second, their own pocketbook. It is perfectly true that the citizens at large expect and prefer the best section of rail, and it is equally true that it is wise for any street railway company to put in the best section of rail. The two, therefore, agreeing on this, the only point to decide is, can the railway company afford to meet the exactions of the municipality? The municipalities as a rule have but two points to consider: First, the section of rail best suited to the style of street in which it is to be laid ; second, that it be laid in a substantial manner.

Under the heading Style of Streets, we have to consider common dirt roads, macadamized streets, asphalt streets, and paved streets. The first three might be considered almost under one heading. We would then be reduced to two kinds of streets—paved and unpaved. Considering these various styles of streets, and eliminating for a moment the street railway company's financial condition, we should only need three sections of rails: No. 1, a section having a T rail head ; No. 2, a section having a flat flanged head ; No. 3, a section having a grooved flanged head.

Each section should be ten inches deep and have a base at least six inches wide. It is practically conceded that in so far as the head is concerned, Nos. 1 and 2 are greatly to be preferred, No. 3 section being open to the liability of filling with dirt and ice, causing the cars to jump the track, with consequent frequent derailments and serious inconvenience in cleaning the same in winter. Furthermore, there is an increased liability of narrow tired wheels getting into the groove and being twisted off.

If now, we take into consideration the financial condition of the street railways, we readily see that these sections are extremely expensive, and only the largest roads can afford them. It becomes necessary, therefore, to reduce the amount of iron in each section. I, therefore, have made each section six inches deep instead of ten inches. The only other departure is the narrower base, which is four inches. For the sake of brevity, I will designate these sections as 1-A, 2-A and 3-A.

It seems to me that with these sections it would be possible to satisfy all municipalities and all conditions of streets. Consider now for a moment each section.

Section No. 1. This section is too expensive for country roads and inadvisable in the main thoroughfares of cities of 300,000 population or more. In smaller cities and on suburban lines, it can be used with success and satisfaction. Its depth permits easy paving with the best of results.

Section No. 1-A. This section is essentially a sixty pound T rail. It should always be laid upon substantial ties having two foot centres. I consider it by long odds the very best section possible for all dirt, asphalt and macadamized streets. It can also be used in cobble or block paved streets, but in the latter case it would be better placed on stringers. In this latter case the foot of the rail should be notched so that the narrowest possible stringer can be used. In Springfield, Mass., most excellent results have been obtained with this rail. It is the only rail, I believe, used in the city. A course of specially designed brick, laid close to the rail, fills out the space between the edge of the stringer and the side of the rail and assists in keeping the paving in position ; the brick answers practically the same purpose as the flat flange of section No. 2. The only exception in paved streets where it would be advisable to substitute another section would be upon grades. This on account of the excessive wash from heavy rain falls.

Section No. 2. I have included under this section both the solid rail and the Johnson Co.'s electrically welded rail. They are practically the same. I am not prepared to discuss their relative merits. It seems to me that about the only argument for one or the other is the one of expense. The head of the

rail could be the same in either instance, and I am convinced that it is the best and only rail that ought to be used in the crowded streets of large cities, such as New York, Boston, Philadelphia, etc. It is placed directly upon ties and gives ample depth for the deepest of paving blocks. In the Johnson section the joints are held by a special joint called by that company the Standard Girder Joint. I consider it the best joint of its kind. In the solid section a six or eight bolt splice bar should be used. In either case there should be a specially heavy tie placed directly under the joint, and two others as close as good tamping will permit.

Section No. 2-A. This section would be similar in every particular to the solid form of section No. 2, only not as deep. This section can be used in macadamized or dirt roads if required by the municipalities. It hardly seems to me, however, advisable to use it unless compelled to. In paved streets, or in any street where depth is required, this section should be placed upon stringers, and the ties should be placed on three foot centres. A six bolt angle bar should be used so as to approximate the form of joint as closely as possible to the standard T rail joint.

Sections Nos. 3 and 3-A. These should be considered in all their various aspects precisely as Sections Nos. 2 and 2-A, the only difference in them being the grooved flange instead of the straight flange.

Let me now call your attention to a few points in regard to special work. There are to-day two or three companies here in the East making first class special work. I believe that all frogs should be at least ten feet in length. This would permit the cars to run off easily without any twist or wrench. One of the best trackmen of this section has called my attention to the fact that wherever there are branch-offs, whether single or double, the solid rail passing through the frog should always be the one upon which there is the heaviest traffic. Compromise joints have always been troublesome. The Johnson Co. now weld a section of the continuous track directly to the special piece. By this means all compromise joints are done away with and you are enabled to use your standard joint. This certainly is a most excellent feature and merits the heartiest approval. I believe its introduction has been made here on Washington Street. It is well worthy of your attention, and I advise you to look it over this afternoon. Messrs Soule & Dillingham are laying it and speak of it in the highest terms.

In general there are two methods of constructing switch pieces, one is the well-known Johnson method, and the other, the Wharton method, by which the rails or special pieces are held in position by cast steel moulded about them. There is not much difference between these. The latter are cheaper. In all special work, the running parts should be of steel. If possible, the special work should be of the same depth as the straight work. This, however, might be expensive. If it cannot be done, then I advise the use of timber.

In regard to the adoption of special work for country roads or for city roads, I believe the best pays. I see no reason why if it is used for city work it should not be used for all country work. In any event you are saving but very little, for the smallest roads require but a few pieces. Looking at the situation in this light, it seems to me unnecessary to have to use any more than one section for all curves. This section should weigh at least ninety pounds per yard. The Pennsylvania Steel Co. have introduced a removable guard for T rail, which I believe is an excellent thing.

There is one other feature which I have found in practice to be a most excellent one, and that is, to always use right hand connecting tracks By such an adoption, your cars will not run against the points of the switch. It is a very simple matter for electric cars, if necessary, to back a short distance in getting from one track to the other.

In regard to the timber used in construction, I advocate in every instance the best and always as ample proportion as possible. Ties should always have at least a six inch face, be five inches in thickness and seven feet long. It is hard to determine what quality of wood is preferable. I have used almost every variety. I think that hackmatack can be used with great success with any of the above sections of rail, since it is bound to be placed at least six inches below the surface. Hackmatack, oak, cedar, chestnut and Georgia pine are all good. Their life seems to vary with the soil. If we were sure that timber in its natural condition would last, we would be happy, but unfortunately we cannot count on it. It seems, therefore, necessary to use every precaution to preserve it. There are two or three methods now in operation, viz, kyanizing, creosoting and vulcanizing processes. All have done well so far, although the latter has not had as long an experience as the two former. Springfield has had twenty years of experience with the former and declares the wood in as good condition as it was when put in the ground. I believe, however, that the parties exploiting this method have not expanded their business to any great extent. The latter method has recently been vigorously pushed. The process is simple and effective. It has had twelve years' experience, and so far has been successful. It is used extensively on steam railroads, particularly upon the elevated roads in New York. I have placed nearly 1,500,000 ft. of it in the ground myself this year, and anticipate good results. Reports from Professor Thurston, of Stevens' Institute indicate that the treatment in no way injures the wood. It is made harder and more elastic and increases its life indefinitely.

In regard to spikes, knees, tie rods etc., I certainly advise the very best.

In regard to bonding, I advocate the use of at least one No. 0 tinned copper wire for each joint. This is to be employed in every instance. In some cases it may not be necessary to run a supplementary wire, but it should always be the rule to heavily ground the rails as often as is convenient and in the most substantial and thorough manner. Don't be afraid of ground plates. I am convinced that much trouble and loss occurs in our ground circuits. Professor Thomson has always held the opinion that ultimately we would come to iron rods coupled with screw couplings for our return wire.

There is one other point of vital interest and importance to which I invite your attention. We all agree that grade crossings are a menace to life. In many cases, however, we are compelled to endure them. Our cars carry many more people than the steam cars.

These people must be protected. I advocate the adoption of a standard crossing, and then the petitioning of the Railroad Commissioners or the state to make it incumbent upon all steam railroads to permit its employment, under penalty of law. We ought to be permitted to use a crossing which places the tread of our rail on a level with steam rail and allows the notching of the steam rail sufficiently to allow our wheel flanges to pass through. All jump crossings are dangerous.

In all cases the basis of a substantial track is a good bed. Track should never be laid in a loose or uncertain soil. It will pay to remove the same and fill with good sand or gravel.

Exceptional care should always be taken in tamping. Under no circumstance slight this. I am inclined to believe that we ultimately will come to a bed of concrete or cement for a foundation upon which to place our ties. The Biblical story about the two houses has a special application to the foundation of street railway construction.

In concluding, I simply desire to urge a unity of action and a freer exchange of experience. Certainly, we know what is the best form of rail, and I firmly believe that if we honestly and conscientiously strive to get the best, all manufacturers will join with us in this application, and all municipalities will listen and heed our advice. I believe that it is befitting for this organization to start the wheel in motion which will bring about standard forms in this direction, and I urge that some resolution be prepared and adopted at this meeting, to be presented to the National Convention, held in Cleveland next month for that body's consideration.

St. Louis Electric Club.

A meeting was held September 17, at the Mercantile Club, St. Louis, to discuss the proposition in regard to forming a St Louis Electrical Club. When the meeting had been called together James I. Ayer, of the Municipal Electric Lighting & Power Co., Capt. Robert McCullough, of the St. Louis Railway Co. W. L. B. G. Allen, Louis Nahm and many others expressed themselves in favor of the scheme. A committee on permanent organization was then named consisting of Messrs. Ayer, McCullough, Wagner, Allen and Bohle, and they were instructed to draw up a constitution and by-laws and report at the next meeting of the body, which was set for Friday, October 14. Among the gentlemen present were: C. R. Scudder, secretary St. Louis Electric Light & Power Co.; James I. Ayer, general manager Municipal Electric Lighting & Power Co.; H. P. Broughton, of the Municipal Electric Lighting & Power Co.; H. A. Wagner, superintendent Missouri Electric Light Co.; Robert McCullough, general manager St. Louis Railway Co.; J. A. J. Shultz, president Shultz Belting Co., H. L. Parker, A. W. Meston and F. W. Churchill of the Emerson Electric Co.; Louis Nahm, American Electric Manufacturing Co.; W. Matthews, St. Louis Electric Supply Co.; R. V. Scudder, Western Electric Manufacturing Co.; C. E. Sharpe, Southern Electric Supply Co.; E. J. Bagnall, engineer Lindell Railway Co.; H. C. Henley, inspector St. Louis Board of Fire Underwriters and W. L. B. G. Allen, St. Louis Engineering Co.

Street Railway News.

General.

Bridgeport, Conn.—Charles H. Hotchkiss of this city has received nearly the entire franchise of the old Bridgeport Horse Railroad Co. Mr. Hotchkiss will probably adopt electricity as a motive power. The Legislature will be petitioned for more privileges, and the road is soon to be put on a first class basis. The purchase was made from a Rochester (N. Y.) syndicate, who some time ago purchased the road.

Canton, O.—The management of the Canton Street Railway Co. have given their employes an advance in wages without their asking. The men are highly pleased and have published a card of thanks.

Chester, Pa.—The first consignment of cars, four in number, for the new electric road have arrived. They were built by J. G. Brill Co., of Philadelphia.

Davenport, Ia.—Manager Louderback, of the Davenport & Rock Island Railway Co. owning all the street railways in the city, has served notice on Mayor Bills, of the surrender of the West Second Street franchise. Cars will be stopped and the tracks taken up. This is the outcome of the action of the City Council in ordering the operation of the cars in a certain way. The company declare they are losing $20,000 a year in running cars under the present ordinance.

Denver, Colo.—All danger of a tie-up of the city cable system, threatened last month, has been averted, the management having acceded to the demands of the men. The latter get an increase of wages to twenty-two and a half cents an hour, the former rate being twenty cents.

Logansport, Ind.—The Logansport Electric Street Railroad Co. have closed a contract for the purchase of the county fair grounds of thirty-seven acres. The line will be extended to the grounds. The company have offered to deed the city half of the grounds if it will improve and make a park out of it. The race track will be put in first

class repair by the company for the fall meeting of the trotting association.

Lowell, Mass.—The Lowell & Suburban Street Railway Co. have commenced work on the erection of a machine and repair shop adjoining the other buildings at the corner of Middlesex and Pawtucket Streets.

New Haven, Conn.—The West Haven Horse Railroad Co., having no further use for horses, as electricity has been adopted as a motive power, lately sold 100 animals at prices ranging from $15 to $81.

Northampton, Mass.—The Northampton Street Railway Co. have reduced their rates to five cents. The company have doubled their receipts in the past few years.

Philadelphia, Pa.—The Philadelphia Traction Co., and several companies which they control, have filed in the Common Pleas a bill in equity against the Quaker City Elevated Railroad Co., to prevent the erection of an elevated railroad by the defendant company. Counsel for the Traction company cites two acts of Assembly which he claims make it illegal for the Quaker City company to construct an elevated road on the route authorized by City Councils.

Roanoke, Va.—The street railway which was purchased last February by the Roanoke Electric Light & Power Co., has been put in operation on the overhead system. The engines are of the Armington & Sims type, and Edison generators are used. The officers of the company are: President, J. T. Engleby; vice-president, S. W. Jamison; secretary, G. C. McCahan; general manager, W. Frank Carr.

Vancouver, B. C.—The directors of the Vancouver Electric Railroad & Lighting Co. have closed contracts for two new boilers, one engine, two generators and two cars.

Extensions and Improvements.

Ann Arbor, Mich.—The Ann Arbor & Ypsilanti Street Railroad Co. will extend their motor line to South Ypsilanti. The car barns will be removed to the same place. Work has begun.

Boise City, Idaho.—The Boise Rapid Transit Co. are proposing to increase their power station next spring and supply power for manufacturing purposes.

Buffalo, N. Y.—Consents have been granted to the Crosstown Street Railway Co. to construct a street railroad on Michigan and other streets; to change the motive power upon their Exchange and Michigan Street lines from horse to electricity; to construct a railroad on Grant Street between Hampshire Street and the Military Road; to construct a railroad on William Street from the present terminus to the city line, and to construct a railroad on Huron, Pearl and other streets.

Cambridge, Mass.—The West End Street Railway Co., of Boston, have petitioned for leave to construct and use tracks on Peabody, Cambridge Kirkland and other Streets.

Chicago, Ill.—An electric line on Forty-seventh Street, from Western Avenue to Cottage Grove Avenue, in place of the horse car line now in operation there, is proposed. A petition from the property owners has been presented to the Chicago City Railway Co., asking for the change.

Cincinnati, O.—At a meeting of citizens lately H. M. Littell, General Manager James M. Doherty and several directors of the Mt. Auburn electric railway were present, and stated it as their desire at an early date to extend the line of their road from Carthage, through Hartwell and Wyoming to Lockland, a distance of four miles.

THE Cincinnati Street Railway Co. have asked permission to extend the tracks of the Cincinnati & Spring Grove Street Railway from Baltimore and Western Avenue along Baltimore Pike.

Columbus, O.—The Columbus Street Railway Co. lately received six new open cars from the J. G. Brill Co., of Philadelphia. The company have given an order to the Brownell Car Co., of St. Louis, for twenty cars similar to the new twenty-foot car now in use on the High Street line and known as the Accelerator.

Denver, Colo.—The Denver Tramway Co., it is said, are trying to obtain control of the franchise of that part of the Circle railway that extends through South Denver and Sheridan and Loretto Heights. In this case very extensive improvements will be made.

Detroit, Mich.—It is reported that the Wyandotte branch of the Suburban Street Railroad Co. will shortly abandon the Healy motor and equip the line with electricity.

Gainesville, Tex.—The present street railway will probably be converted into an electric system.

Gloucester, Mass.—The street railway company will build an extension to Lanesville.

Hartford, Conn.—President Goodrich, of the Hartford & Wethersfield Horse Railroad Co., has asked leave to construct an experimental underground electric wire system from the Vernon Street stables to Broad and along Park.

Harrisburg, Pa.—The Citizens' Street Railway Co. have decided to make several extensions.

THE East Harrisburg Passenger Railway Co. are at work on an extension to Hoffmans' woods. They have given notice, also, of their intention to extend their line from the city limits to Grantville and Progress on the Jonestown road to the intersection of the first public road beyond the village of Progress.

Laredo, Tex.—The Laredo Electric Street Railway Co. have petitioned the City Council for a franchise to extend the line and make of it a belt railway.

Leavenworth, Kan.—W. F. Putnam has become the owner of the Third Street railway, and also of the Rapid Transit Street Railway, from the Messrs. Erb, and will change both systems to electricity.

Lynn, Mass.—It is said that the North Shore Traction Co. have plans to build a road between Lynn and Salem on the east side of the Boston & Maine Railroad. This road will run from Lafayette Street, Salem, through Loring Avenue and Swampscott to East Lynn.

A HEARING will be given to the Lynn & Boston and the Naumkeag Street Railway companies October 3, on a petition to allow the Naumkeag to extend their trolley system and to allow the Lynn the right to erect a trolley system into the town to connect with the Naumkeag.

Malden, Mass.—The petition of the West End railroad for right to erect the trolley system on their tracks in Malden has been granted by the Board of Aldermen on condition that the West End reduce the fare from eight cents, which has been the fare for years, to five cents, and the road has agreed to do so.

Manchester, N. H.—The Manchester Street Railway Co. have petitioned for right to extend their line from the corner of Elm and Valley Streets to the end of Wilson Street.

Memphis, Tenn.—The Citizens' Street Railway Co. have petitioned for right to build a double track on Adams Street and to make other improvements and extensions.

Meriden, Conn.—A deal has been completed, whereby the Meriden Street Railway was sold to John W. Coe, assistant treasurer of the Meriden Provision Co., who has secured $67,000 of the $80,000 of stock. It is believed the purchase was made in the interest of an out of town syndicate and that electricity will be tried again. Mr. Coe is reported to have said that an electric road will connect Wallingford and Yalesville with Meriden.

Nashville, Tenn.—A bill authorizing the Overland Dummy Railway to use electricity has been passed by the Council.

New Britain, Conn.—By a vote of the Common Council, Dolan Bros. have been granted permission to use the trolley system. They will extend the line to Plainville.

New York, N. Y.—The Metropolitan Traction Co. lately applied to the Board of Aldermen for permission to extend the tracks of the Metropolitan Crosstown Railway and other lines controlled by them.

Oakland, Cal.—A petition is being circulated among the residents of Fruitvale to the San Leandro & Haywards Electric Road Co., asking them to extend their line to East Twenty-seventh Street along Twenty-third Avenue.

COUNCIL has granted to the East Oakland Street Railway Co. a franchise to run electric cars through certain streets of the city.

AN ordinance has been passed granting to the Consolidated Piedmont Cable Co. a franchise to construct several extensions.

Omaha, Neb.—The Omaha Street Railway Co. have been granted a permit to extend their tracks half a mile.

Plainfield, N. J.—An ordinance has been passed authorizing the Plainfield Street Railway Co. to extend the location of their tracks.

Potwin, Kan.—The Potwin Council have been asked for an ordinance allowing the Topeka Railway Co. a franchise through the streets of Potwin.

Sacramento, Cal.—Application has been made by J. H. Henry, president of the Central Electric Railway Co. for a franchise on G Street.

San Francisco, Cal.—Behrend Joost on behalf of the San Francisco & San Mateo Electric Railway has applied for a new franchise to cover the old route now operated, and for supplemental feeders.

Savannah, Ga.—President Collins of the electric railway has placed the order for a sixty horse power motor capable of drawing cars containing 300 passengers at the rate of thirty miles per hour. It will be used on the Thunderbolt branch of the system.

Youngstown, O.—An ordinance has been asked granting the Youngstown Street Railway Co. the right to extend their Fruit Street lines. The ordinance calls for the line to be in operation by December 1, 1892.

New Roads.

Akron, O.—Council has passed an ordinance, extending to 1917, granting permission to the Cuyahoga Falls & Akron Railway & Power Co. to construct and operate an electric street railroad in and along certain streets therein named.

Alameda, Cal.—The Alameda, Oakland & Piedmont Electric Railroad Co. will build a street railway from Alameda to Oakland and Piedmont. The capital stock is $500 000. The directors and stockholders are Col. F. H. Meyers, Brooklyn township; Eli S. Denison, Oakland; W. H. Rank, Alameda; S. H. Bass, Oakland.

A PETITION was recently circulated and extensively signed favoring the granting of electric franchises to W. M. Rank, by property owners on San Jose Avenue, St. Charles Street, Martin Street, Kings Avenue and High Street.

APPLICATION has also been made to the Council by David Hirschfield for franchise rights on the streets wanted by W. M. Rank, save on San Jose Avenue. Mr. Hirschfeld offers to pay ten dollars license for each car and at the end of five years to give the city 2½ per cent. of the gross receipts of the road.

Ashland, Pa.— A corporation has been formed here to be known as the Schuylkill Traction Co., capital $600,000, which will connect all the towns in the Mahanoy Valley by an electric railway.

Atlantic City, N. J.—An electric company, of which J. Rush Ritter, of the Solicitors' Loan Association, of Philadelphia, and George Cook are the leaders, have applied to the Borough Council for a franchise to build a road on Brigantine Avenue.

Belleville, Ill.—The Southern Construction Co., of Galveston, Tex., propose to build an electric railway on the turnpike between this city and East St. Louis, providing they can raise a subsidy of $25,000.

Boyerstown, Pa.—There is a project on foot to build an electric road from Boyerstown to Ringing Hill and thence to Pottstown. Dr. J. F. D. Geiger, J. & H. K. Boyer, of Boyerstown, are among those interested.

Brainerd, Minn.—The electric street railway franchise recently granted to H. Spalding and others, of this city, has been acquired by C. N. Parker, of St. Paul, who proposes to immediately construct and put in operation the four miles of track required by the terms of the franchise. The road will be in operation by November 1.

Cambridge, Mass.—The Storage Battery Street Railway Co. have petitioned for a location. Among those appearing in behalf of the petition were Archibald Howe, W. S. Hall, A. E. Jones and Hon. H. O. Houghton. The proposed road was objected to by H. M. Whitney, Gen. E. W. Hincks and George G. Wright. The matter was referred to the committee on roads and bridges.

Carthage, Mo.—The Southwest Missouri Electric Street Railway Co. have filed articles of incorporation.

Chelsea, Mass.—The proposed new electric railroad in Chelsea will be a belt line. The amount of capital will be $75,000. A D. Bosson, C. H. Black, C. A. Campbell, Joseph R. Carr and others are said to be interested.

Chicago, Ill.—The Chicago Union Elevated Railway Co. has been organized; capital stock, $5,000,000; incorporators, Samuel A. Craig. Thomas Bayle and others.

THE Chicago, Harvey & Glenwood Rapid Transit Co., with a capital stock of $300,000, have been incorporated by Clayton L. Hayley, W. R. Jones and Calvin C. Hall.

THERE have been filed articles of incorporation of the Chicago & Southwestern Electric Railway Co. The capital stock is $250,000, and the incorporators are George W. Warr, Fred. S. Collier, O. L. Baskin, M. D. Byers, Henry R. Baldwin, all of Chicago.

Clearfield, Pa.—A charter has been issued to the Clearfield & Curwensville Passenger Railway Co. to run between the above towns, seven miles; capital $100,000. Three of the directors are: John J. Patterson, Mifflintown; Isaac B. Norris, Curwensville; W. E. Wallace. Clearfield.

Detroit, Mich.—F. H. Cozzens has asked the Council to act on the petition for a franchise filed by the Detroit, Springwells & Dearborn Railroad Co. last winter and referred to the committee on streets and ordinances. The franchise desired is for a rapid transit railroad from Livernois Avenue and over a number of streets to Warren Avenue and the city limits.

Dixon, Ill.—A. C. Bardwell has petitioned the City Council for a franchise for the construction and operation of a street railway.

Elmira, N. Y.—The West Side Street Railroad Co. have been granted a franchise to and through Horseheads, and will construct an electric road.

Eureka, Cal.—A road is proposed to run from Elk River to Arcata, through this city, with three or more branch lines on the cross-town streets. Among those interested are: Stephen Hill, W. S. Clark, J. C. Bull, Jr., and O. H. Spring.

Everett, Wash.—The Union Railway & Electric Co., of Everett, was lately organized with Col. J. B. Hawley, president; M. Swartout, vice-president; George S. Brown, secretary; W. G. Swolwell, treasurer. The capital stock is $200,000, and work will begin immediately to construct electric railway lines, and probably a belt line around the peninsula and to Snohomish.

Fostoria, O.—A certificate of incorporation has been issued to the Tiffin & Fostoria Electric Railway Co. The capital stock of the corcern is $175,000 and among the incorporators are: Hon. Charles Foster, of this place, and J. A. Beatty and E. W. Brown, the promoter. of Tiffin. The road will be constructed as soon as the preliminary arrangements can be made. It will be thirteen and five-eighths miles in length.

Haywards, Cal.—In September, 1891, a franchise was granted to F. Chappellet, H. M. Miller, N. C. Ames and Herman de Laguna to operate an electric road from Haywards to the county line of Santa Clara County. Recently they sent a communication to the supervisors, desiring them to commence work on the road, and asking them to designate the exact location where the tracks shall be laid.

Hazleton Pa.—The Hazleton & South Side Electric Railway Co., capital $75,000, has been chartered to build a line twelve and a half miles long. The president is Alvin Markle.

A CHARTER was also issued to the Hazleton & North Side Railroad Co., length, capital and officers the same as the other company. It will run from Hazleton to Drifton.

Home City, O.—At a meeting of the citizens of Home City, Delhi, Fern Bank and Addyston, of which W. G. Miner was chairman it was resolved to build a street railway. Committees were appointed to secure the franchises and the right of way from the property owners along the proposed route.

Homestead, Pa.—A charter has been granted to the Homestead & Highland Street Railway Co., capital $30,000. This company will build a two-mile line to Munhall and Mifflin township. The directors are: James S. Kuhn of McKeesport, Jacob Trautman, Louis Rott, Dr. George Gladden, John F. Cox and Richard Trickling, all of Homestead.

Huntington, Ind.—A company called the Huntington Street Railway Co., has been organized among a number of local capitalists who intend to put in an electric plant at once, if the franchise can be obtained. The capital is $100,000, and the officers are: President, Dr. G. H. McLin, vice-president; Robt. J. Day, Sr.; secretary, Willis Kenower; assistant secretary, W. N. Richter; treasurer, Olney Grafton.

Jersey City, N. J.—John V. Bacot, of East Orange, Charles B. Ludlow, New Brunswick, Arthur L. Fairchild, New York, Stuart Lyman, Englewood and E Mora Davison. New York, have associated themselves into what is to be known as the Pennsylvania City Development Co., of Jersey City, whose object is to form, operate or aid the formation of railways, street railways, elevated railways or other transportation companies, and to build, construct and equip the same. The total amount of capital stock is $2,000,000. divided into 20,000 shares. Articles of incorporation have been filed.

Long Island City, N. Y.—The Long Island City Board of Aldermen have granted the Crescent Street Railroad Co. a franchise to operate cars through the streets of this city. Flushing is the terminus of the proposed route.

Manistee, Mich.—A franchise has been granted by the Council, and the contract has been awarded for the construction of the long hoped for electric street railway. The first two miles of the road are to be completed before January 1, 1893.

Marshalltown, Ia.—The Marshaltown Light, Power & Railway Co. have just been incorporated; capital $250,000.

McKeesport, Pa.—A charter has been issued to The Versailles Traction Co., capital, $18,000. The proposed road will be three miles long and operated by electricity. The line will extend from McKeesport to the village of Boston. S. M. Bowman, of McKeesport, Frank Thomson, of Pittsburgh, and W. H. Sykes, of Versailles township, are three of the directors.

Montgomery, Ala.—The West End & Riverside Street Railway Co. have recently been organized with a capital stock of $100,000. Dr. S. D. Seelye and Mr. Satchwell are among the incorporators. The company will build the West End line and have secured other franchises.

New Albany, Ind.—The end of the year may see electric cars running from the elevated station at First and Water Streets over the tracks and terminals of the Kentucky & Indiana Bridge Co., the New Albany Street Railway Co., and the Highland Electric Railway Co. to the top of the New Albany knobs, nearly eight miles distant.

New Orleans, La.—On September 11 Comptroller Kennedy sold at public auction to Judah Hart for $500 the franchises for a proposed street railway. It is provided in the ordinance that at the expiration of the franchise of the Levee and Barracks line this proposed line shall be extended to the lower limits of the city. The grant is for twenty-five years, at the expiration of which the railway and appurtenances shall revert to the city.

Norwalk, Conn.—The Norwalk Tramway Co. propose to begin immediately the work of building an electric road from the foot of Spring Hill and thence, over various routes, to the South Norwalk depot.

Pasadena, Cal.—Prof. T. S. C. Lowe will build an incline plane road near this place. Cable power will be used. An electric road may also be built.

Philadelphia, Pa.—A charter was issued September 2 to the Philadelphia & Ardmore Passenger Railway Co.; capital stock, $40,000. Frederick P. Hays is president.

A NEW electric street railway companyentitled the Ridge Avenue Cemetery Railway Co., with a capital of $6,000, has been incorporated. Geo. S. Widener, of 1202 North Broad Street, is president.

FREDERICK W. RUSH. of 1643 South Fifteenth Street, is president of the Ferry Passenger Railway Co. that will build a new electric street railway. The capital is $5,000.

Phillipsburg, Pa.—A charter has been issued to the Phillipsburg & Houtzdale Passenger Railway Co., the line to run between Phillipsburg and Houtzdale, ten miles; capital stock, $100,000; John J. Patterson, Mifflintown; Isaac B. Norris, Curwensville, and W. E. Wallace, Clearfield, are three of the directors.

Pittsburgh, Pa.—The Aspinwall Street Railway Co. with a capital of $12,000 has received a charter. The proposed road will be operated by electric power, and will be about two miles long. It will begin at a point where the line of the Citizens' railway now ends and the Freeport road, thence along this road to Ross Grove. Of the directors are: William R. Holmes and George C. Wilson, of Pittsburgh and James J. O'Donnell, Allegheny City.

THE Bellefield Street Railway Co., capital $12,000, have been chartered to build a line two miles long, beginning on Centre Avenue to Herron Avenue. The directors are: George W. Elkins, William T. Elkins, Joseph Stuart, John G. Traggarth and George C. Wilson, Pittsburgh. The road will be operated in harmony with the Pittsburgh Traction system and will be an electric line.

Pittston, Pa.—The Pittston, Jenkins & Avoca Street Railway Co. has just been incorporated to build and operate an electric railway. Thos. English is president, and the capital stock is $75,000.

Pottsville, Pa.—The Pottsville, Cressona, Schuylkill Haven & Orwigsburg Electric Railway Co., with a capital of $75,000, have been granted a charter. The officers of the company are: John T. Shoener, of Orwigsburg, president, and George F. Dengler, of Schuylkill Haven; L. K. Hannum and C. W. Wildermuth, of Pottsville, and J. I. Hollenbeck, of Audenried. The new road will probably be completed by next spring.

Raritan, N. J.—A project is on foot to construct an electric railway between Raritan, Somerville, Finderne, Bound Brook and New Brunswick, N. J. Among those said to be interested in the scheme are Sylvanus Ayers, jr., J. I. Livingston, E. Chamberlain and L. M. Coddington.

San Francisco, Cal.—The Southern Heights & Visitacion Railway Co. has been incorporated for the purpose of building a double track railroad through the southern section of the city. Associated in the enterprise are: Charles F. Crocker, H. E. Huntington, F. S. Douty, N. T. Smith and J. L. Willcutt. The capital stock is to be $1,000,000.

Santa Barbara, Cal.—H. L. Williams has petitioned the supervisors for a franchise to construct a railway from the city of Santa Barbara to Summerland and through the Montecito Valley.

Santa Cruz, Cal.—The Santa Cruz Electric Railway has been incorporated. Capital stock, $500,000. Directors: James P. Smith, J. H. Logan, F. W. Ely, W. H. Talbot, Morris Newton, H. H. Clark and J. G. Tanner.

Scranton, Pa.—A charter has been granted to the Lackawanna & Old Forge Street Railway Co. The line which the company propose to construct will extend from Duryea to Hyde Park.

Sharon, O.—An electric railway is proposed here by J. C. Whitla, Dr. Theo. P. Simpson, Simon Harrold and J. P. Stone of Beaver Falls, Henry M. Camp, of Rochester and Howard Wheeler, of Beaver Falls.

Sioux City, Ia.—The Morning Side Street Railway Co. want a franchise for a line of street railway. The company is a new one, the incorporators being Wm. L. Joy, A. H. Rederich and five others. The company propose to build an electric line to connect with the elevated line at or near Leech Street, or with the Peavey system. The construction of the line is to be commenced by June 1, 1893.

Spokane, Wash.—Operations, which, owing to misunderstandings have been for some time suspended will again be resumed on the Spokane & Cœur d'Alene Electric Railroad.

St. Paul, Minn.—The Fifth Ward Railway Transfer Co., capital $50,000, have filed articles of incorporation. The incorporators are L. H. Glassbrook, M. H. Holy, H. H. Galusha and others.

Stoneham, Mass.—The Boston, Malden & Stoneham Co., through F. K. Sweetser, E. P. Shaw and W. B. Ferguson have petitioned for a route from Stoneham Centre to the Boston & Maine Depot in Malden.

THE Stoneham & Boston Railway Co., through W. B. Stevens, George W. Mansfield and George H. Campbell have also petitioned for the same route.

Tacoma, Wash.—The long talked of electric road between this city and Seattle is now in a fair way to be built. Frank C. Ross says he will build the line from Sumner to Tacoma if Fred Sander and other Seattle parties build from Seattle to Sumner.

Takoma Park, D. C.—Work has been commenced on the electric road to be known as the Petworth, Brightwood & Takoma Railroad. It is hoped to complete the road by December 1.

Vicksburg, Miss.—R. C. McFarland and J. B. Mattingly, of Vicksburg, and E. F. Fuller, of New York, have lately received a franchise for an electric line four to five miles long.

Wilkesbarre, Pa.—An electric railway is to be built and operated by the Lackawanna & Old Forge Street Railway Co., of which John Graham, of Wilkesbarre, is president.

York, Pa.—More than a year ago a charter was granted to a York corporation known as the Black Mountains Railway Co., to build an electric railway from the southern terminus of the present street railway to the top of Shunk's Hill, and from thence down the hillside to Highland Park by a gravity road, two miles. Operations have at last been commenced.

Personal.

Mr. **Charles Guidet**, paving contractor of this city and the owner of large granite quarries on Cape Ann, Mass., died at his home in this city, September 23.

Mr. **E. L. Babcock**, president of the Falls Rivet & Machine Co., of Cuyahoga Falls, O., was in New York last month and called at the office of the STREET RAILWAY JOURNAL.

Mr. **Charles T. Yerkes**, president of the North Chicago Street Railway Co., who went abroad last spring, returned from his trip via the City of Paris, September 21.

Mr. **J. A. Hanna**, of the McGuire Manufacturing Co., called at this office while in New York last month. He reported an increased call for McGuire trucks among street railway companies.

Mr. **J. H. Bickford** has resigned his position of electrical engineer of the Naumkeag Street Railway, and has opened a temporary office as electrical engineer at 60 Washington Street, Salem, Mass. He will later, probably, remove to Boston.

Mr. **David S. Carll**, who has had charge of the cable construction for the Washington & Georgetown Railroad Co., has accepted a position as permanent engineer with the company, and will have charge of all the mechanical appliances employed in the operation of the lines.

Mr. **F. L. Hart**, who has been for a number of years mechanical engineer in charge of the 128th Street cable power station of the Third Avenue Railroad Co., has recently resigned that position to accept a situation with the Broadway & Seventh Avenue Railroad Co., and will have charge of the cable stations of the latter line.

Mr. **Dennis Sullivan**, superintendent of the Coney Island, Brooklyn, Electric Railroad, was shot on Monday, September 19, by Frank Gately, an ex-employe whom Mr. Sullivan had discharged the Saturday previous. One bullet shattered the joint at the left shoulder blade and the other severed the apex of the left lung. Although Mr. Sullivan is in a critical condition, the physicians have a hope of his ultimate recovery.

Mr. **Edward E. Higgins**, general manager of the Short Electric Railway Co., who is now traveling in Europe, informs us in a recent letter that he will soon sever his connection with the Short company, and will engage in independent professional work in New York City as consulting expert on all matters pertaining to the engineering and economic features of street railways. In his work among prominent street railway operators during the past few years he has acquired a fund of special information which thoroughly fits him to enter into close advisory relations with investors in street railway properties.

New Publications.

Electric Lighting Specifications for the Use of Architects; by E. A. Merrill. Published by W. J. Johnston Co., Ltd., New York.

The practice of installing even the smallest electric lighting plant under minute specifications is now so general that the value of a book of this kind will be readily appreciated. Specifications adaptable to each case differ with the conditions, but a general outline from which changes can be made is, of course, often convenient. The specifications include those applicable for the different systems of incandescent and arc lighting, and with the specifications are included the rules adopted by the National Electric Light Association at Montreal in 1891, and amended at Buffalo in 1892, the rules of the National Board of Fire Underwriters and those of the New England Insurance Exchange. The volume contains 176 pages.

Perfected Graphite for Lubricating Purposes; published by the Joseph Dixon Crucible Co., of Jersey City, N. J.

In this small pamphlet are given the advantages determined from experiment of pure graphite as a lubricant and a brief summary of some tests made with Dixon's perfected graphite as a lubricant, by Prof. R. H. Thurston. These tests showed that, as compared with the best quality of winter sperm oil, the graphite, when mixed in enough water to distribute it over the bearings and under the same number of pounds pressure and with a shaft traveling at the same rate of speed, was three times a better lubricant than the sperm oil. The best quality of lubricating grease without being mixed with graphite showed the same results as the oil, but when 15 per cent. by weight, of graphite had been added the bearings ran nearly six times longer. Where the graphite was used it was also shown there was no cutting, and the bearings were in perfect condition.

Economic Legislation of all States and the Law of Incorporated Companies Operating Under Municipal Franchises. Vol. I.; by Allen R. Foote. Charles E. Everett, editing attorney. Published by Robert Clarke & Co. Cincinnati.

The prospectus and the set of advance sheets comprising the first 258 pages of this work sent us, indicate the publication soon of a most valuable book to all persons interested in companies operating under municipal franchises. Mr. Foote states that no time or expense has been spared in its compilation and this is evident from the completeness of the book and the care employed in the systematic arrangement of subject matter. In his work the auther was assisted by one or more attornies from each state, with one for the territories, who have each contributed a section on the history and status of municipal franchises in his state or territory. The work will be in two volumes and will be ready for delivery about October 1. Price, bound in leatherette, $10.00 per copy, in law sheep $12.00 per copy.

The Catalogue of George Cradock & Co., Wakefield, Eng. Third Edition.

This handsome catalogue shows the extensive field covered by George Cradock & Co., and the variety of uses to which their well known ropes are applied. It is divided into five sections, being respectively, the mining, shipping, engineering, cable tramway and agricultural divisions of their business. The pages contain a large number of illustrations, among which are some of special interest, showing the appearance of the rope manufactured by this firm after a considerable period of use in cable railway service. These include views of sections of rope employed in Melbourne, London, Edinburgh and elsewhere, and show that the wear was very evenly distributed over the surface of the cable. The catalogue also contains, in addition to views of cable appliances, a number of important tables of the breaking strains of different ropes, directions for splicing ropes, etc. This company manufacture the Lang lay rope, and recommend it for cable railways. Among the street railway companies which have employed Cradock's cables we notice a number of American roads.

Systems of Car Lighting; by A. M. Wellington, W. B. D. Penniman and Charles Whiting Baker. Illustrated. Engineering News Publishing Co., New York.

This treatise on the comparative merits of the various systems of car lighting is a revised reprint of a series of articles on this subject which have been recently published in the *Engineering News* of New

York and is a result of original investigations and tests made by the authors, of whom Messrs. Wellington and Baker are editor and associate editor of the *Engineering News*, and Mr. Penniman is chemist of the Baltimore & Ohio Railroad. The book is devoted to steam railway car lighting, but the tests are in many particulars valuable to street railway managers as well. The principal systems of lighting discussed are the dry carburetter or gasoline vapor system; the Pintsch compressed oil gas system; oil burning lamps and electric lighting. The first, which we think has not been employed on any street cars, did not evidently meet the approbation of the authors in every particular as a car illuminant. In the chapter on the Pintsch system a more favorable opinion was reached. This system has met with wide adoption on railways abroad, and is being installed on cable railways in this country. Oil burning lamps, the authors estimate, are employed on at least 27,000 out of over 30,000 cars now running on passenger trains in this country, and this chapter is of special interest to street railway managers. The authors consider the relative values of 150 deg. and 300 deg. test oils, pronouncing themselves greatly in favor of the use of the latter—which, indeed, is insisted on in most states—and for central draught burners. For electric lighting of trains they recommend the combination dynamo and storage battery system employed on the Pennsylvania limited trains between New York and Chicago, and on a few other roads. The photometric tests on the value of the different lights, showed a slight gain in the use of gas over oil lamps, through the better distribution of light, while the comparative cost of operation for the same amount of light is in favor of oil. Throughout, the authors state, they have endeavored to avoid giving expression to any conclusions of their own, so far as clearness and completeness would permit, preferring to allow the reader to form his own independent conclusions; but on the other hand they have not hesitated to record all facts made against any system, as well as for it. In order not to do injustice to any system, the authors announced their willingness to publish any statements from any persons interested in any system criticizing any statements made in the book. This request has been complied with in several instances.

Equipment Notes.

The Sperry Electric Co. have opened an office at 29 Broadway, New York, and are introducing an electric motor and trolley system which has been in use for over a year at Youngstown, O. It is said to have given good satisfaction.

The Shawmut Fuse Wire Co. is the title of a company recently organized in Boston with headquarters at 85 Water Street. The company manufacture a fuse wire made of a special alloy which has a number of advantages for the purposes for which it is intended.

Charles D. Shain, for a number of years Eastern District manager of the Edison General Electric Co., has resigned from that position, and has established himself as an electrical engineer and manufacturers' agent at room 303 Electrical Exchange Building, New York. Mr. Shain has been appointed selling agent for the Weston Electrical Instrument Co., of Newark, N. J.

The Pittsburgh Terra Cotta Lumber Co., of Pittsburgh, Pa. manufacturers of porous terra cotta, report extensive sales of their product recently. The material is being largely used for building purposes, and the company, among other applications, have made a special form of tile for ceilings and roof. In connection with iron girders or beams, this makes a fireproof structure.

Messrs. Smith & Wallace, of 8 Oliver Street, Boston, have placed on the market an improved electric snow plow. They state that a plow similar in many respects to the plow now sold by them was used with marked success all last winter on the line of the Allentown & Bethlehem Rapid Transit Co., where the weather was particularly severe. The plow has been improved in many respects since then, and is now quoted by the manufacturers at a low price.

The Page Belting Co., of Concord, N. H., write us that their trade is steadily growing for their staple grades of belts and in their specialties, including the Acme link, Eureka dynamo and dynamo double belts, and that the demand for their belts is so great that they find it hard work to keep up with orders. They are at present working on some new buildings which they expect to get into by January 1, and which will more than double their capacity. The company state that they are also having a large trade for their raw hide lacing.

The Lamokin Car Works, of Chester, Pa., manufacturers of street cars, tell us that among their customers for carsdelivered in September are the following well known street railway companies: Paterson Central Electric Railway, Paterson, N. J.; Chester & Media Railway, Chester, Pa.; Dennison Electric Railway, Dennison, Ohio; Philadelphia Traction Co., Philadelphia; Schuylkill Electric Traction Co., Pottsville, Pa.; Derby Street Railway, Derby, Conn.; Belle City Railway Co., Racine, Wis.; Citizens' Passenger Railway Co., Harrisburgh, Pa.

Milliken Bros., of New York and Chicago, manufacturers of Milliken patent poles for electric street railway and electric light work, inform us that they are very busy in their pole department and have orders on hand for poles for nearly all the large cities in the country which are now installing or extending electric railway systems. This firm are also designers and builders of iron and steel roofs, making a specialty of iron work for electric power and light stations, and are very busy on this line of work, having many large roof and building contracts on hand.

The Interior Conduit & Insulation Co., New York, have issued in pamphlet form a recent article in one of the electrical papers descriptive of a perfectly wired private residence. The system of interior conduits employed and the manner in which they are applied in this instance, the manufacturers state, represents the highest state of the art yet attained. The development of their business, they say, during the past year has been extraordinary, and over 1,000,000 ft. of their tubing per month is now being installed throughout the country. Their underground system for electric railways is also giving good satisfaction wherever used.

J. P. Sjoberg & Co. is the title of a firm recently established in New York City at 155 and 157 Eleventh Avenue between Twenty-first and Twenty-second Streets, as manufacturers of street car wood work, and for repairing, rebuilding and constructing street cars of every style. Mr. Sjoberg has had long experience in this line of work, having been connected with J. A. Trimble for a number of years. The factory of the firm is equipped with the best and latest improved machinery, and located in the centre of New York's lumber yards and lumber drying companies, giving them the best opportunity to examine, select and kiln-dry their lumber.

A. Groetzinger & Sons, of Allegheny, Pa., manufacture an improved process raw hide pinion which is giving good satisfaction in electric street railway service. The great advantage of these pinions lies, of course, in their noiselessness, but the manufacturers state that in the point of wear they are equal to the best steel pinions, while the expense of installation is inconsiderable. The material of which these pinions are made is termed dermaglutine, and the manufacturers supply finished gears for all systems, or blanks from which the gears can be cut, if preferred. These pinions are also largely used for other fast running machinery where the qualities possessed by them are a desideratum.

The Burnham & Duggan Electric Appliance Co., of Boston, Mass., have met with an extensive demand for their brackets and guard wire supports. Among the prominent companies which have adopted these supports are the Worcester, Leicester & Spencer Railway, of Worcester, Mass., the Worcester & Millbury, of Worcester, Mass., the Newton & Boston, of Newton, Mass., the Naumkeag Street Railway, of Salem, Mass., Norwich Street Railway, of Norwich, Conn., and the Quincy & Boston Street Railway, of Quincy, Mass. This guard wire support effectually protects the trolley wire from accidental contact with telephone and other wires, and so greatly lessens the liability to accident.

The Lewis & Fowler Manufacturing Co., of Brooklyn, N. Y., are having a large call for the various appliances which they manufacture. Their stove department has been especially busy during the last month on account of the approaching winter. The excellent results obtained last winter with the snow plow manufactured by this company have had their natural consequence in many orders for similar appliances from street railway companies who wish to keep their lines free from snow this winter. The register department also shows its usual activity, and to a visitor the factory of the company presents a very busy appearance. In the girder rail department there is the usual rush, and this rail seems to be more popular than ever.

The Chapman Valve Manufacturing Co., of Indian Orchard, Mass., report that the demand for all classes of goods which they manufacture has been unusually large during the past year, this being especially true of their new valve with bronze sides for high pressure steam service, which was described in a recent issue of the STREET RAILWAY JOURNAL. The call for their goods has been much larger than they anticipated, and among the customers to which they have furnished high pressure steam valves recently, they number some of the largest steam plants in the United States. The Chapman valve has given such excellent results in practice that the company write us it will take some time to fill all the orders which they have on hand.

The Neftel & Marsh Co., of 126 Liberty Street, New York, have just completed a reconstruction of electric line of the Camden Horse Railroad as well as the extension of the same to Merchantville. This piece of work was of a difficult and novel nature. The road was previously operated with a two wire overhead system, and at a potential of 220 volts. The present road is a single wire, 500 volt line with Westinghouse motors. The change in line work and motors was made without any accident and without stopping the operation of the line. The only time when work was possible without current on the wires, was from midnight until 5 A. M. Mr. J. Stanford Brown had immediate charge of this work. The same company are now installing the electric light plant for the Green Island Electric Light Co., of Green Island, New York, with a capacity of 150 and 2,500 incandescent lamps.

The Ellis Car Co., of Amesbury, Mass., are meeting with a large call for their street railway cars of all sizes and styles, and have a large number of orders on hand from prominent companies in different parts of the country. On their floors are seven ten bench, open cars for the Naumkeag Street Railway Co., of Salem, Mass.; three ten bench open cars for the Haverhill & Amesbury Street Railway Co: ten box cars for the Hopedale Electric Co. and one box car for the Bradbury-Stone Storage Battery Co. These latter cars are for storage batteries, and the two for the Hopedale Electric Co. are finished with mahogany both inside and out, and are very handsome in appearance. They are also changing twenty-five sixteen foot box cars into twenty foot cars for the West End Street Railway Co., Boston, Mass., and have also a number of orders for electric snow plows which have been described in the STREET RAILWAY JOURNAL.

The Meneely Bearing Co., of West Troy, N. Y., manufacturers of rolling journal bearings for railway cars and general machinery, have sent us the results of some tests of their bearings, made by Delaware & Hudson Canal Co., Sept. 14–17, 1892, with Belt Line trains of four

cars, each train weighing 102 tons. The coal test showed that with brass bearings the consumption in running eighteen round trips (270 miles) was 14,800 lbs. With tubular bearings the consumption in running the same distance was 11,100 lbs., showing an excess of consumption with brass bearings of 33⅓ per cent., or 3,700 lbs. of coal. In the dynamometer test the results showed that with brass bearings the power required to start a train was 3,276 lbs., while with tubular bearings the power required was only 252 lbs., the ratio of required power being 13 to 1. In the gravity test the results were: With brass bearings, distance run from foot of grade, 100 ft.; tubular bearings, distance from foot of grade, 534 ft.

The Richard Vose Car Spring Co., of New York, report, among recent large contracts closed by them, the following: with the J. G. Brill Co., 180 sets of their graduated rubber and iron cone springs, with steel cushions for cars built during the spring and summer months for the Chicago City Railway Co.; with the Bemis Car Box Co., and American Car Co., 200 sets of the same style of spring; for the West Chicago Street Railway Co., and with the Brownell Car Co., of St. Louis, Mo., 50 sets for cars of the Baltimore Traction Co., Baltimore, Md. Their graduated rubber and iron cone spring has been adopted as the standard on these roads. They will also furnish graduated springs for the Broadway cable cars, New York, and also for the 114 new cars lately contracted for by the Baltimore City Passenger Railway Co. These springs give great satisfaction on roads which use them, and the manufacturers state that the prospect for the balance of the year is very encouraging for a large amount of business.

John A. Roebling's Sons Co., of Trenton, N. J., have received the usual number of orders for cables during the past year for various cable railways in the United States, and in addition repeated orders for cables from abroad. Among the new roads in this country to which they have supplied duplicate cables, are the Broadway, New York, cable railway, the Baltimore City Passenger Railway, Baltimore, Md., and the Third Avenue Railway of New York. The order received by them from the Third Avenue Railway Co. was the largest single order ever awarded to any cable company, the cables being not only larger in diameter, but greater in length than any previously made by them. The Roebling company state that in Chicago where their cables have been put into competition with cables of other makers, the Roebling cables have lasted three times as long as some of the others. The company are also very busy in their insulated wire department, and are meeting with a large sale for their trolley wire, feeder wire and magnet wire.

The Ball Engine Co., of Erie, Pa., write us that the demand for their well known automatic cut-off engines is constantly increasing. The business of this company during the past year has been very large. They state that at the beginning of the year they expected, with the new works just erected by them, they could easily take care of their orders, but during the first nine months of 1892, the volume of their business increased 40 per cent. over that of the same period in the previous year, and they very shortly found that they could not keep up with their orders, and were, therefore, again compelled to build an addition to their works. They have been running at their factory night and day since the first of the year, except during the hot months of July and August, and still have several months' work ahead. The prospects for the future, they consider, are very bright as the Ball engine is constantly gaining in popularity and they say that they have every reason to believe that they will have all they can do during the present fall and winter.

The Billings & Spencer Co., of Hartford, Conn., manufacturers of machinists' tools and drop forgings, write us, in reviewing last year, that their business has been very satisfactory, and in amount far exceeded that of 1891. Their trade, they say, in Billings patent commutator bars, drop forged, of both pure Lake copper or Tobin bronze, has been constantly increasing, and they are now doing a large business in this line, not only with the electrical companies manufacturing dynamos and motors but also with the street railway companies direct who require these goods for repairs. The sales in their machinists' tool department have also been very satisfactory and constantly on the increase. In the electrical line their linemen's hand vise, combination pliers and drop forged wrenches are meeting a large demand. They state that they consider the outlook for the coming year to be very promising, and in evidence of this, mention that they are at present erecting a new factory, office and shipping department. The total length of these buildings will be 208 × 40 ft., two stories and basement.

Carleton & Kissam, proprietors of the United States Steam & Street Railway Advertising Co., of Boston and New York, report a very prosperous business during the past year. Their exhibit at the Pittsburgh Convention, as will be remembered, attracted general attention by reason of its novelty—as an exhibit—and occasioned favorable comment from various railway officials. Since that time Carleton & Kissam have added considerably to their extensive list of cities and now have under lease over 6,000 "full time" cars. They conduct their business in such a manner that complaints from passengers are unknown, railway officials are pleased, and it is safe to assert that this firm have the correct idea of running the business that has been somewhat unpopular in certain quarters. Their rentals to street railway companies aggregate nearly $150,000 annually, and they have over $80,000 invested in advertising racks. Their perfectly systematized method of conducting business has gained them the confidence and trade of the world's great advertisers. Mr. Carleton resides in Brookline, and Mr. Kissam in New York.

The Wainwright Manufacturing Co., of Massachusetts, 8 Oliver Street, Boston, inform us that their sales during the six months ending July 1 were in excess of the entire sales for the year of 1891, and that the orders in prospect are better at the present time than they have ever been. They have been especially successful with their feed water heaters for compound engines, of which they make a specialty, and have sold a large number of them to street railroad companies. The Lynn & Boston Street Railway Co., at their Lynn and Chelsea stations, have nine of these heaters, and the Union Railway Co., of New York, have four. The following is a list of their recent sales to street railways and electric companies: Newark Electric Light & Power Co., of Newark, N. J., 500 H. P.; Portland Electric Railway Co., Portland, Ore., 900 H. P.; Ottumwa Railway Co., Ottumwa, Ia., 500 H. P.; Ypsilanti Electric Co., Ypsilanti, Mich., 200 H. P.; Mahanoy, Shenandoah, Girardville & Ashland Street Railway Co., Rappahannock, Pa., 500 H. P.; Hull Electric Light & Power Co., Hull, Mass., 500 H. P.; Bay County Electric Co., Bay City, Mich., 700 H. P.; Aurora Street Railway Co., Aurora, Ill., 500 H. P.

Elihu Nelson, of New York, manufactures a compact feed water heater for marine and other uses which is meeting with considerable success, and which is claimed to be the only heater that can be used with the present type of ship condenser. The following description of the heater is from a letter written by William A. Pettit, engineer, formerly of the steamer "Crescent City." The heater is connected to a marine compound engine, and the steam, after traversing the heater, is passed through a condenser where it is condensed, and beyond the condenser an air pump carries the water of condensation through an oil separator into a receiving tank, apparently free from oil. A boiler pump takes the water from the receiving tank along with an extra supply to compensate for the loss, and carries it to the heater. I have also found that you have attached a vacuum gauge to the condenser, and another to the exhaust pipe near the engine. I have made the following observations of the reading of these gauges, and to the thermometer attached to the feed water pipe leading from the heater: Vacuum at condenser, twenty-nine inches; vacuum at exhaust pipe, twenty-seven inches; temperature of feed water beyond the heater, 212 degs.

The Jewell Belting Co., of Hartford, Conn., inform us that they have received a large number of orders for belts recently, and that their belts are giving good satisfaction in the various electric light and street railway plants where they have been installed. During the last year they have closed a large number of contracts, and every indication points to a continued and increasing call for their well known belts. Among other companies which they have supplied recently are the following: Jamestown Electric Street Railway Co., Jamestown, N. Y., two thirty-six inch double; United Electric Co., Springfield, Mass., one forty-four inch double; Chillicothe Electric Street Railway Co., Chillicothe, O., complete outfit; Piqua Electric Street Railway Co., Piqua, O., complete outfit; Elkhart Electric Street Railway Co., Elkhart, Ind., complete outfit; Albany Railway Co., Albany, N. Y., one forty-eight inch double; Carrol Electric Light Co. (street railroad), Matteawan, N. Y., complete outfit; United Electric Street Railway Co., Nashville, Tenn., complete outfit; Consolidated Electric Street Railway Co., Atlanta, Ga., two forty-eight inch double; Hamilton Electric Light & Tramway Co., Hamilton, O., complete outfit; Chicago, Milwaukee & St. Paul Railroad Co., Milwaukee, Wis., one fifty-six inch double.

Westinghouse, Church, Kerr & Co., of Boston and New York, report that their business during the past year has been the best of their ten years' record, since the demand for their engines, stokers and other specialties has steadily increased, and at present shows no indication of falling off. The large work, they state, is chiefly running into compound engines and the development of the type in which they are interested, of which, perhaps, the most prominent feature is the ability to work economically over wide ranges of load. Naturally, in the electrical street railway field there is a large call for this class of machines, and this industry has largely contributed to the increase of trade which they have had during the year. To them the most interesting feature of the year's work has been the development of the direct coupled system of driving street railway generators, and the experience thus far gained, they consider, indicates that this system has not only come to stay, but must almost of necessity become the standard practice regardless of size. They have considerably increased their facilities recently, chiefly through the erection of a large erecting and testing shop, and have established a special "testing branch," which is simply an extension of the plan which they have always followed in the placing of every engine under test before shipment.

The Robinson Machine Co., of Altoona, Pa., manufacturers of the well known Robinson all-steel trucks, report business as being excellent, and that during the summer they found it necessary to work far into the night to keep up with their orders. Owing to their rapidly increasing business, they have decided to enlarge their plant, desiring to be always prompt in making deliveries. Among the recent contracts may be noted the following: Citizens' Street Railway Co., Steelton, Pa.; York Street Railway, York, Pa., both above orders to be equipped with Lamokin Car Co.'s car bodies; Duquesne Traction Co., Pittsburgh, Pa.; Niles & Mineral Ridge Railway, Youngstown, O.; Consolidated Street Railway Co., Oskaloosa, Ia. (under Lamokin Car Co.'s car bodies); Brightwood Railway Co., Washington, D. C.; Philadelphia Traction Co., Philadelphia, Pa. (complete with Lamokin Car Co.'s car bodies). They have also secured orders from Watertown, N. Y., and Dennison, O., the latter with car bodies from the Lamokin Car Co. As regards their all-steel double trucks for long cars, they have just been awarded a contract for twenty sets from San Francisco, Cal. It is their intention to have on exhibition at the coming street railway convention one of their all-steel standard trucks, and trust that all interested will carefully examine it.

The Robinson Electric Truck & Supply Co., of Boston, have removed their offices from 180 Summer Street to 620 Atlantic Avenue, where, they state, they will be glad to welcome their friends. Their new offices are in the Hathaway Building, which adjoins the New England Building, in which their former offices were situated, and to

which it is connected by bridges, so that the new offices are practically on the same floor with the old ones. This company write us that the West End Street Railway Co., of Boston, are adding to their equipment 100 additional Robinson radial cars. The trucks for these cars are being built at the shops of the West End Co. The Winter Hill line is already equipped with twenty-five new radials, and other lines will be equipped as rapidly as the cars can be built. The car bodies for these radial trucks are of the usual length—twenty-five feet, exclusive of platforms. When these are all out they will make more than 150 Robinson radial cars with twenty-five foot bodies on the West End road. Among other orders for Robinson radial trucks filled within a few months by the Robinson company are twelve for the Metropolitan Railway Co., San Francisco, Cal.; twenty-one for the Union Railroad Co., Providence, R. I.; forty for the Brooklyn City Railroad Co., Brooklyn, N. Y., and six for the Rock Creek Railway Co., Washington, D. C. In addition to these, many others have been delivered in various parts of this and several foreign countries, including British Columbia, Brazil and several European countries.

The Street Railway Advertising Co., of New York, during the last two years, have enjoyed a phenomenal growth and extension of their business, under the personal management of Mr. Samuel P. Ferree, the treasurer and owner. For the previous five years the business had been confined to the main street railways of Philadelphia, but immediate y upon Mr. Ferree's assuming the entire supervision, the business was extended to New York City and Brooklyn, where they now control 2,000 cars on the best and most valuable lines, and are in a similar position there, to that held for so many years in Philadelphia. They have recently extended their system to the adjacent cities of Harrisburg, Lancaster, Reading, Altoona, Chester, Atlantic City and similar points. Their policy has always been to encourage home or local advertisers to use their cars, and the results confirm the wisdom of such a course. To-day, there is no medium known by which local advertisers can so prominently and effectually reach the public. In order to secure the curved veneer advertising rack in sufficient quantities to meet their own demands, as new lines were added to their system, the Street Railway Advertising Co. were compelled to establish a manufacturing plant of their own. This places them in an independent position, and they are now able to equip an entire line of 100 cars at once. It would be well for street railway officials to confer with this company before leasing the advertising privileges on their cars, for the ability and responsibility of this company are fully attested by the lines they control.

John Stephenson Co., Ltd., of New York, are at work upon a number of new cars which they are equipping with their new standard truck, described on another page of this issue in connection with a car of the Johnstown Electric Railway, N. Y. The Stephenson factory contains at present many handsome cars in process of construction. Among these are some of an order of thirty-two passenger cars for the cable line of the Washington & Georgetown Railway Co., Washington, D. C., which immediately attract attention. The body color is Paris green with gold lettering, the interior is fitted up in quartered, oak and the seats are upholstered with old gold plush. The car body is sixteen feet in length, and has a monitor roof. This order was the direct outcome of the excellent satisfaction given on the line of the same railway by the grip cars recently built by the Stephenson company for the same road. The Stephenson shops also contain the second of the order of 100 cars which this company are building for the Broadway Cable Railway. These cars, as described in a recent issue, possess a number of novel features and are being equipped with the new Stephenson standard truck. Adjoining the Broadway car in the Stephenson shops is another handsome car which the company are building for the Newark & South Orange Electric Railway. This car has extra large platforms, and the body is eighteen feet in length, and is painted blue, with gold lettering and silver trimmings. Among other cities for which this company are building cars are: East Liverpool, O.; Houston, Tex.; Elmira, N. Y.; Canton, O.; Cleveland. O.; and Peubla, Mexico.

W. R. Fleming & Co., *Mail and Express* Building, New York, report the following sales of the Ide and Ideal engines manufactured by the Harrisburg Foundry & Machine Works, Harrisburg, Pa: Central Park Apartments, New York City, two 175 H. P., Ideal engines; Raritan & Perth Amboy Electric Light Co., Perth Amboy, N. J., one 150 H. P. engine; Racket & Tennis Club, New York City, one thirty-five horse power and one seventy horse power Ideal engines. San Francisco Laundry Association, San Francisco, Cal., one 100 H. P., tandem, compound, Ideal engine; Edison Spanish Colonial Co., New York City, two twenty-five horse power, Ideal engines for steamships "Mexico" and "Panama"; Rubber Reclaiming Co., New York City, one fifteen horse power Ideal engine; Canfield Rubber Co., Bridgeport, Conn., one thirty horse power Ide engine; Hotel Beresford, New York City, two forty-five horse power Ideal engines. This firm has just completed a plant for Hotel St. Lorenz, in New York City, that consists of two sixty horse power, Ideal engines, and is also installing in the Century Club of the same city one fifty and one sixty horse power Ideal engines. The firm has also recently taken several contracts for complete steam plants, and is now erecting the following: Hotchkiss School Association, Lakeville, Conn., one complete plant of seventy horse power, Ideal engine and ninety horse power, horizontal, tubular boiler; Mount Vernon Construction Co., Alexandria, Va., complete boiler plant of 300 H. P.; Municipal Electric Light Station, South Norwalk, Conn., complete plant of 100 H. P. Ideal engine and 125 H. P., horizontal, tubular boiler.

J. G. White & Co., electrical engineers and contractors, 29 Broadway, New York, have sent us a list of the contracts closed by them during the current year, as indicative of the confidence street railway companies in the quality of their work. This list includes the following roads: Wilmington Street Railway, Wilmington, N. C., 3 miles overhead construction; Yonkers Street Railway, Yonkers, N. Y., 4½ miles overhead construction; Steinway Street Railway, Astoria L. I., 5 miles overhead construction; Pawtucket Street Railway, Pawtucket, R. I., 2½ miles overhead construction; New Orleans & Carrollton Railroad, New Orleans, La., 16 miles iron pole overhead construction, same amount track construction; Baltimore Traction Co., Baltimore, Md. (recently completed), 7½ miles overhead construction; Carey Street extension, 4 miles overhead construction; Central Railway Co., Baltimore, Md., 11 miles overhead construction; City & Suburban Railway Co., Baltimore, Md., 7 miles overhead construction; Lake Roland Elevated Railway Co., Baltimore, Md., 20 miles overhead construction, 12 miles track laying; Newport Illuminating Co., Newport, R. I., erecting 20 miles incandescent and railway feeder, erecting 15 miles arc and pressure wires; Binghamton Street Railway, Binghamton, N. Y., 12 miles new overhead construction, and refitting 8 miles old overhead construction; Tonawanda Street Railway, Tonawanda, N. Y., 4 miles overhead construction; Highlandtown, Towsontown and Point Breeze branches of City & Suburban Railway, Baltimore, Md., 2½ miles double track, iron pole, cross suspension, 12 miles double track octagonal wood pole, bracket and cross suspension, about 13 miles track construction; Interstate Consolidated Rapid Transit Co., Kansas City, Mo., 13 miles overhead construction.

Barbour, Stockwell & Co., Cambridgeport, Mass., report an increased demand for tee rail work over last year, and their specialties in this line have found a ready sale, not only in New England, but in many points in the South and West. Their patent steel frog is also meeting with general approval. This frog is made from any section of girder, tee or tram rail cast into a bed plate of gun metal, thereby making the waist of the frog (which is usually bolted together) a solid piece of metal and giving it strength and durability where these qualities are most desired. There are no bolts to work loose, and no angle irons to drop off and cause the frog to separate, as is the case with most of the modern construction. The Barbour, Stockwell & Co., sleet wheel which has been placed upon the market during the last year will undoubtedly meet with a large sale this fall and winter. This wheel thoroughly cleans the trolley wire of all sleet and ice, having a frictionless metalline bushing. It is made to fit any trolley pole, and a change can be made from the regular wheel to the sleet wheel by any motorman or conductor in a minute. In the line of steam railroad crossings, several styles have been put on the market, and taking into account their time of use they have given excellent satisfaction to the railway companies using them. The Dowd gravity track cleaner—another one of the many improved devices that this progressive firm are putting forward—furnishes a perfect contact for all electric cars. It consists of a set of steel wire brushes attached to both ends of the car, and works automatically as the car moves along, requires no expert mechanic to adjust it, and leaves the rails thoroughly cleaned. The above firm have lately enlarged their plant, and are prepared, with their increased facilities, to fill any sized order with promptness and dispatch.

The Berlin Iron Bridge Co., of East Berlin, Conn., are putting up two iron buildings for the Randolph & Clowes Co. at Waterbury, Conn. One is a casting shop 42 × 82 ft., and the other a pickle room 25 × 100 ft. The Berlin company are also building a new gas house for the Philadelphia & Reading Railroad at Philadelphia, Pa., a new retort house for the Geo. H. Morrill Co., of Boston, Mass., and a new boiler house for the Pope Manufacturing Co. at Hartford, Conn. All of these buildings are to be of iron, after the well known plans of the company. This company have also received a contract from the Elmira Electric Illuminating Co. for the iron roofs for the new plant at Elmira, N. Y., which the latter company are building. The dynamo room of this station will be 66 × 177 ft., and will be covered with the Berlin company's patent anti-condensation, corrugated iron roofing, the floor space being controlled by a ten ton traveling crane. They are also building for the United States Projectile Co., of Brooklyn, N. Y., an addition of iron, 240 ft. long, to their present building The company write us also that their business during the present year has been very large. In no single year heretofore have they done a greater business than $1,000,000, while this year their sales up to September 15 were over $1,000,000, with three months and a half to their credit. They state that they have done more bridge work in 1892 than usual, and that their iron building work has also increased very largely. They have now contracts for iron buildings at New Orleans, La.; Anaconda, Mont.; Detroit, Mich.; Berwick, Chester and Philadelphia, Pa.; Wilmington, Del.; Elmira and Syracuse, N. Y.; Providence, R. I.; Hartford, Waterbury and Meriden, Conn.; Aspen and Denver, Colo.; Lynn, and Millbury, Mass., and Bath, Me., all on their well known designs of iron fireproof construction.

The National Pipe Bending Co., of New Haven, Conn., have been making heaters for fifteen years, and their sales of over 500,000 H. P. indicate that the heater is a success wherever used. They report the following sales among others: Two 150 H. P. to the Consolidated Electric Railway Co., Macon, Ga.; two 300 H. P. to the Binghamton Street Railway Co., Binghamton, N. Y.; one 100 H. P. to the Kingston City Electric Railway Co., Rondout, N. Y.; one 400 H. P. to the Edison Electric Illuminating Co., Altoona, Pa.; one 200 H. P. to the Camden Horse Railway Co., Camden, N. J.; one 500 H. P. to the Jersey City & Bergen Railway Co., Jersey City, N. J.; two 400 H. P. to the Hudson Electric Light Co, Hoboken, N. J.; one 100 H. P. to the Punxsutawney Electric Street Railway Co., Punxsutawney, Pa.; one 500 H. P. to the Malden Electric Co., Boston, Mass.; one 700 H. P. to the Portland Electric Light Co., Portland, Me.; one 800 H. P. to the Coney Island & Brooklyn Street Railway Co., Brooklyn, N. Y.; one 650 H. P. to the Seashore Electric Railway Co., Asbury Park, N. J.; two 300 H. P. to the Naumkeag Street Railway Co., Salem, Mass.; one

125 H. P. to the Ocala Light & Power Co., Ocala, Fla.; one 500 H. P. to the New Haven & West Haven Street Railway Co., West Haven, Conn.; one 200 H. P. to the Catskill Cable Road, Catskill, N. Y.; one 200 H. P. to the Biddeford & Saco Street Railway Co., Saco, Me.; one 100 H. P. to the Little Falls Electric Light & Power Co., Little Falls, N. Y.; one 150 H. P. to the Leominster Electric Light Co., Leominster, Mass.; one 1,000 H. P. to the Allegheny County Light Co., Pittsburgh, Pa.; one 200 H. P. to the East Side Railway Co., Brockton, Mass.; one 400 H. P. to the Yonkers Street Railway Co., Yonkers, N. Y.; one 200 H. P. to the Haverhill Electric Light Co., Haverhill, Mass.; one 350 H. P. to the Hopedale Machine Co., Hopedale, Mass.

The Morton Safety Heating Co., of Baltimore, Md., write us that their system of heating is growing rapidly in favor on account of its simplicity, efficiency, economy and absolute safety. This company have several large contracts now on hand as well as many smaller ones, and find their heaters are growing constantly in popularity. One evidence of this is shown by the recent action of the Railroad Commission of the State of Maine, which at the meeting in August approved the system and authorized its use in the state. This was done on the application of the Grand Trunk Railway of Canada, who propose to run trains heated with the Morton heaters through the state. The Morton heater, of course, is especially adapted to street railway lines, and they number many street railway companies among their customers. The company have recently issued a pamphlet entitled "Stored Heat in Earthenware Tubes" descriptive of their system of heating, which contains a number of testimonials worthy of attention. Among the street railway companies who use Morton heaters and have written to the company testifying their entire satisfaction in its operation, are the Consolidated Light & Power Co., of Dover, N. H.; the Federal Street & Pleasant Valley Passenger Railway Co., of Pittsburgh; the Pittsburgh, Allegheny & Manchester Traction Co., of Pittsburgh, and the Roanoke Street Railway Co., of Roanoke, Va. Other street railway companies which are using Morton safety heaters, are the Attleboro, North Attleboro & Wrentham Street Railway Co., of North Attleboro, Mass.; the West End Street Railway Co., of Boston; the Baltimore City Passenger Railway Co., of Baltimore, and the Baltimore Traction Co., of Baltimore. The railway companies which heat their cars by this system include some as far north as the Grand Trunk Railway Co., of Canada, and others as far south as Virginia, showing that the heater is equally well adapted for severe cold weather and moderate cold.

The Pennsylvania Iron Works, of Philadelphia, are at present building quite an extension to their already large plant. This building, according to the *Iron Age*, "will be 230 × 65 ft. in width and will have a clear height of forty feet. It will be used exclusively for the heavier kind of work done by the company, and will, in consequence, be equipped with machinery intended for handling work of the most massive description. The list of some of the most important machines which will find permanent resting places in this building is as follows: A twenty-five ton electric crane built by the Morgan Engineering Co., of Alliance, O., which will have a traveling speed of 300 ft. per minute. In one corner of the shop will be a pit lathe, in which two wheels, forty feet in diameter and ten feet face can be turned at the same time. There will also be a 122 in. × 50 ft. Bement, Miles & Co. planer, a sixty-three inch lathe and two horizontal boring mills, all by the same company, a fourteen foot boring mill by the Betts Machine Co., and several Brown & Sharpe standard milling machines. It is expected to devote this extension almost exclusively to the manufacture of cable driving appliances and the larger parts of refrigerating machines. We may state in addition that this company has been in actual operation only some five years, therefore, its extensive plant is equipped with machinery of the best design. The following dimensions of the main rooms will give a good idea of the extent of the whole establishment: The office is 100 × 40 ft. on the ground; the foundry, 200 × 225 ft.; the present erecting shop, 180 × 70 ft., and two machine shops, 225 × 90 ft. and 225 × 80 ft. An aim in laying out the first plans was to provide for the easy handling of heavy pieces of work, and we therefore find that the largest castings can be taken from the foundry and deposited in any department without any hand labor whatever. In addition to the above there is an ice machinery department measuring 190 × 80 ft., in which work peculiarly pertaining to the manufacture of these machines is carried on."

The Germania Electric Co., of Boston, manufacturers of the improved Schaefer incandescent lamp, the De Khotinsky incandescent lamp, and the Germania dynamo, write us that they have completed the construction of the addition to their factory at Marlboro, Mass., and now have the plant in such shape that they can promptly fill their orders. This has given them a definite increase in output, so that during the last month their sales have more than doubled, although during the same period last year they showed a decrease. Their dynamo, they state, is now fairly on the market, and has received a considerable amount of favorable attention. Two large machines are being put into the Rotch mills at New Bedford, Mass., and one of 600 light capacity was started up during the last month at the mill of the Mascomo Flannel Co, at Lebanon, N. H. Besides these they have sold a considerable number of other plants, and find that the dynamo is very favorably regarded by purchasers, not only on account of its slow speed, but also the fine workmanship and moderate price. In their lamp business they have about concluded devices at the factory necessary for the construction of the De Khotinsky lamp, and are now manufacturing a three-watt lamp of this type for fifty volt circuits. They are also ready to put on the market a curled filament for street railway lamps which does away with the anchoring wire at present in use, and hence avoids any tendency of the filament to saw off under the constant vibration of the car. Their storage battery is now so far along that they announce themselves willing to take orders for equipments for either street railway or lighting plants. The battery used is that of Captain De Khotinsky, which has given such great satisfaction on the Prussian government railroads. The active material is placed in longitudinal grooves in a lead grid, which method of construction allows considerable expansion to the material without either buckling or forcing the active material out of the grid, thereby reducing the chances of short circuiting, either through deformation of the plate or the lodgment of falling particles. The demand for their shade holders, they also state, has increased to double what it was last year, and finally, they look forward to a very prosperous season of business next year, equal to several times that which they have formerly carried on.

The Reliable Mfg. Co., 53 State Street, Boston, manufacturers of the Reliable sand box, Collett ratchet brake handle, Reliable track switch, trolley wheels and other street railway supplies, only completed their factory in Everett last January, but since that time they have added several new machines of various kinds, and now employ ten times the number of mechanics. Their business has steadily increased with the growth of electric street railways. Their Reliable sand box is meeting with a large sale, it being able to distribute coarse or fine sand in large or small quantities, and at just the moment and place required, thereby preventing accidents and so often saving many times over the cost of their application. Their Collett ratchet brake handle is also being largely adopted. Some of these handles have been in use over three years, and are good for as many more years. They are guaranteed for one year by the manufacturers, and are claimed by them to be the best and cheapest ratchet handle that can be put on electric cars. Their Reliable track switch, described in our last issue, is just being put on the market, and seems to meet with general favor. It is automatic, and the mechanical arrangements are very simple. The Reliable Manufacturing Co. also now manufacture an excellent line of trolley wheels. Last month Reliable sand boxes were shipped to Lowell & Suburban Street Railway Co, Lowell, Mass.; Lynn & Boston Street Railway Co., Lynn, Mass.; Ottawa Electric Street Railway Co., Ottawa, Ont.; Merrimack Valley Street Railway Co., Lawrence, Mass.; East Middlesex Street Railway Co., Melrose, Mass.; Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.; Rochester Street Railway Co., Rochester, N.Y.; Kankakee Electric Railway Co., Kankakee, Ill.; Alliance Street Railway Co., Alliance, O.; also to Lamokin Car Works, Chester, Pa.; for Citizens' Passenger Railway Co., Harrisburg, Pa.; Paterson Central Electric Railway, Paterson, N. J.; Philadelphia Traction Co., Philadelphia, Pa.; and to the Newburyport Car Mfg. Co., Newburyport, Mass.; for Natick Street Railway Co., Natick, Mass.; Worcester & Millbury Street Railway Co., Worcester, Mass. The following are a few of the railway companies to which the Collett ratchet brake handles have been shipped during the month: New Haven & West Haven Horse Railway Co., West Haven, Conn.; Lowell & Suburban Street Railway Co., Lowell, Mass.; Natick & Cochituate Street Railway Co., Natick, Mass,; Fitchburg Street Railway Co., Fitchburg, Mass.; Globe Street Railway Co., Fall River, Mass., Lynn & Boston Street Railway Co., Lynn, Mass.; Allentown & Bethlehem Rapid Transit Co., Allentown, Pa.; Merrimack Valley Street Railway Co., Lawrence, Mass.; Briggs Carriage Co., and Ellis Car Co., Amesbury, Mass.; Newburyport Car Manufacturing Co., Newburyport, Mass.; Thomson-Houston Electric Co., Lynn, Mass.

The R. D. Nuttall Co., of Allegheny, Pa., manufacturers of electric railway supplies for all systems, are doing a large business, and their appliances are meeting with deserved popularity in all sections of the country. This company have recently been making some important additions to their factory, and have increased their machinery to enable them to keep pace with the constantly increasing demand for the articles manufactured by them. They have now divided up their works into different departments under the charge of competent men. The machine shop department has been placed under the charge of Mr. E. F. Caterall who has had a long experience in this line of work. The fitting department is under the charge of Mr. M. Benninger, who is a thorough mechanic and graduate of one of the best technical schools in Germany. The armature winding department is under the direction of Mr. H. Gilleland, who has had long experience in general armature work, and is well posted on the subject. Mr. A. Swoger is in charge of the tool room of the Nuttall Co., and exercises as well a general supervision over all the small tools of the factory. This system of division chiefs, the Nuttall Co. find, works excellently in practice, since it holds every one strictly responsible for the production of work in his respective department. The company are also paying special attention to the matter of inspection, each article manufactured by them being thoroughly inspected before it leaves their works. In this way they insure to the user of their goods a perfectly well made and finished article. It is undoubtedly owing to this care on their part that the gears and other appliances manufactured by them have reached the degree of excellence found by users. The company have also enlarged their selling department by the establishment of offices in Chicago and St. Louis. Their Chicago office is presided over by two gentlemen thoroughly acquainted with the line of business in which they are engaged, and widely known in the trade. They are Mr. P. H. Carey, formerly with J. G. White & Co, of New York, and Mr. E. H. Harrison, formerly with H. Ward Leonard & Co., of New York. These gentlemen have already secured a large number of orders for Nuttall appliances, and they report the prospects for business excellent. They are making preparations to carry a large stock of supplies in Chicago so as to be able to ship promptly on demand from that point any appliances which may be ordered. The St. Louis agents of the R. D. Nuttall Co. are Messrs. T. C. White & Co. This firm was organized about the first of last April and are genuine hustlers. They have already received a large number of orders in St. Louis and vicinity, and have found their business to increase so rapidly during the six months in which they have been at work, that they have been obliged to move from 904 Pine Street, where they were at first located, to more commodious quarters at 805 Locust Street.

WESTERN NOTES.

The Railway Equipment Co., of Chicago, have secured the right to manufacture and sell on a royalty the Ahearn electrical car heater and other electrical appliances belonging to Messrs. Ahearn & Soper, Ottawa, Can.

The National Electric Manufacturing Co., of Eau Claire, Wis., are now represented in Chicago by Paul W. Bossart, special agent. The office is now located at 608 Pullman Building, having been removed from 931 "The Rookery."

Arthur S. Partridge, Bank of Commerce Building, St. Louis, Mo., has recently secured several excellent agencies for St. Louis and the West, and has sold of late a great deal of material to electric railways. His business in electric railway supplies, he states, is constantly on the increase.

The Charles Munson Belting Co., of Chicago, manufacturers of Eagle and Dynamo belting, tell us that they have recently closed, among other orders, one with the Brush Electric Co., of Baltimore, for another monster belt. This belt with be three ply, fifty-four inches wide and 130 ft. long.

The Kuhlman Co., of Cleveland, O., write us that they have just received a large order from one of the Cleveland street railway companies for "Cleveland Combination" cars. They state that these combination cars are meeting with great success, and that they are giving good satisfaction to railway managers and the general public. In consequence the Kuhlman Co. are improving their facilities for manufacturing them, and making arrangements for a large output during the coming season.

The Valentine-Clark Co., of 540 Rookery, Chicago, successors to the Ernest L. Clark Co., report that they are meeting with a large sale for their street railway poles and ties. Their business, the past season, has been satisfactory in all respects, and for the season of 1893 they are anticipating a much larger demand than ever, and they are now hard at work equipping themselves to supply the demand. They expect to carry larger stocks than ever before, and will also establish more yards at various initial points enabling them to handle orders from any section of the country with more promptness and dispatch.

Taylor, Goodhue & Ames, of Chicago, have organized a company that will be known by their combined names. They will manufacture and deal in electrical material, with offices at 827 Monadnock Building. The three gentlemen composing the company have all been with the Electrical Supply Co., of Chicago. William Taylor, the president of the new corporation, was assistant manager in that company. The three organizers of the new business are energetic men and thoroughly acquainted with all branches of electrical trade. They will sell to both electric light and railway companies, and will soon introduce a number of interesting and novel specialties.

The St. Louis Car Co. have just completed for the St. Louis & Suburban Railway Co. thirty palatial cars, which are claimed to be the finest and most comfortable street cars ever seen in the West. They are thirty-four feet over all, with bodies twenty-eight feet long, handsomely finished in cherry, with elegantly decorated veneered ceilings, suspended from which are five two-light bronze electroliers of C. G. Woods' latest pattern. The seats on both sides of the centre aisle are rattan with reversible backs. The cars are each equipped with two twenty-five horse power, Thomson Houston type T, single reduction motors, with latest controlling device. The cars are light, roomy, comfortable and convenient.

The Q. & C. Co., of Chicago, manufacturers of railway specialties, write us that the Bryant metal sawing machine and other specialties manufactured by them are meeting with a large demand, the rail saw being especially popular. Although this machine has been on the market for only a year, and in the hands of the Q. & C. Co., for but a few months, it has had a large sale. The Q. & C. Co. have improved it in many details, and state that whenever used it has given the best of satisfaction. Among other recent customers are J. B. & J. M. Cornell, New York; Barbour, Stockwell & Co., Boston; Smith & Lovett, Boston; Dearborn Foundry Co., Chicago; Paige Iron Works, Milwaukee; Sampson Steam Forge Co., Chicago; Stacey Manufacturing Co., Cincinnati; West End Street Railway, Boston; Manhattan Railway Co., New York, and the Troy & Lansingburgh Railway, Troy, N. Y.

Pullman's Palace Car Co., of Chicago, have a large number of orders on their books, and their new cars throughout the country are mantaining their usual record for handsome appearance and excellent workmanship. Among their recent orders in the street railway department are the following: One double deck motor car, for the Tampa Suburban Railway Co., Tampa, Fla.; forty-five closed horse cars, for the Capitol, North O Street & South Washington Railway Co., Washington, D. C.; two combination open and closed motor cars, for the Joliet Street Railway Co., Joliet, Ill.; Three closed motor cars, for Messrs. Jones & Hovey, for service at Marshalltown, Ia.; six closed motor cars for the Galesburg Electric Motor & Power Co., Galesburg, Ill.; one double deck centre vestibule motor car, for the Louisville Terminal Railway Co., Louisville, Ky. In their freight and passenger car department they also state that they are, as usual, very busy.

The Lodge & Shipley Machine Tool Co., of Cincinnati, O., are in receipt of many orders for the different types of lathes and other machines manufactured by them. This company purchased, a short time ago, the entire plant, business and good will of the Ohio Machine Tool Works, and so secured the entire interest claimed in all pulley lathes formerly belonging to the Lodge & Davis Machine Tool Co., and which that company had transferred to the Ohio Machine Tool Works. The Lodge & Shipley Machine Tool Co. are manufacturing a heavy lathe especially adapted to the rapid production of motor gears. This lathe will turn, face and bore an iron gear twenty-three inches in diameter, four and one-half inches face, three and three quarters inches bore in less than half an hour. Only a very small additional amount of time is required in turning out a steel gear, and the machine can continue at the work all day. This motor gear lathe has been adopted by several of the largest of the electric supply companies in the United States and is giving generally the very best of satisfaction.

The Stirling Co., of Chicago, report a constantly increasing demand for their water tube safety boilers, and that they have a large number of orders on hand at present from street railway companies. The boiler manufactured by this company has shown itself especially adapted for street railway power stations, and the company have equipped the following companies since January 1, 1892: Minneapolis (Minn.) Street Railway, a 2,000 H. P. boiler; Yonkers (N. Y.) Street Railway, a 240 H. P. boiler; Waco (Tex.) Electric Railway, & Light Co., a 150 H. P. boiler; Toledo (O.) Consolidated Street Railway, a 600 H. P. boiler; Piqua (O.) Street Railway, a 100 H. P. boiler; Ottumwa (Ia.) Electric Railway, a 750 H. P. boiler; St. Joseph & Benton Harbor (Mich) Street Railway, a 400 H. P. boiler; Evansville (Ind.) Street Railway, a 750 H. P. boiler; Pittsburgh (Pa.) & West End Electric Railway, a 618 H. P. boiler; Braddock (Pa.) & Turtle Creek Electric Railway, a 206 H. P. boiler; Mobile (Ala.) Electric Light & Power Co., a 350 H. P. boiler; Springfield (O.) Street Railway, a 500 H. P. boiler, making a total of 6,464 H. P. during the preceding nine months. The Stirling Co. report that they can show a similar list of electric light plant boilers installed during the same period, and aggregating as large a total.

The Laclede Car Co., of St. Louis, are, as usual, rushed with orders. Of the equipment for the Third Avenue cable road, of New York, 108 cars have been delivered, seventy-eight are being shipped and are on their way, and twenty-two are not yet finished. Twenty combination cars are being built for the Philadelphia Traction Co. for use on the lines of the Pittsburgh and Duquesne Traction companies, of Pittsburgh, Pa., ten combination cars for the Pittsburgh & West End Co., of Pittsburgh, also cars for the Suburban Rapid Transit Co., of Pittsburgh; ten forty-seven foot vestibule cars, Baumhoff's patent, for the Lindell Railway Co., of St. Louis; cars for the Topeka Electric Railway Co., of Topeka, Kan.; the Lincoln Electric Street Railway Co., of Lincoln, Neb.; Superior Rapid Transit Co., of West Superior, Wis.; Electric Railway & Power Co., of Tiffin, O.; Springfield Electric Street Railway Co., of Springfield, O.; Bloomington City Railway Co., of Bloomington, Ill.; Brightwood Railway Co., of Washington, D. C.; Ashland & Catlettsburg Railway Co., of Ashland, Ky.; Urbana & Champaign Street Railway Co., of Champaign, Ill.; Shreveport Railway Co., of Shreveport, La., and Easton, Pa. The company is to replace the present frame buildings with those of brick, and will then be in better shape to manage their large and increasing business. The boiler capacity of the works has been increased from 200 H. P. to 400 H. P.

The Fulton Foundry Co., Cleveland, O., are at present extending and enlarging their works so that they can be better able to fill larger orders than ever before. Their works are running to their full capacity, and this company are at present turning out a large number of switches, railroad crossings and special work. In the truck department, however, they report special activity. A large number of companies have adopted the Fulton Foundry truck as a standard, and orders are being received from all sections. The following roads are among others which use the truck: East Cleveland Railroad, Cleveland, O.; Bloomington City Railway, Bloomington, Ill.; Janesville Street Railway, Janesville, Wis.; Toronto Street Railway, Toronto, Ont.; Montreal Street Railway, Montreal, Can,; Consolidated Street Railway, Toledo, O.; Brooklyn City Railway, Brooklyn, N. Y.; Springfield Street Railway, Springfield, O.; Milwaukee Street Railway, Milwaukee, Wis.; Edison General Electric Co., Schenectady, N. Y. Many of these companies have ordered additional equipments showing that they are well satisfied with the operation of the truck. Every truck recently furnished by the Fulton Foundry Co. has been equipped with their double tread wheel which they find very popular. They are turning out a large number of these wheels, and are endeavoring to get ahead with their orders, so that they can always have a large stock on hand.

The Detroit Electrical Works write us that during the past year their factory at all times has been worked to its fullest capacity in their endeavor to keep up with orders for railway motor equipments and generators that have been received. Among the most prominent of the contracts which the company have taken during this period are the following: Dubuque and Sioux City, Ia.; Racine, Wis,; South Chicago, Cairo, Jacksonville and Kankakee, Ill.; Omaha, Neb.; Kokomo, Ind.; Detroit, Mich.; Chattanooga, Tenn., and Salina, Kan. Of these orders a number have been for increase of equipment, notably Jacksonville, Ill., where the Jacksonville Railway Co., after purchasing three Detroit standard equipments and three of another type, and running both for a number of months, placed their order for an increase with the Detroit Electrical Works; also, the Calumet Electric Street Railway Co., South Chicago, whose first order was given the Detroit Electrical Works, July 31, 1890, since which time the same manufacturers have received five orders from this company for increase of equipment, the last being placed after the company had tested other motors. The Detroit, Chattanooga, Dubuque, Racine and Salina contracts were only placed with the Detroit Electrical Works after the most thorough and personal investigation of all other systems by the officers of the railway companies. Owing to the great amount of work which has been contracted for by this company, it has been found necessary to largely increase the manufacturing facilities, and consequently the factory has been enlarged and new machinery intro-

duced, so that now their capacity is fully treble what it was a year ago. This company are now manufacturing multipolar generators up to 250 K. W. capacity, and before the year is past will be prepared to furnish up to 500 K. W. capacity, Their generators have every improvement suggested by the latest practice, and in consequence of their being of new pattern, have many advantages over machines previously designed. As a convenience to the trade, and that all business may be transacted with greater dispatch, the general offices of the company have been removed from the works in Detroit, corner of Woodward Avenue and the railroad, to the Campau Building, corner of Larned and Griswold Streets. where now the company have an elegant suite of offices fitted up with every known convenience for prompt dispatch of business, and where, they write us, they will always be pleased to entertain their friends and customers. As, notwithstanding the fact that the capacity of the works has been greatly increased, the work in hand is still so great that it requires the working of a night force as well as the regular day force, it will be seen that the outlook for this company is very bright, and they have little doubt but that the business of the coming year will be more than treble that of any year in the history of the company.

Press Comments On Our New Hand Book "Street Railways."

"In the work the author has treated the subject in the broadest sense, giving first a very comprehensive view of the actual methods employed, and then entering into many details of the construction and management of roads, which are here probably brought together for the first time.

"It has evidently been Mr. Fairchild's aim throughout to place the subject matter before the reader in such a manner that even those little versed in technical matters will be able to gather a correct understanding of the various systems and to form an opinion of their relative merits viewed from both a mechanical and a commercial standpoint. The illustrations throughout are admirable, and together with the lucid text, make this the best compendium on the subject extant. Mr. Fairchild and his publishers are to be congratulated."—*Electrical Engineer.*

"To those who have not looked into the matter before, this handsome quarto will come as a surprising revelation of the enormous development in America of what we on this side of the water call tramways, but what they in the United States appropriately enough designate street railways. The great monthly journals published in America and devoted to street railway interests are, indeed, sufficient evidence of this development, but to the general public here they are quite unknown. No such journals could exist here, and no such book as the present could be attempted, for the street railway industry as understood across the Atlantic, is with us only in embryo. In 'Street Railways' Mr. Fairchild has produced an eminently practical and useful work.

"There seems to be scarcely a detail which a tramway manager should know that is omitted from the work, while for all interested in the subject the book is a valuable one. Hundreds of illustrations and diagrams elucidate the text. We believe there is no other work of a similarly comprehensive nature yet published. It represents vast knowledge and industry on the part of the author, and everything is brought down to date.

"Mr. Fairchild is recognized as an eminent authority in the American street railway world, and his book merits careful study by all who are connected with the new tramway department of the Town Council. To some of them it may be an eye opener; to all it will be profitable."—*The Glasgow* (Scotland) *Herald.*

"Mr. Fairchild has accomplished a great work and has produced what must be considered the first full and complete treatise upon street railways. For years he has been a close and careful student of every phase of the many systems of transit, and he has recorded the results of his study and investigation in a very painstaking manner. His treatment of the subject is broader than the scope of any other work upon this topic, including not only electric, cable and animal traction, and steam, air and gas motors, but also inclined planes, rack rail inclines and elevated railroads. These various methods of traction are treated in great detail, and Track Construction and Car Building form two very valuable chapters in the book. Three chapters treat of discipline and rules, the organization and financing of companies and the keeping of street railway accounts, all of them subjects of great importance, but not generally given the attention they deserve. The book is profusely illustrated with a great number of original plans, sketches and drawings, so that every description can be easily and thoroughly comprehended. Few people have any idea of the prodigious amount of work involved in the preparation of such a volume, but those who do will appreciate the accuracy and completeness of what Mr. Fairchild has done. To any man who has any connection with a street railway this book must be invaluable."—*Manufacturers' Record.*

"This book deserves to become a manual on street railways, for it is the best and most comprehensive work that we have seen on the subject, about which there is not much reliable literature. While the book contains a great deal of technical detail, it has been so skillfully written that an ordinary reader, interested in the wonderful development of the street railway system of transportion follows on, chapter after chapter, with keen interest.

"We think it would be a good plan to make a hand book of the chapter on electric traction for the benefit of men engaged in operating electric cars."—*Locomotive Engineering.*

"This volume is a book of great usefulness to those dealing with the practical side of the subject, and of some value even to lawyers.

"It is also undoubtedly a very useful book for engineers."—*Railway and Corporation Law Journal.*

"There have been treatises on street railroads, or tramways, but none recently, and this class of roads has received so rapid a development, both in extent and methods of operation, within a few years past that a new treatise had become a necessity. Mr. Fairchild has undertaken to fill this vacancy, and has done it with a very considerable degree of success.

"The great development of electric traction is very well treated, and much space is given to electric appliances, but the cable road and other systems are not neglected. The chapter on Rules and Operating are of a practical kind, and the author has given accounts of the best methods of management and those which have been approved of in practice. Upon the whole, Mr. Fairchild has made a very good book, and one which will meet a decided want.

"It can be recommended to all who are interested in street railroads and their methods."—*The Railroad and Engineering Journal.*

"There has been a need in the street railway field, for some time, of a practical reference book, a book that an untrained or unskilled man could look to for practical points and information. Until the publication of this book there has been nothing to fill this need in supplying it. Mr. Fairchild has brought his years of experience and his ability and his enthusiasm to a focus, and the result is a book that is quite invaluable. It evidently represents a large amount of work, as the book is quarto size and there are nearly 500 pages. A glance at the table of contents shows how comprehensively the subject is covered."—*Electrical Industries.*

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, AUGUST 30, 1892, TO SEPTEMBER 20, 1892, INCLUSIVE.

AUGUST 30.

Car Truck Gear, Edgar Peckham, New York, N. Y. 481,704
Electric Motor and Regulating Device therefor, Frank J. Sprague, New York 481 739
Electric Railway, Rudolph M. Hunter, Philadelphia, Pa. 481.905
Extensible Step for Cars, William H Voss, East Stroudsburg, Pa. 481,658
Motor for Street Cars, James G. Lightford, Indianapolis, Ind. 481.7 5
Rail Chair, Charlie E Mark, Cleveland, O. 481,575
Railway Joint, Henry T. Hey, Philadelphia, Pa. 481,758
Railway Rail Joint, Charlie E. Mark Cleveland, O. 481,576
Street Car, John A. Mehling, Cleveland, O. 481,800
Trolley Carriage for Conduits, Stephen L. Platt, Elgin, Ill. 481,817

SEPTEMBER 6.

Automatic Gipsy for Cable Railways, Andrew J. Smith, St. Louis, Mo. 482 279
Automatic Trolley Disconnector, George A. Kimball, Seattle, Wash. 481,956
Car Journal Box, Charles T. Schoen, Allegheny, Pa. 482,200
Crossing for Underground Cable Railways, William H. Page, Philadelphia, Pa 481,966
Conduit System for Electric Railways, Reuben Lawrence, St. Joseph, Mo 481,959
Means for Drawing Cables into Conduits, Thomas F. O'Connor, New York, N. Y., and Joseph W. Marsh, Pittsburgh, Pa. 482,270
Trolley for Electric Railways, Clarence A. Adams and Thomas J. Thorp, Lincoln, Neb. 482,031
Trolley for Electric Railways, James M. C. Tyner and Samuel S. Irving, Minneapolis, Minn 482,325

SEPTEMBER 13.

Bell, Edward D. Rockwell, Bristol, Conn. 482,696
Electric Locomotive, William H. Soley and William W. Perkins, Philadelphia, Pa 482.594
Inclosed Conductor for Electric Railways, Geo. A. Dupuis, Detroit, Mich. 482.343
Street Railway Switch, Tom. L. Johnson, Cleveland, O 482,426
Underground Trolley, Joseph Fischer, Cleveland, O. 482,509

SEPTEMBER 20.

Brace Chair for Railroads, George Murray, Johnstown, Pa. 482 807
Car Wheel, George Hull, Binghamton, N. Y 482.064
Chair for Railroad Rails, Arthur J. Moxham, Johnstown, Pa. 482,801
Channel Rail and Chair, Arthur J. Moxham, Johnstown, Pa. 482.803
Closed Conduit for Electric Railways, Levi P. Bunce, Minneapolis, Minn. 482,993
Combined Railroad Rail and Chair and Method of Making the Same, Arthur J. Moxham, Johnstown, Pa. 482,805
Conduit for Electric Railways, Francis O. Blackwell, Boston, Mass. 482,719
Electric Locomotive, Conrad M. Conradson, Madison, Wis. 482,863
Electric Railway Conduit, Ralph M. Hunter, Philadelphia, Pa. 482,964
Fare Register and Recorder, Charles Crook, Brooklyn, N. Y. 483.102
Guard Rail, Simon H. Stupakoff, Pittsburgh, Pa. 482.766
Insulator, Charles T. Lee, Boston, Mass. 482,872
Metal Railroad Tie, Robert E. Daniels, Youngstown, O. 482.997
Metallic Railway Tie, Charles B. Macneal, Philadelphia, Pa. 482.967
Rail Joint, Thomas J. Kennedy, Renfrew, Pa. 482 796
Railroad Rail Chair, Arthur J. Moxham, Johnstown, Pa. 482,802
Railroad Rail Chair and Process of Making the Same, Arthur J. Moxham, Johnstown, Pa. 482,804
Railway Chair, Simon H. Stupakoff, Pittsburgh, Pa. 482 765
Sign for Cars, Charles S. Reed, Boston, Mass. 482,928
Street Railway Switch Appliance, James P. Hodger, Spokane, Wash. 482.903
Trolley Stand for Electric Railways, John C. Hough, Pittsburgh, Pa. 483,061

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Sept. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co ...	50	1,250,000	Q.—J.	1½	.....	116	.....
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	270	.....
Brooklyn City R. R. Co.....	10	6,000,000	Q.—J.	2	.....	.....	.....
Coney Island & Brooklyn R. R. Co.....	100	500,000	.....	...	.....	143	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.....	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	104
Broadway R. R. Co.....	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds.....	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates.....	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st.....	.....	125,000	F. & A.	7	Aug. 1897	106	.....
South Brooklyn Central R. R. Co., 2d.....	.....	150,000	F. & A.	6	July, 1941	102	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	109	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.....	100	750,000	Q Feb.	1½	1890	119	120
Watervleit Turnpike & R. R. Co.....	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort...	1865	40,000	J. & J.	5	1905	105	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	102½	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	102	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	102	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	102½	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	105¼	.....
" " " Debenture..	1891	200,000	M. & N.	6	1901	113	.....
Watervliet Turnpike & R. R., 1st Mort.....	1889	350,000	M. & N.	6	1919	115	118
Watervliet Turnpike & R. R., 2d Mort.....	1889	150,000	M. & N.	6	1919	108½	113

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Sept. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1	.....	.....	150
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	140	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.. ..	117	120
42d & Grand St. Ferry.....	100	748,000	Q.—F.	3	.....	260	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	50	53
Eighth Avenue.....	100	1,600,000	Q.—J.	2	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	J. & J.	5	.....	113	116
Sixth Avenue.....	100	1,500,000	M. & S.	3	.....	200	204
Third Avenue.....	100	2,000,000	M. & N.	6	.....	210	215
23d St.....	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue.....	100	800,000	.....	3	.....	130	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	112
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	104	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	104	.....
Additional.....	.....	1,000,000	J. & J.	5	July, 1905	94	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	116	120
Central Crosstown.....	.....	250,000	M. & N.	6	Nov., 1922	115	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	100	101
Scrip.....	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry.....	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	111	114
2d mort.....	.....	1,200,000	J. & J.	6	1915	63	65
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	100	107
Second Avenue.....	.....	1,600,000	M. & N.	5	Nov., 1909	103	105
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	112	114
23d St.....	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. Sept. 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.....	50	$6,400,000	J. & J.	4	1887	87½	87¾
West End Com'n.....	50	9,085,000	J. & J.	5	1890-1892	71½	72

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Sept. 19.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co.....	100	$270,000	New.	...	Oct., 1887	93	100
Union R. R. Co., Prov.....	100	2,000,000	Q.—J.	2	1862-1863	200	210
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co....	100	1,000,000	J. & J.	4	.....	210	225
Holyoke Street R. R.....	100	200,000	J. & J.	4	.....	212	225
Northampton Street R. R.....	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.....	50	$100,000	J. & J.	3	.....	.....	60
Enterprise Ry. Co.....	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.....	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
*Carrollton R. R. Co.....	100	800,000	Quart.	1½	1867	127	132
Crescent City R. Co.....	100	1,150,000	"	1¼	.866	96½	99½
Canal & Claiborne R. R. Co..	40	240,000	.....	...	1888	26	34
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1800	137	145
Orleans R. R. Co.....	50	185,000	"	2	1868	64	68
St. Charles Street R. R. Co..	50	600,000	"	2	1866	90½	92½

Bonds.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	.....	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93-'99	.....	.....
do do new	1886	40,000	M & N	6	1896	.....	.....
N. O. City R. R. Co.....	1879	495,200	J & D	6	1903	120	.....
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92-'06	.....	.....
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89-'01	.....	.....

*Bids on Carrollton R. R. are ex-privilege of new stock.

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	35	.....
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	26	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	.....
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1899	103	.....
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued).....	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Sept. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	232	233
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	91⅛	92⅛
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	29	29½
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	99½	100
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	115	.....
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	115	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	470	480
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	99½	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5 000,000	J. & J.	4	.....	270	275
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	215	218
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619.500	J. & J.	4½	.....	98⅝	98¾
Chicago Passenger	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	101½	102
" " "	.....	1,850.000	M. & N.	4½	1927	96½	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100⅝	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101½	.....
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	96¼

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 421 Wood Street, Pittsburgh, Pa., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co ...	50	1,500,000	.....	..	.....	....	29½
Citizens' Traction R. R. Co ..	50	3,000,000	J. & J.	3	.....	62¼	63
Pitts. & Birmingham R. R. Co	25	3,000,000	.....	...	.....	25⅝	25¾
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	.....	60
Federal St. & Pleasant Valley	50	1,400,000	J. & J.	3	.....	25½	25½
Pittsburgh, Allegheny & Man	50	3,000,000	. ....	...	.....	.....	44
West End R. R. Co.	50	200,000	J. & J.	...	.....	. ...	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	. ...	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	....	.....
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	.....	.....
Pittsburgh Incline Co.	100	150 000	.....	...	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co ..	1887	1,250,000	A. & O	5	1927	107½	.....
Pitts. & Birmingham Trac-tion Co.	1889	1,500,000	M. & N.	5	1929	.....	.....
Pittsburgh Traction R. R. Co.	1887	750.000	A. & O.	5	1937	106	.....
Pleasant Valley Ry.	1891	1,250,000	J. & J.	5	1919	.....	.....
P., A. & M. R. R. Co.	1891	1,500 000	J. & J.	5	1931	.....	.....
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	.....	.....
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30.000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.	1883	125,000	.....	6	1903	.. .	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	....	.....
Monongahela Incl'e Plane Co.	1887	50,600	A. & O.	5	1897	...	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.. ..	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.	100	1,000,000	Monthly	5	.....	113	115
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Occan R.R.Co	100	1,000,000	.....	1	.....	95	110
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	.....	64
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	34	40
Omnibus Cable Co.	100	2,000,000	Monthly	4	.....	59¾	61
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	.....	29¼
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	.....	105
Market Street R. R.	.....	3,000,000	J. & J.	6	1913	122½	.....
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	116½	.....
Powell Street R. R.	.....	700.000	M. & S.	6	1912	110¾	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	114¾	116½
Park & Cliff House R. R.	.....	350.000	J. & J.	6	.....	95	.....
Cal. St. Cable R. R.	.....	.....	.....	...	.....	102½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.	100	$324,000	Q.—J.	3	1864	110	150
Cass Ave. & Fair Grounds.	50	300,000	.....	...	1876	46	47
Citizens'	100	1,500,000	A. & O.	1¼	1887	90	95
Jefferson Avenue	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	72	74
Missouri	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central	100	200,000	.....	...	1884	100	105
People's	50	1,600,000	M. & S.	6	1889	45	50
St. Louis	100	2,000,000	J. & J.	6	1890	150	160
4th Street & Arsenal	50	150,000	Jan.	.50	1872	10	12
Union	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban	100	2,500,000	... .	...	1891	48	50
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine	1891	$500,000	F. & A.	6	1911	102	102½
Cass Avenue & Fair Ground...	1892	1,800,000	J. & J.	5	1912	97	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	106	107
Lindell	1890	1,500,000	J. & J.	5	1895–1910	99	100
Mound City	1890	525,000	A. & O.	6	1900–1910	105	106
Missouri Cable	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort	1882	125,000	J. & D.	6	1902	102	105
" 2d mort	1886	75,000	M. & N.	7	1902	104	105
People's Cable	1889	800,000	J. & J.	6	1889–1914	97	100
St. Louis Cable	1890	1,500,000	M. & N.	5	1900–1910	97½	98
Union	1885	150,000	M. & N.	6	1895–1915	102	103
Union Depot	1890	1,600,000	A. & O.	6	1900–1910	105	106

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'	50	$500,000	Q.—J.	4	1858	255	265
Continental	50	1,000,000	J.—J.	6	1873	125	130
Frankford & Southwark	50	1,250,000	Q.—J.	5	1854	210	212
Germantown	50	1,500,000	Q.—J.	2¼	1858	103	110
Green & Coates	50	500,000	Q.—J.	3	1858	120	122
Hestonville	50	2,050,000	.....	...	1859	32	34
Lombard & South	25	500,000	A.—O.	8	1861	58	60
People's Common	25	1,500,000	M.—S.	2½	1873	49	51
" Preferred	25	750,000	M.—S.	2½	.....	49	.....
Philadelphia City	50	1,000,000	J.—J.	7½	1859	151	152
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	70	72
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	90	91
Ridge Avenue	50	750,000	Q.—J.	5	1872	222	225
Second & Third	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	203	207
Union	50	1,250,000	J.—J.	9½	1864	191	192
West Philadelphia	50	750,000	J.—J.	10	1857	200	202
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	138	140
Baltimore Traction	25	5,000,000	.....	1	1889	26	26½
Buffalo (N. Y.) Railway	100	6,000,000	.....	...	.....	44	45
Newark (N. J.) Passenger	100	6,000,000	.....	...	.....	29	30
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	26	27
BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1.500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1.250.000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1.750,000	J. & D.	5	1942	106	107
Germantown, 1st mort	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort.	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Sept. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati ex. 1¼ per cent.	50	$6,000,000	Q.—J.	5	.....	107⅛	107¾
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	108	108½
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	125	135
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry.	100	500,000	.....	...	.....	92	95
" " " Pref.	100	100,000	.....	6	.....	100½	101½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	.....	.....
" "	.....	50,000	J. & J.	7	July, 1893	102¾	.....
" "	.....	50,000	J. & J.	7	July, 1894	107	.....
" "	.....	50,000	J. & J.	7	July, 1895	108½	109
" "	.....	50,000	J. & J.	7	July, 1896	110½	111½
" " extended	.....	100,000	J. & J.	4	July, 1896	99¾	100¼
	.....	50,000	J. & J.	5	July, '96	102	103½
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	106
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104½	105¼
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	116	.....
" " " "	.....	300,000	J. & J.	6	Jan. 1914	108	108½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	95
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	.....	111¼
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	112	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Sept. 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	26½	27

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	105	110
" " " cons. mort.	1892	500,000	.....	5	.....	103	105
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " gen. mort.	.....	1,500,000	.....	5	.....	105	.....
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	110	110½
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	106¼	106¾
" " "	1891	1,250,000	M. & S.	6	1901	105	106
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	111	112

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	310	.....
Metropolitan R. R.	50	750,000	Q. J.	...	1864	96	103
Columbia R. R.	50	400,000	Q. M.	...	1870	58	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	33	40
Eckington & Soldiers' Home	50	352,000	.....	...	.....	.....	40
Georgetown & Tenallytown	50	200,000	.....	...	.....	.....	50
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	101	.....
do. do. convert.	'83-'91	3.000,000	J. & J.	6	1899-1929	130	.....
Eckington & Soldiers' Home	.....	150,000	J. & D.	6	1896-1911	101	.....
Capitol & North O St. R. R.	1921	240,000	J. & J.	5	1921	100	.....
Metropolitan R. R. convert.	1901	200,000	J. & J.	6	1901	110	.....
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Sept. 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	55	59
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	52	54
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	.....	25
Newark (N. J.) Pass. Ry	100	6,000.000	.....	...	1890	29½	30
Columbus (O.) St. Ry.	100	3,000,000	.....	...	1892	45	50

BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	94	96
Buffalo (N.Y.) Ry.	1891	5,000.000	F & A	5	1931	97½	.....
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry	1890	6,000 000	J & J	5	1930	90	92
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	94	97½

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	170	175
Cleveland City Cable, common	100	4,000,000	.....	..	.....	22½	25
" " pref'd	100		.....	...	.....	95	105
East Cleveland R. R.	100	2,000,000	Quart.	2	.....	172	175
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	135	140

Financial.

THE stockholders of the Metropolitan Traction Co., of New York, voted last month to increase the capital stock to $30,000,000.

$ $ $

THE Gloucester (Mass.) Street Railway Co. have declared a dividend of $3 per share to stockholders of September 24, payable on and after date.

$ $ $

THE Columbus (O.) Street Railway system for the month of August shows receipts $45,949.83 as compared with $33,895.63, during the same month in 1891.

$ $ $

THE gross earnings reported for the Rochester (N. Y.) Street Railway Co. during August are, $69,676, as compared with $58,337 in the same month last year.

$ $ $

THE earnings of the Buffalo (N. Y.) Street Railway Co. for the month of August are reported as $125,364, as compared with $86,793 for the same month last year.

$ $ $

IT is announced that the Newton (Mass.) Street Railway Co. will pay a dividend of 2 per cent., September 30, to stock of September 25, making 7 per cent. thus far this year.

$ $ $

THE New York State Railroad Commission has granted the application of the Brooklyn City Railroad for permission to increase their capital stock from $6,000,000 to $12,000,000.

$ $ $

THE Helena (Mont.) Rapid Transit Co. by resolution of the board of directors have given an option to R. S. Vivian, of Kansas City, to sell $375,000 in bonds of the company for ninety cents on the dollar.

$ $ $

THE State Board of Railroad Commissioners have approved of the increase from $120,000 to $350,000 of the capital stock of the Cayadutta Electric Railway Co., which runs from Fonda to Gloversville, N. Y.

$ $ $

THE stockholders of the Lake Street (Chicago) Elevated Railway Co. recently held a meeting to ratify the reorganization of the company. Over 80 per cent. of the stock was represented. It is intended to issue $10,000,000 bonds to complete the work.

$ $ $

THE negotiations which have so long been pending for the sale of the Troy (N. Y.) & Lansingburgh Railroad to a syndicate were consummated last month. The purchasers are Clark, Dodge & Co., of New York, and the price paid was $112.50 for each $50 share.

$ $ $

THE gross earnings during August for the Baltimore (Md.) Traction Co. are given as $65,047, an increase of $8,002 over those of the corresponding period last year. The maximum receipts in any one day in the month was on August 30, when $2,635 was taken in.

$ $ $

THE report of the Lake Charles (La.) Street Railway Co., for the year ending July 31, 1892, shows cost of road $9,478; earnings from December 17, 1891, $3,913.11; cost of operation, $3,013.59; net earnings, $899.52, of which $478.61 has been used toward construction.

THE Newark Passenger Railway system of the New Jersey Traction Co. shows gross receipts for August $102,491.47, as compared with $91,653.67 last year. The gross returns since January 1 have been $793,024.80, as compared with $665,900.15 in the same eight months of 1891, an increase of $127,124.65.

$ $ $

THE gross earnings of the North Chicago (Ill.) Traction Co. for August were $246,132, a gain of $25,888 over the corresponding month last year. The aggregate receipts for the other months since January 1 (omitting one day, the receipts of which are not at hand) are $1,392 103 as against $1,227,486 for the corresponding period of last year.

$ $ $

BALTIMORE (Md.) Traction stock has been advancing steadily in price since the starting of the cable last month, the price quoted September 18 being 26½. The gross earnings for the first ten days in September were $26,578, with maximum receipts during one day of $3,215. During the same period in 1891 the gross earnings were $19,337, and maximum receipts $2,162.

$ $ $

THE Citizens' Street Railroad Co., Indianapolis, Ind., have recorded a mortgage to the Illinois Trust & Savings Bank of Chicago and Stoughten J. Fletcher, trustees, for $800,000, divided into 800 bonds of $1,000 each, drawing 6 per cent. interest. Of this amount $500,000 is to be used in refunding the existing indebtedness of the company and $300,000 to be expended in prosecuting general improvements.

$ $ $

THE Pittsburgh (Pa.) Traction Co. show receipts for the month of August of $63,952. During the same month last year the receipts were $26,232. It should be stated, however, that the mileage of the line is different, and that three cent fares were in force in August, 1891, so that a fair comparison of the business done is not shown by the above figures. The day of largest traffic in 1892 was the 27th of the month, in 1891 the 30th.

$ $ $

THE Atlantic Avenue Railroad Co. show in their annual report for the year ending June 30, gross earnings from operation $777,658; less operating expenses, $700,640; net earnings from operation, $77,018; income from other sources, $111,440; gross income, $188,459; deductions for taxes and interest, $133,983; net income, $54,475; dividend, 6 per cent. on capital, $68,794; deficit for the year, $14,319; total surplus at end of year, $147,700. The amount expended by the company during the year for betterments was $826,691, of which amount $806,041 was spent on the road and $20,650 in additional equipment.

$ $ $

THE management of the West & South Towns Street Railway Co., of Chicago, have awarded contracts for track construction, and have authorized the sale of half the bond issue of the company. The total issue consists of $500,000 of first mortgage, 6 per cent., gold bonds, payable in 1912, or redeemable after 1902 at 105 and interest. The charter of the company allows five kinds of motive power as follows: "The cars to be used on said railway may be operated by animal or cable power, electric, compressed air or gas motors, provided if overhead wires are used, the main electrical feeders shall be placed underground, and connections to the trolley wire shall be made through hollow iron pipes." The company also have the right to operate cars over tracks not owned by it "upon such terms and conditions, by lease or contract, as may be agreed upon between the companies owning such respective tracks, or otherwise not in conflict with any of the conditions of this ordinance or the general ordinances of the city."

$ $ $

THE street railway companies in which Philadelphia capital is largely invested, says the *Daily* (Phila.) *Stockholder*, continue to report handsome increases in their earnings. The statements of some of them are remarkable in one feature, namely, that large gross earnings are reported with heavy decreases in the operating expenses. This is true particularly with the Columbus Street Railway Co., whose August operations show a gain of $12,686 in the gross receipts, and a decrease of $9,797 in the operating charges. The figures of the month, together with those of August, 1892, are appended:

	1892.	1891.		
Gross earnings	$46,584.20	$33,897.88	Inc.	$12,686.32
Operating expenses	22,220.69	32,017.87	Dec.	9,797.18
Net earnings	$24,363.51	$1,880.01	Inc.	$22,483.50

The Newark system, another system in which Philadelphians are largely interested, shows net earnings for July of $5,518.54. The operations for the month, as compared with the same month last year, show as follows:

	1892.	1891.		
Gross earnings	$107,430.21	$98,207.35	Inc.	$9,222.86
Operating expenses	67,847.71	64,142.39	Inc.	3,705.32
Net earnings	$39,582.50	$36,063.96	Inc.	$5,518.54

The net earnings of the Rochester company for July are given at $34,786, an increase of $14,120. The figures of the month's operations follow:

	1892.	1891.		
Gross earnings	$67,201	$58,146	Inc.	$9,055
Operating expenses	32,415	37,480	Dec.	5,065
Net earnings	$34,785	$20,666	Inc.	$14,120

The Buffalo company show a net gain of $14,753 for July. The other figures follow:

	1892.	1891.		
Gross earnings	$116.410	$93,035	Inc.	$23,374
Operating expenses	63,239	54,617	Inc.	8,621
Net earnings	$53,171	$38,417	Inc.	$14,753

The Works of the American Engine Co.

The factory of the American Engine Co. is located at Bound Brook, N. J., thirty-one miles from New York City, on the line of the New Jersey Central Railroad, and the following interesting statements given in the *Bound Brook Chronicle* will give an idea of the extent of the work now being carried on there.

The raw materials used in the manufacture of high speed engines, including pig and scrap iron, coal, coke, moulding sand, etc., are run into the yards by means of switches from the railroad and unloaded directly into bins arranged alongside of the foundry which is equipped

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with a twenty ton traveling crane and other facilities for handling heavy weights. From the foundry to the machine shop is but a step, and this latter department is especially complete in all particulars. A ten ton traveling crane, five horizontal and three vertical boring mills, capable of doing work of large dimensions, half a dozen Brown & Sharpe universal grinders and milling machines, sixty or more lathes, upright and radial drills, numerous jigs and special tools all from standard makers make up the equipment of this department.

Engines can be seen here in various stages of construction, and from eight to 150 H. P. Being of high speed, they are chiefly designed for running electric dynamos, steam yachts, etc., although they can, of course, be used wherever power is needed. Adjoining is the blacksmith shop with annealing ovens, cutting and punching machines, etc. On the south, and connected with the shops already mentioned are three other buildings; one is a carpenter shop, another is used for storage of patterns, while the third is a general storage room for all sorts of stock, such as steel, bar iron, nuts, bolts, hardware, belting, pulleys, hangers, etc. The electric light and power plant consists of three dynamos, one for running the cranes in the foundry and machine shop, and two others for lighting the shops and adjacent village.

Protection against fire is carefully provided for by a complete sprinkler system which exists throughout the entire plant, including store houses, pattern room and offices, and which is supplemented, as an additional precaution, by hydrants and a large fire pump located where they are

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FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

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WANTED—A practical business man who is thoroughly familiar with the manufacture of Street Cars, and competent to assume the active business management of a large Car Manufacturing Company already established. Must be able to invest $25,000 or more in the business. To the right party this opportunity is a most favorable one, as the prospects for the development of a large business are excellent. Full particulars and information will be furnished. Address "CAR COMPANY," care STREET RAILWAY JOURNAL, New York. 1t.

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WANTED.—By a Practical Man, position with Street Railway Company as Superintendent or Manager. Have had experience with Electric Steam Motor and Horse Lines. Satisfactory references as to ability and character in the construction, operation of Street Railways and Surburban Lines. Address, "STREET RAILWAY," 6,608 Evans Ave., Chicago, Ill.

WANTED—A position as chief engineer by a thoroughly competent man who understands doing all repairs, and also understands repairing and managing railway generators and motors, having had charge of the assembling and testing those machines in the Thomson-Houston works; also understands wiring and repairing cars. Can take entire charge of mechanical department of power house and station. Can furnish the best of city reference in Brooklyn and New York. Have first-class papers from both cities. Address ECONOMICAL, STREET RAILWAY JOURNAL.

WANTED TO PURCHASE.

WANTED to Purchase Entire Issue of Good Street Railway Bonds. Correspondence solicited. Address, V. I. HASKELL, 39 Dey St., N. Y. City

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84 Cross Seat Open Cars, gauge 4 ft. 8½ ins., 30 of which seat 50, 34 seat 40, and 20 seat 32 passengers each. Cars are in good condition—some are nearly new, We are selling on account of change of motive power. Apply to the office of the 3d Ave. R. R. Co., 65th St., and 3d Ave., New York City. 1t.

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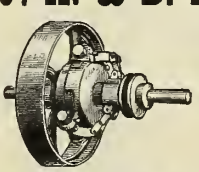
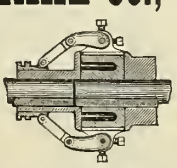
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easily accessible. Tramways are arranged around the shops, running from one department to the other, with turntables, cars, etc., the cars having roller bearings, and being capable of carrying enormous loads with ease, and needing only one operative to handle them.

In regard to railroad facilities the company are exceedingly fortunate, as they have ranged about them the Port Reading Railroad on one side, the Lehigh Valley, Philadelphia & Reading, and the Jersey Central on the other, with intercommunicating switches, so that transfers can be made with convenience and dispatch.

The president of the company is Hon. Ray V. Pierce, and the general manager Mr. Elmer S. Smith.

Dedication of the World's Fair Buildings.

The dedication of the buildings of the World's Columbian Exposition at Chicago, will occur October 20, 21 and 22, and the following programme of the dedicatory exercises connected therewith has been decided upon:

On the evening of Wednesday October 19, a grand reception will be tendered the President of the United States, his cabinet and other distinguished guests at the Auditorium. After the close of the ceremonies on this and each of the three succeeding evenings, there will be magnificent pyrotechnic displays.

Thursday, October Twentieth, the first day, will witness an imposing procession indicative of peace, contentment and prosperity, participated in by civic organizations, which will be reviewed by the President of the United States, his cabinet, members of Congress and other honored guests. In the evening, at Jackson Park, amid many electric lights and other displays, a water pageant, "The Procession of the Centuries", will move through the canals of the Exposition grounds, illustrating some of the great facts of history connected with the discovery of America.

Friday, October Twenty-first. On this day the President of the United States and other distinguished official guests will proceed to the Manufacture and Liberal Arts Building, in which the dedicatory exercises will be held.

At one o'clock in the afternoon in this building the dedicatory programme will be carried out under the direction of the Director-General. It will consist of the reading of an appropriate ode, report of the Director-General to the World's Columbian Commission, presentation of the buildings for dedication to the President of the United States and their dedication by him, and orations by Wm. C. P. Breckinridge, of Kentucky, and Chauncey M. Depew of New York. At the close of this programme a special electric and pyrotechnic display will be given.

Saturday, October Twenty-Second. On this day, a series of military manœuvres and parades will constitute the main portion of the day's programme. In the evening attractive and appropriate celebrations will be provided, followed by a magnificent display of fireworks.

Insullac.

A new compound, with the above name, has recently been put on the market as a substitute for shellac, which, heretofore, has been the only practical agent for effective work in coil and armature winding and in the multitudinous applications where insulation resistance and waterproofing is required.

The manufacturers, the Massachusetts Chemical Co., of Boston, claim for the new compound, which is an alcohol varnish, an insulation resistance nearly four times greater than that of the best grain alcholic shellacs. The Massachusetts Electrical Engineering Co is the authority by which this superiority is established.

"Insullac" varnish is of a beautiful transparent amber color, but to suit the public taste the manufacturers will produce it in any desired color. Its appearance when applied, method of application and rapid drying qualities are identical with those of shellac.

A careful analysis of the new compound, by Professor Babcock, shows no traces of any acids injurious to any materials to which it may be applied, or any constituents in any way injurious to the health of workmen.

Great Railroad Traveling.

"I happened to take the 10:30 A. M. train the other day, from Chicago, on the Lake Shore and N. Y. Central, and thought the entire trip would be a bore," said Geo. W. Lederer to a DRAMATIC TIMES reporter. "But imagine my surprise, when I found upon entering the train, a *fac-simile* of their famous Chicago limited, and positively the same comfort, convenience and equipment which I have so often enjoyed on the latter. I arrived in New York City at 2:10 the next day, the train being on time to the minute, and had sufficient time left that day to transact a great deal of very important business. I shall return again to Chicago on the very same train, as it leaves here at 1.55 P. M., and gives me a good half day to settle up my unfinished business."—*New York Dramatic Times.*

The 10:30 A. M. train to which Mr. Lederer refers, is the popular "Chicago and Boston Special," the latest addition to the train service of the Lake Shore & Michigan Southern R'y. The equipment, which is of Wagner build, consists of two Vestibule Sleeping Cars, one Vestibule Buffet Smoking and Library Car, running through to Boston, arriving at 3:40 P. M. next day; one Vestibule Sleeper through to New York, arriving at 2:10 P. M.; a vestibule Dining Car, Chicago to Cleveland, and Utica to Boston, and day Coach, Chicago to Buffalo, and Buffalo to Boston.

The train leaves daily from Van Buren Street Station at the hour named above, and is the greatest favorite with business men and tourists, as by it not only are the cities on the B. & A. R. R. reached early in the afternoon, but the Atlantic Coast resorts are reached before dark.

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SOUVENIR OF The Street Railway Journal.

ORIGIN AND BENEFITS OF THE AMERICAN STREET RAILWAY ASSOCIATION.

THE American Street Railway Association, whose tenth anniversary and eleventh meeting we greet and celebrate, was born December 13, 1882, at Boston, where liberty itself had its birth, and was of good stock, inheriting a spirit of fraternity and continental unity. The times were those of great political, scientific, educational and mechanical activity, and questions of material progress occupied the minds of our people when, fortunately, a few railway men, being mindful of their duties and responsibilities in regard to their particular calling, undertook to bring the street railway business into line with the march of progress which characterized so many other industries.

What can we do to unite a distracted class? What to unify discordant elements? What to calm the tempest of personal and sectional passions and jealousies? What to cultivate a spirit of fraternity among the members of the same calling? How to promote technical knowledge, and provide for an interchange of experience in all matters relating to the construction, equipment and management of street railways, to the end that the best service may be obtained at the least possible cost?

Important questions for statesmen even; how well they were answered by these men who made no pretence to statesmanship the subsequent history of the Association strikingly shows, for they seemed to realize that the permanent success of the Association depended very much upon the auspices attending its establishment and the character of the organic laws which it should adopt.

The gentlemen most active in the formation of this Association and to whom the entire fraternity owes a debt of gratitude were: D. F. Longstreet, Providence, R. I.; H. H. Littell, Louisville, Ky.; Henry M. Watson, Buffalo, N. Y.; *Walter A. Jones, Brooklyn, N. Y.; Thomas Lowry, Minneapolis, Minn.; J. E. Rugg, Boston, Mass.; Moody Merrill, Boston, Mass.; Charles Cleminshaw, Troy, N. Y.; William J. Richardson, Brooklyn, N. Y.; Julius S. Walsh, St. Louis, Mo.; T. H. Robillard, Montreal, Canada; Abner C. Goodell, Salem, Mass.; Tom L. Johnson, Indianapolis, Ind.; *Calvin A. Richards, Boston, Mass.; Wm. H. Hazzard, Brooklyn, N. Y.; George B. Kerper, Cincinnati, O.; Charles Hathaway, Cleveland, O.; C. C. Woodworth, Rochester, N. Y,; Frank de H. Robison, Cleveland, O.

*Deceased.

The call for the first meeting of what was then styled an Association was from the pen of H. H. Littell, and was dated from Louisville, Ky., November 8, 1882, and the preliminary meeting was held at Young's Hotel, Boston, December 12, 1882, when Mr. Littell called the meeting to order, and the Hon. Moody Merrill was unanimously elected chairman. After an address by the chairman and the appointment of a committee to draft a constitution and by-laws, of which Mr. Charles Cleminshaw was chairman, an adjournment was taken until eleven o'clock, December 13, when the report of the committee was read by the secretary, Mr. William J. Richardson, and a permanent organization under the name and title of the American Street Railway Association was perfected.

The details of this meeting, and of all subsequent meetings, in fact, a complete history of the Association was given in the October, 1889, issue of the STREET RAILWAY JOURNAL, and in our Souvenir edition of last year, so that it is not necessary to repeat it in this connection, but we give below extracts from the proceedings of the different conventions, which will indicate the character of the work and show by what stages the street railway systems have reached their present efficiency; but first we will briefly review the work and note the benefits and duties that come to the membership as an incentive to still higher efforts, and as a means of calling the attention of such street railway companies as have not yet become members of the organization to its objects and aims.

BENEFITS.

The eminent success which has attended the organization and operation of the Association is the source of mutual congratulation among all the friends of urban transit both at home and abroad. To its direct agency and the influence of its proceedings, diffused through the medium of the STREET RAILWAY JOURNAL, more, no doubt, than to any other cause, are due the marvelous improve-

ment of street railways in all their relations, the rapid intellectual and social elevation of managing directors as a class, and the universal awakening of public interest in all that concerns the installation, operation and maintenance of this important industry, even calling for a still better and higher order of service. Although this Association has accomplished great good, it is destined to exert a still broader and more beneficial influence, a statement to which any wise observer, who will briefly scan its history and note the successive steps of its advancement, will assent.

Only ten years since its first meeting, at which not a single street railway line operated by mechanical traction was represented! Cable lines, however, had been in operation for some time in San Francisco and were being introduced in Chicago, but electricity, as a motive power, was not mentioned. Then there were only 3,000 miles of street railway track, all told, in this country; now there are over 5,000 miles operated electrically.

The Association may be regarded as a great interrogation point, for its proceedings have always been marked by an eager desire on the part of its members for definite information in regard to the practice of others in particular cases, and to the advantages and cost of mechanical traction. In the earlier meetings the questions related principally to the feed and care of horses, stables, track construction, track cleaning, registers, and how to make conductors honest. It is not claimed that all these questions have been definitely answered and a standard of practice established; but many of them have been answered, while others have become obsolete, and in the records all the best that has been thought and said to the world regarding this industry has been preserved for the guidance of those who will come after.

The later meetings continue to be marked by the same spirit of inquiry, and we find often the same men who took part in the early meetings are still earnestly seeking light, but along higher lines. The same characteristic will, doubtless, mark the subsequent history of the Association, for what we call our improved street railway systems are but the aggregate of the trial attempts of the past in practice to solve the rapid transit problem, which in its historic growth has taken on such forms and appliances as conditions seemed to demand, and has yielded to such formative influences as the growth and changes in city life have required, and which it must continue to do as society and social conditions improve. Hence, then, there must continue to be an earnest groping after light and knowledge, and where this spirit is light will surely come, not of itself, but as the reward of toil, of effort, of wisdom, so that in time all the puzzling questions which confront the average manager will be satisfactorily solved.



HOLLENDEN HOTEL—HEADQUARTERS OF THE AMERICAN STREET RAILWAY ASSOCIATION.

We believe that the benefits which the Association is able to confer upon its members should be shared by the street railways of the whole country, and that the time has now come when all companies should be gathered into this great educational brotherhood; when the practical street railway men in the North, the South, the East and the West should unite in a general effort to promote the welfare of this industry in the whole country, by concentrating the wisdom and power of experienced minds, and by distribution among all the accumulated experience of all those who are devoting their energies, and contributing their means and genius to advance the dignity, respectability and efficiency of this particular calling.

EXTRACTS FROM THE PROCEEDINGS OF THE DIFFERENT CONVENTIONS.

First Annual Meeting, Boston, 1882.

"You have come here from all parts of the country for the purpose of forming a National Street Railway Association. Some one may ask what interest in common, affecting the street railways of the country, corporations local in their character can have, that would seem to call for an organization for their protection. I would say that, probably, our Association is not to be formed so much to *protect* as to *promote* them. The street railways of this country have grown so rapidly during the past ten years, and are still growing with such rapidity, that an association of this character seems highly desirable. There are now organized and doing business in this country and Canada, 415 street railways. These companies employ an army of about 35,000 men. They run 18,000 cars, which, with the horses attached, would make a solid line of cars reaching from Boston to Albany."

* * * * *

"If there is any benefit to be derived from this Association, the young companies, just starting in growing places, will profit by it more than the large companies. They will receive the benefit that may arise from a knowledge of the various inventions that will be exhibited and discussed at our meetings, and from the experience of the older railroad men whom they may meet, representing the roads of the entire country.

Second Annual Meeting, Chicago, 1883.

* * * * * "And we face that last and greatest discovery of the century, the application of which bears more directly upon our immediate interests than any other, namely, electricity as a motive power. So long as purely brute strength and endurance enter so largely as a factor in our enterprise, there must ever be perplexing and annoying obstacles that the ingenuity of man will be taxed to overcome. Any invention looking toward the abolition of these, thus simplifying our methods of locomotion, will be eagerly welcomed and thoroughly discussed in our deliberative councils. I see in the recent subjugation of the subtile and hitherto illusive force of electricity to the needs of man, boundless possibilities for the world's three greatest requisites for advancement—heat, light and motion.

"The crude experiments already made with electricity as a motive power in propelling cars, in lieu of steam or horse power, clearly foreshadow the inevitable application of the new motor to our immediate interests."

* * * * *

"Nothing tends to develop any particular locality so much as a well conducted street railroad. Along the course of its road will at all times be heard the sound of the hammer, indicating the erection of new domiciles, their builders being drawn hither by the superior inducements offered for speedy and cheap transit. The street railroad car may well be called "the poor man's carriage." Under judicious and economical management, the rate of fare should be such that the burden will be light on the public, at the same time making the operation of a street railroad pay, to encourage enterprise in that direction.

* * * * *

"The rate of wages should be in all cases such an amount as to afford a fair support to the employed, and sufficient to induce men to be desirous of retaining their positions permanently. A high standard of educational qualifications is not required in the street railroad service, but the better the company is equipped with men above the ordinary laborer, conductors especially, the more it will prove to the advantage of that company's interests. The conductor and driver deal directly as our agents with the public; and as they exhibit good judgment and discretion in their intercourse with people, so will be our commendation by the public, and consequent remuneration by increased business, resulting from the highest efficiency in the service. It is, therefore, for the best interests of a company to get the best class of labor that may be obtained for this work especially. The inducement held out by some roads, of an increase of pay for long continued service, is a very judicious plan to insure faithful performance of duty. This plan wherever tried is highly spoken of by such roads as have adopted it."

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"Too much care cannot be used in preparing the hoof for the shoe. The frog should never be cut; the shell requires more or less cutting. The shoe should always be fitted to the foot, and not the foot to the shoe as is often done.

"In shoeing the horse, the workman should bear in mind that he is protecting the foot from the unnatural wear, and that it is only done for that purpose; therefore, all prejudices as to opinions of how it should be done should be laid aside. The horse commences life with sound feet, but too many of them are ruined by unskillful shoeing, and thus brought to comparative uselessness at a time of life when they should be in the prime of their power."

Third Annual Meeting, New York, 1884.

"The graduated system of compensation works well with us here, and makes 'strikes' an impossibility. No honest and intelligent laborer will 'strike' for higher wages when he knows that by serving through a regular course he will attain what he cannot possibly get anywhere else.

"Furthermore, this system furnishes us a reliable and trustworthy set of workmen, because the longer they stay the more efficient they become in the discharge of their several duties. Such a wage system secures to us steady and punctual men who perform their work more cheerfully because they know that their value is acknowledged by the company which remunerates them for their services with the highest possible wages."

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"Mr. President, I think my friend is right; but, from my experience, I think it is necessary to keep up the moral sense of the community that ride in our cars. That is the thing to which we ought to give more prominence. We carry gentlemen in our cars—gentlemen of as apparent respectability as you who sit before me—and who, while they would shrink from the commission of the crime of forgery, burglary or anything of that kind which would send them to state prison, yet do not shrink from robbing you or me, and educating our conductors to be the most infernal scoundrels outside the state prison."

Fourth Annual Meeting, St. Louis, 1885.

"In conclusion, your committee consider the application of electricity to the propulsion of street cars as entirely feasible. The seven electric railways in Europe, besides the tests in this country, prove this to be true. It is now narrowed down simply to a question of dollars and cents, or comparative economy with horses, cable power, etc. In the crowded streets of the American cities no system of overhead wire would be permitted by the municipal authorities. The rails could not be used to carry the currents for obvious reasons, therefore a conduit system offers the only practical solution. The system of running cars by accumulators can be applied with least trouble and less first cost, but at a great sacrifice of electricity. The result of two years' working of the electric railway at Zankerode, Prussia, showed that only 30 per cent. of the power of the steam engine was applicable to the propulsion of cars, but even this compares favorably with the cable system."

Fifth Annual Meeting, Cincinnati, 1886.

"We commend, therefore, mutual street railway insurance as worthy of earnest consideration as a means of reducing a costly department of our business, and at the same time of avoiding intensely annoying delays and difficulties in the adjustment of losses, when losses occur."

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"Owing to the ingenuity of the government to unjustly tax and increase the burden of corporations, it behooves us to oppose by every honorable means within our power further aggressions, which, though according to law, are thoroughly lawless in conception."

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"This was brought about by an organization called the Knights of Labor, a secret society which required absolute obedience to the mandates of the few who controlled it. The injustice of the orders that our employes were required to obey was in many cases admitted by them, but so powerful was the organization at that time that no slavery could have been more abject, and, it would seem, more humiliating, than that to which the employes of the street railroads had become the willing subjects. The tyranny of the order was manifestly so un-American that the absolute power which it had shown at the outset soon waned. Exceedingly unwise, and even foolish action followed their first efforts, and, as the result, what little respect the order had enlisted in the minds of the people was materially lessened by reason of its reckless disregard of public convenience in the wholly unwarranted stoppage of the great business of city transportation."

Sixth Annual Meeting, Philadelphia, 1887.

"To move a large number of cars, as for instance, upon the Third Avenue or Broadway lines in New York City, the electrical conductor, whether overhead or underground, must be of great size, if the current is of low tension; while, on the other hand, if a small or moderate sized conductor be used, the current must then be of dangerously high tension, and, of course, it would then be very difficult to avoid great loss of electricity from leakage."

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"Without referring to the excessive first cost required for the expensive cable traction system, and comparing the first cost of the entire plant and equipment needed for a storage battery electric railway, on which three cars will perform the service of four horse cars, with the first cost of the entire plant and equipment of a railway using horse power, it will be found that the advantage will, in most cases, be in favor of storage electricity."

* * * * *

"No electric or steam car, or any self propelled vehicle, will climb grades of more than 6 per cent. in slippery weather, with absolute certainty. If we go beyond 6 per cent., we must have some artificial adhesion; we must introduce some rack on the road, or cables, which have a positive motion. Any one who attempts to guarantee a self propelled vehicle, whether propelled by steam or any other means, on grades of more than 7 per cent. will most certainly lose his reputation."

Seventh Annual Meeting, Washington, 1888.

"Looking from such a standpoint, we are impressed at once with the national importance of the vast interests here represented, and this feeling grows deeper and broader as we consider the financial relations of our calling with the millions involved; the varied, useful and indispensable relations it sustains to the well being of every person, in every city and every town of any importance in the whole land; the mighty factor it has become in making or unmaking values in properties of all kinds; and especially does this feeling become almost overwhelming when we consider to what grand proportions this industry has grown during the lifetime of the youngest of our members."

* * * * *

"I think from my experience in the business, that there are just as smart men in the employ of the company on the cars as there are in the office; and, indeed, some of the most successful managers of railroad properties, street and steam, are those who have come from the bottom round of the ladder and climbed by diligence to the top. I think, in fact, that the men know more about the profits of our business, the expenses and the income, than we think for, and if all the profits of a company are not taken by the management, but by a small investment made in this way (reading rooms for conductors and drivers), or in some other proper manner an interest is shown in the employes, I believe that very decided returns will come from such an investment."

Eighth Annual Meeting, Minneapolis, 1889.

"I wish to say in this connection, that I have been exclusively engaged in the street railway business for sixteen years, and I am fully convinced that confidence begets confidence; good treatment secures good treatment in return, and anything that the street railway manager can do to advance the interests of his employees will, in my judgment, yield good results. There is more importance in the exchange of a "good morning" between the employer and the employe than most men generally suppose. I have got such a set of men that to-day, in view of my last five years' experience, I would rather take the money that is lost by drivers in making mistakes in change and in falling out of their pockets, than all that is knocked down on the road. I treat my men on all and every occasion as if they were my equals, and I believe I get better results from it."

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"A young lady and a young gentleman, a tender young lady and a still more tender young gentleman got upon the car, and they were nestled in one corner like two turtle doves. No one in the car noticed them. They were exchanging the most endearing glances, and their hands were closely locked. They had been sitting in that way for some moments, when the young man suddenly started as if he had sat on a tack. He said: "My darling, I must let go your hand." She answered, "Why, pet, must you let go my hand?" He said, "I must; the fact is, there is a bug crawling down my back, and I cannot keep my thoughts on you and the bug at the same time."

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"There is one place, however, as all of you know who have had any business in court, and especially when opposed to a woman, where she stands pre-eminently above you. What chance to win a lawsuit has a man when he is opposed to a woman? Did you ever see such a case tried? Why, it does not make any difference what she says or what she does; the lawyer who cross examines her is put down at once as a brute, and it is a dangerous thing even to ask her age. A man does not stand any more chance to win a lawsuit in that kind of a case than he does of going to Congress without lying or spending money."

Ninth Annual Meeting, Buffalo, 1890.

"To-day, the world over, and in this country more than any other, labor and capital, the former willingly and the latter under the lash, are on a dead run for the same goal. And this goal, this consummation, ignore it as we may, call it what we will, disguise it as we please, is no other, in fact, than absolute state management; and state management is neither more nor less than state socialism of the German type."

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"Conceding to you a great satisfaction in the consciousness of doing work that benefits others, we of the technical press are also glad to state that we take great delight in our work, furnishing, as we do, a medium by which inventors and dealers can present their wares directly to the users, and by which all are regularly informed of the latest and best practice in all parts of the world. We can but feel some satisfaction in our work, and the more from the frequent evidences given both by the street railway companies and the advertisers of their appreciation of our work."

Tenth Annual Meeting, Pittsburgh, 1891.

"'Horse sense' counts for but little in this age of rapid transit. We old dogs have been obliged to learn new tricks, and without the usual privilege of serving an apprenticeship. Our stables are being converted into power houses; the electrician has taken the place of the veterinary surgeon; our drivers are being educated as motormen, and most of us have horse cars for sale. It is well for us that at such a time, when a thousand unsettled questions perplex us, we can come together in this organization with the memories of nine other gatherings warm in our hearts, to exchange experiences, compare notes and give to each other helpful information."

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"Financially, the cable road shows a low operating cost, less depreciation and a high earning capacity, in other words, most favorable as an investment. Practically, it ranks foremost in trustworthiness and complete independence of climatic conditions, moving its loads steadily through heat, cold, snow, frost or flood, so that, indeed, no disturbance short of an earthquake has any effect on its power to maintain a service on which the public has learned to depend."

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"I feel that the time has now come when some of the physical dimensions of electric cars may, with benefit to all, be standardized. As to how far such standardization should go, committees of this Association can best determine. The guiding principle, it seems to me, should be this: That standardization of parts should be so directed as not to interfere with the progress of invention. Bearing this in mind, may we not at this stage of development have a standard axle diameter for cars of a given weight? Also standard key weights for gears? And while there is some uncertainty in my mind on this point, may we not have a standard gearing? It, of course, involves uniformity in the reduction ratio between speed of the armature and speed of the car. There is, however, now no very great difference in this respect, and the possibility of uniormity is at least worth considering."

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"The occupation of the poor car horse has almost entirely gone. He has been forced to seek other spheres of usefulness and toil. Perhaps he has become an agriculturist or, it may be, the motive power of the laborious cart; but whatever his employment, I have no doubt, were we able to comprehend his musings, we would often find him, in his restful hours, sadly contemplating the marvelous change a few brief years have wrought. If he dreams, methinks he will sometimes in his restless sleep hear the tinkling bell which once made music to his ear, and thus live over again, in imagery, the busy, toilsome days when weary and footsore he tramped our hard, uneven streets and faithfully dragged his heavy load. If there is anywhere in the mysterious beyond a happy pasture ground for the noblest of God's dumb animals, I verily believe that the patient, suffering and faithful service of the abused car horse will secure him an abundant entrance thereinto. In the meantime we bid an affectionate farewell to his services, and gladly welcome the power which the genius of man has harnessed for our use."

THE CLEVELAND CONVENTION.

ELEVENTH ANNUAL MEETING OF THE AMERICAN STREET RAILWAY ASSOCIATION.

THE coming Convention at Cleveland is an event in which every street railway man should take a deep interest, whether he is to be present at the meeting or not. If not able to be present, he can read the report of the meeting, which will appear in the November issue of the STREET RAILWAY JOURNAL, but will miss the inspiration and good cheer that an attendance at the meeting always gives.



INTERIOR OF THE ARCADE BUILDING.

The advantages of a membership in the Association, and of being present at its annual gatherings, are in too many cases overlooked, and for this reason we will emphasize some of them with the hope of reaching those companies which have thus far remained indifferent to the benefaction and claims of the Association. Among the former there is nothing richer, nothing of deeper import and more lasting value than the social features which give the men from widely separate localities an opportunity of becoming acquainted, and of gaining that confidence that comes of being a part of a great and powerful organization, to which one can look for support and sympathy in times of trouble and serious opposition, and of enriching those social bonds which will do much to encourage, cheer and benefit in every way the toilsome lives to which most street railway men are bound, making them productive of more good work than they could otherwise accomplish.

The meetings of the Association offer an opportunity for recreation, fun and amusement, as the latter are characteristics of the proceedings, especially those at the banquet. It allows one to drop care, to drop toil or thoughts of it, and engage in the serious discussion of the practical part of the street railway business, and at the banquet to

exchange thoughts of mirth, regard and friendship. A bow that is seldom unstrung refuses at last to unbend, and loses its elasticity; the same is true of man. He needs these intervals of rest and change, and is wise when he provides for these needs.

In an Association like this there is a confidence born of union that adds greatly to the productive power of the individual. A soldier required to engage in battle alone would make but a sorry attack or defence, but if he can feel the touch of elbows with comrades on the right and left, he will find his own courage increased and his power for doing useful service multiplied many fold.

A second advantage in the present case will come from the inspection of the various appliances which will be placed on exhibition by the manufacturers and dealers in street railway supplies, and of making the acquaintance of their representatives, which, perchance, will be of advantage in future business transactions. These exhibits are in the nature of an exposition of industries allied to the street railway business, and are collected at no little expense on the part of the manufacturers, and merit careful inspection on the part of all who wish to avail themselves of the latest and best appliances that the market affords.

A third benefit will come from the opportunity of visiting and studying the operations of the street railway systems of the city, which embrace not only animal but the leading methods of mechanical traction, with which a deal of experimenting has been done, resulting in excellent cable and electric lines which will serve as models for imitation.

A fourth inducement to visit Cleveland at this time will be the opportunity of visiting in company with others the extensive local industries which are devoted to the production of street railway appliances, and of which the city is justly proud. Prominent among these are the works devoted to the manufacture of electrical supplies which are quite fully illustrated in another column, the managers of which will provide generously for all who will do them the honor of accepting their hospitality. Then there are other works also illustrated in this issue, whose names are familiar to all our readers, whose products are in use in every part of the country, and whose extensive facilities for work inspire confidence that orders will be promptly filled and the goods of the best quality.



PERRY-PAYNE BUILDING.

Lastly comes the practical work of the Association, to give and to receive, and to take home the newest and best thought derived from actual practice either with the old, familiar or newest things, and the new born intelligence which may be gained from the examination and discussion of fresh ideas, new inventions and new theories that belong to this business, so that there may be a determination and better understanding of how to elevate and improve the standard of the business until it shall hold a high position in public estimation and favor.

We are aware that there are but few active street railway men who do not already appreciate the advantages that we can name, and do not claim to know the business so thoroughly that they need not concern themselves to learn more about it; but there are many who will not be present at the Cleveland meeting, not from indifference, but because of the indifference of their directors, who have neglected to make provision for their vacation and for the necessary funds. Could we gain the ear of such we would like to suggest that it would be a graceful act on their part to offer a vacation to their faithful heads of departments and to provide liberally for the incidental expenses of a trip to Cleveland.

In reviewing the history of the Association, and noting the names that have been prominently connected with it from its early history, we find that in most cases they are the same persons who now control or manage the most important street railway systems of our large cities, and who are ever ready to witness to the advantages they have derived, by participating in the proceedings of the Association. In conclusion, we are confident that it will pay in more ways than one for every street railway company in the country, as well as those firms engaged in the manufacture of street railway appliances to be represented at the Cleveland meeting.

PROGRAMME AND PRELIMINARY ARRANGEMENTS

FOR THE

ELEVENTH ANNUAL CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION AT CLEVELAND, O., OCTOBER, 19, 20, 21, 1892.

THE officers of the Association and the local committee, having done their part in perfecting the arrangements for the coming Convention, it now remains for the clans to gather in even larger numbers than last year, and make this the most profitable, enjoyable and memorable meeting in the history of the Association. The business meetings will be held in Association Hall (illustrated on 2d page), which is located near the headquarters of the Association, and is amply large and convenient for the accommodation of all who will attend. The first business meeting will be called to order at ten o'clock Wednesday morning by the president, Mr. John G. Holmes, of Pittsburgh.



SOCIETY FOR SAVINGS BUILDING.

Following the adjournment of the first meeting, the delegates and others in attendance will accept an invitation from the Short Electric Railway Co. to visit the Brush and Short works which are located in the suburbs of Cleveland. The trip to the works will be made in handsomely decorated electric cars, over the lines of the East Cleveland Railway Co., when an opportunity will be given to meet the representatives of the Short company, and make a tour through the extensive works and inspect the details and successive steps in the manufacture of generators, motors and other electric appliances for which this company is gaining an enviable reputation. A substantial lunch will follow, and the visitors may be assured of a royal good time, in keeping with the proverbial hospitality of this company.

A second business meeting will be held on Wednesday evening at 8 P. M., and on the morning and afternoon of Thursday, and the morning of Friday. Besides the regular business meeting of the Association, special committees will report on the following: "A Model Electric Street Railway Roadbed and Underground Wiring," Geo. W. Baumhoff, chairman; "A Perfect Overhead Electric Construction," Chas. H. Smith, Chairman; "Economy of Machine Shops for Electric Street Railways," John H. Bickford, chairman; "Power House Engines," T. W. Wrenne, chairman; "Relative Cost of Operating Horse, Cable and Electric Roads," W. McRamsay, chairman; "Standards for Electric Railways," O. T. Crosby, chairman; "Form of Street Railway Electrical Statistics," Thos. H. McLean, chairman.

Special papers are also to be presented under the following titles: "Experiments on the Expansion of Continuous Rails," and "Is a Standard Rail Head Possible?" A paper is also to be read by Mr. D. F. Longstreet, one of the founders of the organization, which will narrate the events which led up to the formation of the American Street Railway Association.

THE ANNUAL DINNER

will take place on Thursday evening, the 20th inst., at the Hollenden Hotel, which, as usual, will be made an enjoyable feature of the Convention. Two delegates from each street railway company that is a member of the Association will be entitled to free admission to the banquet.

For all others, whether an additional delegate or representative of business firms, a charge of $10 each will be made, except the ladies, for whom a charge of $5 each for admission to the banquet will be made. In order to secure seats at the banquet, however, it will be necessary for the members and others who expect to be present to notify the secretary of the Associa-

tion in advance, so that definite arrangements may be made for the accommodation of all who wish to attend.

HOTEL ACCOMMODATIONS.

The headquarters of the Association will be at the Hollenden Hotel, one of the finest appointed hostelries in the country. At this and the other hotels of the city only the regular rates for room and board will be charged, so that visitors need have no fear of exorbitant charges being made for this special occasion. The rates at the Hollenden on the American plan will be $3 to $5 per day according to room; European plan, rooms $1 to $2.50 per day.

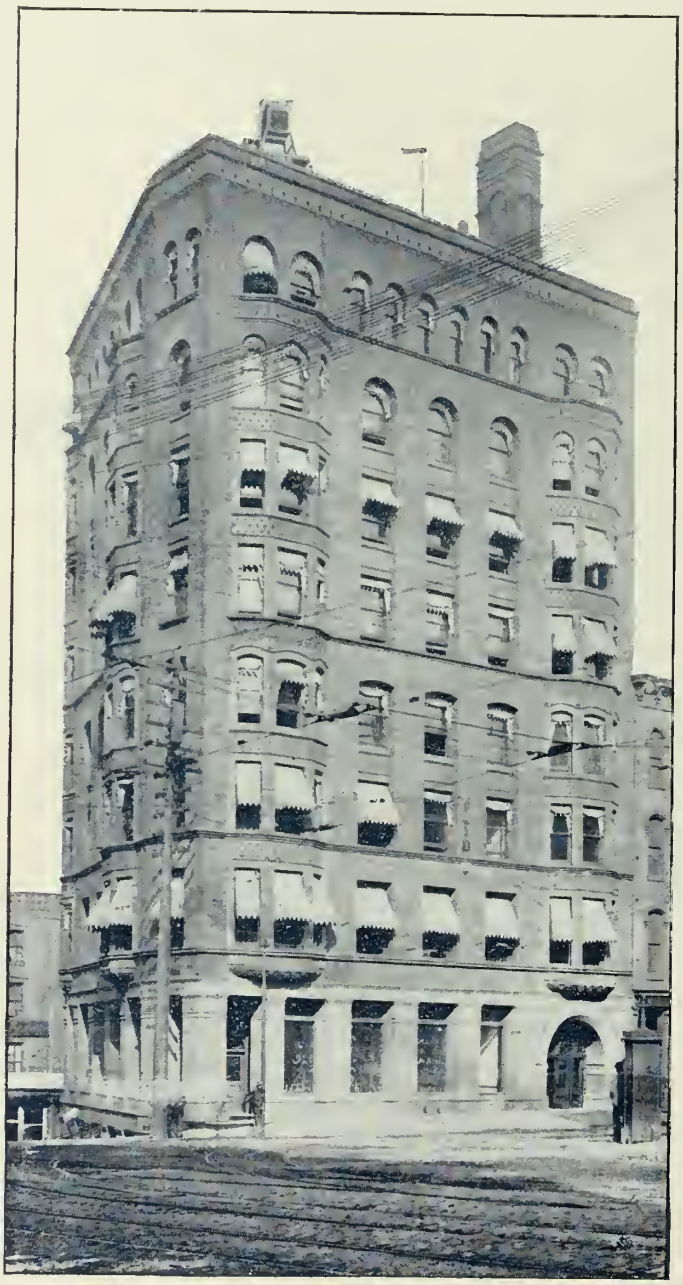
The other hotels that will provide accommodation to the delegates are the Weddell House, with rates of $3, $3.50, $4 and $5 per day; the Stillman Hotel, $3.50 and $4; Forest City House, $2.50, $3 and $3.50; Kennard House, $2, $2 50, $3 and $3.50; American House, $2 and $2.50; Hawley House, $2; Wilmot House, $2.

Persons desiring to secure hotel accommodations should communicate with Mr. Henry J. Davies, secretary of the local committee, and rooms will be assigned in the order in which the applications are received, and as far as possible in accordance with the expressed wishes of the applicant.

REDUCED RAILROAD RATES.

Most of the railroads of the United States have granted the courtesy of the special rate of a fare and a third for the round trip to all, including friends and members and the families of all in attendance whether delegates, supply men or others, the exception being the lines in the Western and Pacific Coast States controlled by the Trans-Continental Association, and the Western Passenger Association. The latter association has, however, granted the same concession from Peoria via the Chicago, Rock Island & Pacific; Chicago, Burlington & Quincy; Jacksonville South-eastern, and Atchison, Topeka & Santa Fe railways only.

It will be necessary, however, for all to strictly comply with the rules of the railways governing reduced rates. These rules require that the party purchase a first class limited or unlimited ticket to Cleveland, not more than three days prior to the date of the meeting, for which full fare will be paid, and at the same time secure a certificate from the agent at the initiatory station, stating that such full fare has been paid. The purchaser should be particular to inquire of the agent if all or only a part of his journey is covered by the certificate, as it may be necessary to purchase separate local tickets and procure separate certificates. In order to secure the reduced rates for the return journey, the party must present his certificate from the ticket agent to Mr. John J. Stanley, the clerk of the Convention, for this exclusive purpose, within one day after date of adjournment, who will certify that the holder has been in attendance at the Convention, and which, being viséed by the agent of the Central Traffic Association, will, on presentation at the local ticket offices in Cleveland, secure for the holder return fare at one-third the usual rates. No stop-over privileges, however, will be granted on the return tickets, and the holder must return by the route for which fare was paid in going.



WESTERN RESERVE BUILDING.

EXPOSITION OF APPLIANCES.

Army and Navy Hall on Superior Street, almost directly opposite the headquarters at the Hollenden Hotel, has been secured as the place for the exhibition of such appliances and supplies as will be presented for the inspection of the delegates and visitors. The location is convenient both to the headquarters and to Association Hall, and provides an abundance of room for all except the large exhibits, for which room will be provided in a vacant lot adjoining the exhibition hall. A nominal charge for space in the hall will be made, and all who will apply in time can be sure of being accommodated.

The indications are that the exhibit of appliances and supplies will be the largest and most interesting ever presented for the attention of the Association, and, as is stated in another column, has been made at no little expense on the part of the exhibitors, and deserves the careful attention of all the delegates, which we have no doubt it will receive, and prove to be one of the most valuable features of the coming meeting.

LOCAL ENTERTAINMENT.

The street railway companies of Cleveland, in cooperation with the Short Electric Railway Co. and other manufacturing companies of the city, have several little surprises in store for the delegates in attendance at the Convention, and will provide in a hospitable manner for the entertainment during the intermissions, and following the business meetings.

LADIES INVITED TO ATTEND.

The general interest of the Convention having heretofore been largely increased by the attendance of ladies, the same practice will meet with popular favor this year, and the delegates are urged to bring their wives and daughters with them to the Cleveland meeting, ample provision having been made by the local committee for their entertainment and participation in the excursions and banquet.

REPRESENTATIVES OF THE STREET RAILWAY JOURNAL

will, as usual, be present at the Convention, and a cordial invitation is extended to all in attendance to call and register at our headquarters, parlor No. 142, first floor, of the Hollenden Hotel.

We value the honor of being enrolled among the number of those engaged in developing the street railway interests of our country, and welcome all those thus engaged, and wish to assure our friends that it will be our aim in the future, as in the past, to do our part in improving, popularizing and extending the rapid transit facilities of our cities and towns.

SPECIAL EDITION.

We take pleasure in presenting this Souvenir edition of the Street Railway Journal, which will be distributed free to all applicants, as a token of our interest in the well being of the Association, and in honor of this Eleventh Annual Convention.



SCENE IN WADE PARK.

JOIN THE ASSOCIATION.

For reasons fully set forth in another column, we commend the claims and benefits of the Association to every street railway company doing business in the territory which it embraces, and urge upon all the duty and privilege of becoming members in order that they may reap the benefits and share in the good work in which the organization is engaged. The present membership of the Association embraces 198 companies doing business in the United States and Canada. This is only a small number compared with the many corporations engaged in this industry in the country, and it must be inferred that the companies holding aloof from the organization do so because of ignorance as to its purpose, or because of indifference to the benefits which they have already received, or would receive were they enrolled in its membership.



CENTRAL VIADUCT.

THE LOCAL COMMITTEE AND SOME PROMINENT CITIZENS.

DR. A. EVERETT.

The street railway veteran of Cleveland is Dr. A. Everett, president of the East Cleveland Railroad Co. The statement is true as referring to his age—for he was born in Liberty Township, Trumbull County, O., in 1821—and to his years of usefulness as a street railway manager.

Since 1860 he has been at the head of the affairs of the company with which he is now identified, and a sketch of his life means practically the description of the development of the system he has managed so admirably. In that year Dr. Everett was one of a company of gentlemen who purchased the East Cleveland road, the owners of which were glad to dispose of their interest, as the enterprise was not successful financially. He was selected as president by the stockholders, and the rapid growth in the value of the property gives evidence of the wisdom of their choice. The doctor devotes himself as actively to his duties to-day as at the time when the enterprise was an exceedingly small affair. The equipment originally comprised two miles of track and four eight-foot horse cars with windows 7 × 9 ins. From the very start Dr. Everett followed the policy of extension and improvement, the development finally involving the transformation of all the lines into an electric system which to-day is equal in point of completeness to that of any city in the country. The length of the several lines comprising the system is to-day fifty miles, and 100 motor cars carry 10,000,000 passengers yearly, deriving their power from a station of 2,500 H. P. capacity.

H. J. DAVIES.

Those who have desired information regarding the present convention of the American Street Railway Association have, doubtless, by this time become thoroughly acquainted with Mr. H. J. Davies, secretary and treasurer of the Brooklyn and South Side street railroad companies. He has devoted no little time to convention business, and a more patient committeeman never answered the innumerable letters and inquiries of anxious exhibitors. Mr. Davies was born July 26, 1859, near Toronto, Can., but the family moved, four years later, to Cleveland. He was educated in the common schools of Cleveland, and subsequently began the study of shorthand. He became an expert stenographer, and did a large amount of business in the courts of Ohio and Western Pennsylvania. He was associated for many years with Mr. J. G. Pomerene, one of the best reporters in the West. In 1889 Mr. Davies gave up his stenographic work to take the position of private secretary to Hon. Tom L. Johnson. In the following January he was elected secretary of the Brooklyn and South Side street railroad companies.

A. L. JOHNSON.

Albert L. Johnson, president of the South Side Street Railroad Co. and vice-president of the Brooklyn Street Railroad Co., was born in Helena, Ark., December 25, 1860 and is a brother of Hon. Tom L. Johnson. In 1871 he went with his parents to Louisville, Ky., and during his school days worked for the Central Passenger Railway Co., collecting fares on the Walnut and Fourth Street line on holidays and other days of heavy travel, when fare boxes could not conveniently be used. When fifteen years of age he was appointed road officer on the Walnut Street line, and retained this position until his parents removed to Indianapolis. In Indianapolis he worked as a conductor on Illinois Street, and was afterwards foreman of the barns of the Citizens' Street Railroad Co. of that city. In this capacity he bought all the horses and mules for the line, and was known in St. Louis as the "kid buyer," being but sixteen years old. Later he was bookkeeper and secretary of the company. From Indianapolis he went to Cleveland, arriving there three years in advance of his brother. He put in operation the Brooklyn line, which was then a fare box road with four cars and thirty mules. He occupied at that time the positions of manager, superintendent, purchasing agent, bookkeeper, timekeeper and road officer. He has been one of the managing officers of the Brooklyn company ever since.

After the adoption of electricity by the Brooklyn and South Side companies, Mr. Johnson ran a motor three hours every morning and three hours every evening, during heavy travel, for six weeks, in order to familiarize himself with the operation of motors and with the troubles and difficulties liable to be encountered in the running of the roads by the new power.

Mr. Johnson has probably superintended the laying of as much street railway track as any other man in the country. While he was in Indianapolis he had entire charge of construction during one season. He has superintended the laying and relaying of the forty miles of track of the Brooklyn and South Side companies in Cleveland during the past twelve years. He laid the Park Avenue cable line in Brooklyn, N. Y., the Canal Dover & New Philadelphia line and the East Liverpool & Wellsville line. He is the inventor of two street car brakes, a motor truck and an electric railway motor.

He is a Democrat in politics, and was elected a member of the first Board of Aldermen of Cleveland by a plurality of twenty-seven votes in a district which had previously given Republican pluralities of more than 500. He served one term, and has since refused to hold any political office although several nominations have been tendered him.

In addition to his Cleveland interests, Mr. Johnson is a large stockholder in the East Liverpool & Wellsville Street Railroad Co. and the Tuscarawas Electric Co., which operates a street railroad between the cities of Canal Dover and New Philadelphia, O. He is the president of the former company, and secretary and treasurer of the latter. He was the main projector of both lines. The East Liverpool & Wellsville road, eight miles in length, was probably constructed in shorter time, considering the physical difficulties, than any other road in the world. Mr. Johnson obtained his franchise for the line on September 16, 1891, and on December 16, ninety days later, operated electric cars over its entire length. In that time he surveyed and laid the road, built a brick car house and brick power station and put the line in operation. He removed 78,000 cu. yds. of stone and dirt from a mountain between the two towns, and built three long wooden trestles, which have since been converted into wagon bridges by the local authorities. The road is laid with Johnson rail, that in the paved streets of the cities being eighty-two pound girder, and in the country roads fifty-six pound T. The power station and cars are equipped with Short apparatus.

Mr. Johnson has applications for franchises pending in Cincinnati and two other large cities. He is the principal stockholder in the Johnson Electric Co., of Cleveland, a concern recently organized for the purpose of manufacturing motors, gears, pinions and other material used by electric street railways. The company now employs constantly more than 200 men.

FRANK DE H. ROBISON.

One of the most active and energetic street railway men, of Cleveland, is Frank De H. Robison, president of the Cleveland City Cable Co. For seventeen of his thirty-six years, Mr. Robison has been connected with the street railways of Cleveland. He was secretary and treasurer of the Superior Street Railway Co., before it became part of the present cable system, and the change from horses to electricity was made. He is a thorough believer in rapid transit, and under his direction the lines of the Cleveland City Cable Co. have become a model cable system. He is greatly interested in out-of-door sports, and is president of the Cleveland Athletic Club, with a membership of over 2,000 members, of the Cleveland Base Ball Club, and the Cleveland Kennell Club.

J. B. HANNA.

One of the best known street railway men in Cleveland is J. B. Hanna, the indefatigable secretary of the Woodland Avenue & West Side Street Railroad Co. Mr. Hanna is so thoroughly identified with his company that the two names are almost interchangeable in the estimation of residents of the city. He had a somewhat varied experience before he settled down to the duties of his present position. He was born on a farm near New Lisbon, O., August 26, 1854. His parents moved to that town, which is the country seat, when he was quite young, and subsequently made Cleveland their home. When he was fourteen years of age the family removed to Morrison, Ill., and at this place, when sixteen years of age, Mr. Hanna began his business life as a drug clerk. When twenty years old, he went to Clinton, Ia. where he was employed as clerk in a dry goods store, remaining in that position four years, when he returned to Cleveland, entering the employ of Rhodes & Co., dealers in coal, ore, etc. He was stationed











The Local Committee.

1. H. J. DAVIES.
2. F. De H. ROBISON.
3. A. L. JOHNSON.
4. J. B. HANNA.
5. Dr. A. EVERETT.

by the firm at Ashtabula Harbor for five years. On the organization of the West Side Street Railroad Co., he was appointed to the secretaryship, and he held the same position when the consolidation with the Woodland Avenue company was effected, forming the present corporation. Mr. Hanna has been treasurer of the Ohio State Tramway Association since 1885, and secretary and treasurer of the organization since 1889. He is a member of the local executive committee having in charge the arrangement for the convention of the American Street Railway Association.

CHARLES F. BRUSH.

The story of what Charles F. Brush has accomplished has been so frequently related as the first chapter in modern arc lighting that it is familiar to every one connected with electrical industries. His re-



CHARLES F. BRUSH.

markable inventions, which seem matters of course to-day, were fundamental in character and overcame the obstacles which blocked all progress in arc lighting. He performed his great work in an exceedingly brief period, and it is a remarkable fact that the Brush apparatus, which is in use the world over is to-day substantially the same in design and method of construction and identical in principle as that first designed by him to illustrate his inventions.

Mr. Brush was born in Euclid Township, Cuyahoga County, near Cleveland, March 7, 1847. His early life was passed upon a farm, after which he attended the public schools of Cleveland. In the high school he made a fine record as a student, and even at that time he gave marked evidence of his aptitude for mechanical pursuits. In 1866 he entered the University of Michigan, and was graduated three years later with the degree of Mining Engineer. Returning to Cleveland, he opened an office as an analytical chemist, and while he was thus engaged for three years, he was noted for the skill and accuracy which characterized all his work. Subsequently he was interested in the iron business for four years.

In 1875 his attention was attracted by the experiments in electric lighting in progress in Paris and London, and the question arose whether a dynamo superior in construction to any in use would not prove a profitable invention. The matter was talked over with George W. Stockly, of the Telegraph Supply Co. of Cleveland, and an agreement was entered into by which facilities for manufacturing were to be given to Mr. Brush if he invented the right machine. Within two months of the time of the interview Mr. Brush set up his first dynamo, which was so complete and so successful that no radical change has been made in the machine to this day. Of the invention Professor Dolbear says in one of his lectures: "Mr. Brush, of Cleveland, attacked the problem and solved it in a simple enough way, to be sure, so that it is a matter of surprise that those who had before worked with the dynamo had not stumbled upon the method of distributing the light. It consisted chiefly in the consideration of what was apparent enough, that if one arc required fifty volts, two arcs would need 100 volts, and ten arcs 500 volts, and so on. * * * As simple as the multiplication table, yet it waited for the man who had the genius to see the simple thing to do it."

While the dynamo, which he had constructed, performed its work satisfactorily, no lamp was available to use in connection with it, as the antiquated clockwork type was the best to be had. It was necessary to supply the demand in the same way that the dynamo was found—by invention. Mr. Brush believed that he could make a satisfactory commercial lamp as well as a practical machine, and he proceeded to his second task. This was accomplished within a few weeks. The lamp proved to be an invention almost equal to the machine itself, and as at present constructed it is substantially the same in form and principle as the one first produced. Within a year both machine and lamp were in working order and ready to be put upon the market. At this time Mr. Brush was less than twenty-eight years of age, but he had laid the foundations for his marvelous success. Of his other inventions—and they constitute no small number—it is unnecessary to speak here. His fame will always rest upon his two great fundamental inventions.

Mr. Brush possesses a vast fund of available scientific knowledge, but above all he is intensely practical. He is a fine mechanic and competent to perform work intrusted to the most careful employes.

The incident that revealed to the writer the fact that Mr. Brush has a "good eye" was in seeing him pause as he was passing through the shop and remark—"That lathe is not true," referring to one of the several watchmakers' lathes that were just unboxed. When the centres were brought together they were "out" about one thirty-second of an inch, a great deal for such a tool, but very little to "offend" the eye of a passer-by.

CHARLES HATHAWAY.

Charles Hathaway, of Cleveland, one of the directors of the Cleveland City Cable Co., is a street railway pioneer. The list of street railways that he has constructed is a formidable one. At times



CHARLES HATHAWAY.

he has employed 3,000 men in work of this kind at points widely separated. Born at Grafton, Mass., in 1824, his boyhood was passed on a farm. After attending school for three years, in Worcester, he was apprenticed in a machine shop, and learned his trade thoroughly. In 1844, he took his first railroad contract, and he engaged in this work till 1857, when he built his first street railway in Philadelphia. From

that date until a year or two ago he was engaged in constructing railways in cities throughout the United States and Canada. In 1860, he was associated with George Francis Train in building street railways in England. Mr. Hathaway has made his home in Cleveland since 1873. He has been prominently connected with local street railways since that time. He built the Broadway & Newburgh, the Payne Avenue, and the Superior Street railroads. He bought the St. Clair road, in 1884, and operated it until the consolidation with the Cleveland City Cable Co. For fifteen years he was president of the Superior Street Railroad Co., and held the same office in the St. Clair Street Railroad Co., for many years. At the present time Mr. Hathaway claims he has retired from business, but he is still to be found regularly at his office.

M. A. HANNA.

W. A. Hanna, one of the most prominent citizens of Cleveland, is president of the Woodland Avenue & West Side Street Railroad Co.



M. A. HANNA,
PRESIDENT WOODLAND AVE. & WEST SIDE STREET RAILROAD CO.

He was born in Lisbon, O., in 1837, but Cleveland has been his home since 1852. He is the senior member of the firm of M. A. Hanna & Co., which is extensively interested in coal, iron, mining and shipping. Mr. Hanna is president of the Chapin Mining Co. and a director in the Union National Bank, Chapin Bolt & Nut Co., West Side Banking Co. and the Globe Iron Works Co. He has taken an active part in Ohio state politics, and has been an influential factor in several of the most interesting campaigns. He purchased the Woodland Avenue Street Railroad Co., and became its president in 1882, and has held the same office since the consolidation with the West Side Street Railroad Co. three years later. During his administration the service has been greatly improved, and the electrical equipment of the road is now in progress.

WILLIAM G. ROSE,

MAYOR OF CLEVELAND.

William G. Rose is now serving his third term as Mayor of Cleveland. He was first elected in 1877, and served two successive terms. He was nominated for the Lieutenant-Governorship in 1883, on the Republican ticket with Foraker, but was defeated. Last spring he was for the third time selected as the executive head of the municipality.

HON. TOM L. JOHNSON.

There is no name more familiar in the street railway world than that of Hon. Tom L. Johnson, president of the Brooklyn Street Railroad Co. His inventions in this particular field comprise many of the most essential and fundamental features in street railway equipment. While his connection with street railways is familiar, his personal history, which is full of interest, is not so well known. He comes of Virginia-Kentucky stock and among his ancestors were many men of influence and distinction. One of these, Richard M. Johnson, represented Kentucky in Congress, commanded a regiment in the war of 1812, and fought the Indians in the Battle of Thames, in which he was badly wounded. He was credited with killing the Indian chief Tecumseh. He was chosen Vice-President of the United States on the



TOM. L. JOHNSON,
PRESIDENT OF THE BROOKLYN STREET RAILROAD CO.

ticket with Van Buren, in 1836. At the same Battle of the Thames, Col. James Johnson, the great grandfather of Tom L., led against the British, whom he routed in a gallant charge. His brother Judge Ben Johnson, removed from Kentucky to Arkansas in 1830, which state his son, Robert W. Johnson, represented in the United States Senate.

Col. James Johnson's son, Gen. William Johnson, who also saw service fn the War of 1812, was long a leading man in Kentucky. His son, Albert W. Johnson, married Miss Helen Loftin, daughter of Colonel Loftin, a prominent and weathy Tennesee planter, and to them in Scott County, Kentucky, was born on July 18, 1854, Tom Loftin Johnson, who began life under very different conditions from those that his family had enjoyed for several generations. At the close of the war, instead of attending school, he had to go to work, and he ran errands as an office boy of the Central Passenger Railroad Co., of Louisville, in which A. V. du Pont was the principal stockholder. At the age of sixteen Mr. Johnson was made secretary, and was put in charge of the office. He possessed not only executive ability, but he developed a talent for inventions, and the sale of two of his patents for a considerable sum gave him his financial start. Colonel Johnson, his father, had

also gone into the street railroad business, having become superintendent of the Central Passenger Railroad. He and his son bought an interest in the Louisville road. From Louisville they went to Indianapolis, buying up the street railroad system of that city, which, after it had been made very profitable, they sold in 1887. In the meantime Tom L. Johnson had gone to Cleveland, settled there and bought a controlling interest in the Brooklyn line of street railroad, which he had greatly extended and transformed into an electric line. Before adopting electricity as a motive power, Mr. Johnson visited various electrical works and a number of cities in which electric cars were in operation, and so acquired a thorough, practical knowledge of the new force as applied to street cars.

Besides his interest in the Brooklyn and South Side street railroad companies of Cleveland, Mr. Johnson is a large stockholder in the Southern Railway Co. of St. Louis and the Johnstown Passenger Railway Co. of Johnstown, Pa., of both of which companies he is the president. Under his direct supervision and management both were changed from horse lines to electric roads. Under his direction, also, the Tuscarawas Electric Co. built a line of electric street railway connecting New Philadelphia and Canal Dover, O. The system is now under the management of his brother-in-law, Mr. Robert A. Johnson.

While connected with the Louisville company, Mr. Johnson invented and patented a fare box which was adopted and used by the central passenger and many other companies. Later, and before the introduction of electricity into street railway work, he designed a cable system and built a short experimental road in Cleveland, and a longer road in Brooklyn, N. Y., which was successfully operated, but was abandoned as soon as electricity, in his opinion, was shown to be a more desirable power. He also invented and patented an automatic lever brake, which is now in use on almost every cable road in the United States. Among his other inventions are a tower wagon used for stringing overhead wires, and the Johnson life guard, which is in use on all the roads in which he is interested, and which has lately been adopted by the West End Railway Co. of Boston.

He is a director and a large stockholder in the Johnson Co. of Johnstown, Pa., which is engaged in the manufacture of all kinds of rails for street railroad use. He is the inventor of the Johnson girder rail, which is the standard rail used by electric roads in the United States.

Mr. Johnson never took an active interest in politics until the fall of 1888 when the Democrats of Cleveland, without his knowledge, placed him in nomination for Congress. The district was strongly Republican, and he was defeated by a plurality of 500 votes. In 1890 he was renominated and elected. His political friends confidently predict his re-election this fall. Mr. Johnson was a delegate to the last Democratic national convention, and was the author of that part of the platform which declares the Republican protective tariff to be a fraud. He is one of the leaders of the radical wing of the Democratic party, and he is an earnest believer in and a strong advocate of the single tax doctrine of Henry George.



RESIDENCE OF CHARLES F. BRUSH, EUCLID AVENUE.

CLEVELAND.

THE FOREST CITY—ITS STREET RAILWAYS AND OTHER INDUSTRIES.

CLEVELAND is an interesting and a prosperous city, and there is much within the corporate limits to challenge attention and to inspire admiration. But Cleveland is an intensely modern municipality; whatever wealth can add Cleveland possesses, but of entertaining history it can boast but little. True, local historians start their narratives at a time when, some centuries ago, a forgotten Indian tribe occupied the site of the flourishing Forest City, but it is only necessary to go back to 1796 to find the founder of the city, Gen. Moses Cleaveland, entering the mouth of the Cuyahoga River to make the beginning of a settlement. He never realized the importance of his work, and he never revisited the locality which bore his name. Honored, as the founder has been by the erection of a monument to his memory in the Public Square, still his name has suffered at the hands of a utilitarian and irreverent editor, who in 1830, finding it too long to suit the width of his page, eliminated a letter, and thus formed the name by which the city is known the world over to-day. Going back to 1814, when Cleveland became a village, we find that the first ticket was unanimously elected by twelve votes, and consulting the records at as recent a date as 1854, when Cleveland and Ohio City, now Brooklyn, were consolidated, we learn that the joint population did not exceed 25,000.



WM. G. ROSE, MAYOR OF CLEVELAND.

But enough has been written to indicate that the city is a thing of recent creation. To-day Cleveland has a population of 300,000 souls, and its newspapers predict the addition of another 100,000 before the century closes. It boasts, with reason of its manifold attractions, its parks, its Euclid Avenue and its industries, which have given it a world-wide reputation.

Figures are dull at the best, and no extended description of the sources of Cleveland's wealth is contemplated. Brief references only will be made to some few of the interests for which the city is chiefly distinguished. In general, it may be stated that these pre-eminent industries group themselves into the following classes: Shipbuilding, iron, transportation, oil and general manufacturing.

SHIPBUILDING.

In 1813 twenty-eight yoke of oxen hauled down to the Cuyahoga the first boat constructed in Cleveland. It had been built in a yard which is now the site of an opera house on Euclid Avenue, half a mile or more from the river. This was the beginning of an industry which has grown steadily, until to-day the superintendent of the census states that, notwithstanding Cleveland's distance from the seaboard, it builds more vessels than any city in the Union, and is second only to the Clyde. The citizens believe in these craft, as at the present time a greater tonnage of vessels is owned in Cleveland than in any other customs district in the United States, with the exception of New York. Less than fifty years ago the first steamer was built, but the trade on the lake developed to such proportions that the best craft that skill could construct were urgently demanded. With its enormous steel and iron industries Cleveland offered every facility for building vessels in accordance with the most approved modern ideas, and steel steamships, second in size and equipment only to the ocean greyhounds, have been launched from the local yards.

TRANSPORTATION.

The rapid growth of the city is accounted for principally by the fact that it possesses such exceptional transportation facilities. The regular lines of passenger and freight boats from all over the chain of lakes touch at the port either in transit or as a terminal station. Ten railroads centre in the city, with an aggregate of 5,885 miles. The freight shipped and received from lake traffic exceeded in 1890, 4,000,000 tons, which was carried by a fleet whose home port is Cleveland, numbering 250 vessels, with a gross tonnage of 200,000 tons. During the same time the railroads centering in the city handled slightly less than 40,000,000 tons of freight.

IRON AND COAL.

The leading business in Cleveland, which gives em-

ployment to the greatest number of persons, and in which the largest aggregations of capital are invested, is the iron industry in its various branches. In the city a very large proportion of the steel rails used on steam railroads



CLEVELAND DRY DOCKS.

throughout the country is manufactured, and several of the largest bridge works in the country are located here. In fact, almost any article made of iron, from the crudest pig to the finest steel, from a wire nail to a steel ship, can



ORE DOCKS—HOISTING AND CONVEYING MACHINES AT THE LEFT.

be found in process of manufacture in the city. All this has been accomplished since the first foundry was started in 1826.

Just forty years ago the first shipment of iron ore was made from the mining districts of Michigan. The trade has increased until the receipts aggregate 900,000 tons, or one-third of the entire product, and Cleveland has in all probability more capital invested in Lake Superior mines than any city in the country. The methods of handling and distributing the ore at the docks form one of the most interesting sights to be seen in the city.

Somewhat closely connected with the iron industry is the coal interest. Almost all the coal shipped to the northwest above Duluth is controlled by companies located in Cleveland, whose shipments in 1890 reached over 3,000,000 tons.

OIL.

The refining of oil is an industry that is particularly associated with Cleveland, and the principal company en-

gaged in the business which handles more oil than any other two concerns in the world, and which has made all its largest stockholders millionaires, was organized in the city. From all the great oil fields in Ohio the crude oil is piped into the city. The refineries occupy many acres within the city limits, and their owners are the possessors of thousands of acres of oil lands. The industry ranks next to that of iron.

ELECTRICITY.

To the electrical fraternity, and to the great majority of street railway men, Cleveland is of special interest as the city in which is located one of the largest electrical manufactories in the country in which is constructed apparatus used the world over. It is regarded as the birthplace of the commercial arc lamp, and many other inventions of the highest importance in the electrical world have been here developed.

MANUFACTURING.

Some idea of the magnitude of the manufacturing city in search of information. The cable lines in their equipment represent the apparatus and appliances endorsed by the best practice of the day. The fund of information available in the electric motor fields is practically unlimited. The visitor can study the construction and development of one type at the place of manufacture. The oldest and latest forms, representing almost every manufacturing concern, even some of the most recent in the field, can be observed in operation in regular service Most of the trucks can be inspected, and the list of companies who supplied the rolling stock is a long one. The power houses represent the period when old buildings were remodeled to serve a new purpose, and they include two stations constructed in accordance with the latest ideas. They illustrate as well the different ideas regarding the best arrangement of plant. There are to be seen high speed engines belted directly to generators, slow speed engines connected to countershaft, Corliss engines belted to generators and the direct connection of electric machine to engine shaft. The companies, too, have been op-



VIEW IN THE OIL DISTRICT.

nterests of Cleveland may be gained from the following table, compiled from the latest authentic figures for 1890:

Value of manufactured products	$98,926,241
Capital invested	53,974,346
Hands employed	53,349
Wages paid	$30,423,635
Number of manufacturing establishments	2,065

These figures, while they make a splendid showing, are incorrect as referring to Cleveland to-day. The data are taken from a recent address by Robert P. Porter, superintendent of the census, and are based on returns for 1890. No one who is acquainted with Cleveland requires any assurance that the development of its material prosperity has proceeded with marvelous rapidity during the last two years.

STREET RAILWAYS.

The street railways of Cleveland collectively form a a rapid transit scheme that is scarcely surpassed in any city in the country. Within a few months at the farthest every line will be operated either by cable or electricity. The system is complete from every point of view, and particularly so from that of the railway man, who visits the

erating electric cars for a sufficient length of time to thoroughly systematize their work in all its departments, and have adopted many ingenious labor-saving devices in the equipment of their plants.

The railway system is comprehensive, embracing, as it does, 180 miles of track, and is laid out with an eye to the needs and convenience of the public. From the heart of the city almost any point within the municipal limits can be quickly reached ; in fact the ramification of tracks is so complete that in sections of the city lines parallel each other for considerable distances, almost within a stone's throw. The companies operate their cars at a high rate of speed, but the number of accidents caused by the motors is insignificant.

It is a fact worthy of note that the finest thoroughfares in the city are traversed by electric cars; in fact one can in no way gain a better view of the city's beauties than from a car window, though, be it said, the show is a fleeting one, for the speed is too great to permit of any careful survey. The routes include the famous Euclid Avenue, Prospect Street and Jennings Avenue, and pass all the principal parks.

All the lines converge at the centre of the city, and

occupy four tracks in the principal thoroughfare. And just here is found a most interesting fact, viz., that the residents of the city are thoroughly educated up to the idea of rapid transit, and appreciate the fact



THE GARFIELD MONUMENT.

that it is the duty of the pedestrian to look out for himself, and not to shut his eyes and blindly cross crowded streets regardless of cars constantly passing to and fro. They seem to appreciate, in a most unusual and intelligent fashion, that perfect safety lies in keeping one's eyes open, so that Superior Street with its four tracks crowded with cars, which in some places would be regarded as extremely dangerous, has no terrors for them, and confusion and narrow escapes are rarely to be witnessed there.

The street railways of Cleveland are owned by nominally six, practically five, companies. In the following pages a somewhat detailed description of each system is presented, while in the appended table are summarized facts regarding each road :

NAME OF COMPANY.	STOCK.	BONDS.	MILES OF TRACK.
East Cleveland R. R. Co.....	$2,000,000	$1,000,000	50
Woodland Ave.& W.Side St.R.R.Co.	2,000,000	None Iss'd.	32
Cleveland City Cable Co.....	4,000,000	1,884,000	32.25
Brooklyn Street R. R. Co.....	600.000	600,000	30
South Side Street R. R. Co.....	300,000	300,000	10
Broadway & Newburgh St. R. R. Co.	1,000,000	None Iss'd.	26

VIADUCTS.

The viaducts, which are such essential parts of the thoroughfare system of Cleveland, are owned by the city. For the use of these structures as part of their routes, the street car companies pay the municipality a fixed rental, and in addition, furnish the rail and keep the pavement in repair. At the points where the drawbridges are located contact switches are located in the overhead trolley system, by means of which, when the bridge is swung, the current is cut off for a distance of 1,000 ft. on each side. The purpose of this arrangement is obvious. The possibility of a car running into the open draw is rendered exceedingly remote with even a most careless motorman in charge. If he failed to stop at the signal his car would not have sufficient momentum to carry him to the point of danger.

The two principal viaducts are the Central and the Superior Street. The former, which was built during 1887-88 by the King Iron Bridge & Manufacturing Co., of Cleveland, connects the West Side with the city proper. Its total length is about 4,000 ft., and its height above the level of the Cuyahoga River is 101 ft. The roadway is forty feet in width with eight-foot walks on each side.

The Superior Street viaduct is 3,211 ft. in length and connects the east and west sides of the city. That on the west side of the Cuyahoga consists of eleven stone arches, eight of which have eighty-three feet span and two ninety-seven and a half feet span. The length of way thus supported is 1,382 ft. Of the eastern portion 930 ft. is iron work, including the draw which is 332 ft. in length. The elevation of this section of the viaduct is seventy feet above the Cuyahoga. The roadway is forty-two feet wide, and the walks on each side eleven feet in width.

THE MONUMENTS OF CLEVELAND.

Pre-eminent among the monuments of Cleveland is the magnificent Garfield Memorial, located on the loftiest elevation in Lake View Cemetery, five miles east of the Public Square. The monument, which was built by public subscription at a cost of about $150,000, consists of a



STATUE OF GENERAL GARFIELD—INTERIOR OF MONUMENT.

circular stone tower 150 ft. in diameter and 165 ft. in height, in front of which is a square vestibule with a balcony roof. The tower is crowned with a conical stone roof adorned with bands of sunken tile. The principal exterior decoration is a frieze on bas relief, divided into

four panels, each representing an epoch in Garfield's life, as follows: The teacher, the soldier, the orator, the president and his death.

Inside the porch is a vestibule in which is a statue of Garfield, of heroic size. He is represented as rising in the House of Representatives to address the speaker. The memorial was dedicated May 30, 1892.

The Perry monument, in the Public Square, was unveiled in 1860, in commemoration of Com. Oliver Hazard Perry's famous victory on Lake Erie in the war of 1812.

The bronze monument, in the Public Square, of Gen. Moses Cleaveland, the founder of the city, was unveiled in 1888 by the Early Settlers' Association.

RAPID TRANSIT FACILITIES OF CLEVELAND.

EAST CLEVELAND RAILROAD CO.

Capital stock $2,000,000
Bonds 1,000,000
$3,000,000

Miles of track:
Electric 50

President, A Everett,
Vice-President, C. W. Wason,
Secretary and Treasurer, H. A. Everett,
Asst. Secretary and Treasurer, L. E. Beilstein,
Superintendent, E. Duty.

DIRECTORS.

A. Everett, M. A. Bradley,
H. A. Everett, W. W. Boyington,
G. E. Herrick, J. S. Hartzell,
C. W. Wason.

No single company in Cleveland can lay claim to the honor of being the first company in the local street railway field. The honor is shared by two companies alike, the East Cleveland Railroad Co. and the Woodland Avenue & West Side Railroad Co. The project of building lines on Prospect Street and on Kinsman Street was conceived by the same gentlemen; but it was deemed best to divide the responsibility for the operation of the two roads between two companies. In pursuance of this policy the East Cleveland company conducted the Prospect Street enterprise, while the Kinsman Street Railway Co. operated the line designated by their name. The railways were both started on September 10, 1860, a day memorable in the annals of Cleveland as the date of the unveiling of the Perry monument in the Public Square. Each company owned four cars eight feet in length; two of them were designed for regular service, and the others were reserved for special occasions.

The East Cleveland company's cars ran every twenty minutes to Sterling Avenue, and one every hour to Willson Avenue.

The enterprise was not financially successful, and a controlling interest was sold to several gentlemen who elected Dr. A. Everett to the presidency, and he has been the executive head of the East Cleveland company since that time. Mr. Charles Wason was elected to the vice-presidency, and held the office till the time of his death, two years ago.

The company have pursued a policy of gradual extension, and at the present time they operate seven lines, as follows: Euclid Avenue and Prospect Street; Cedar Avenue; Wade Park Avenue; Central Avenue; Mayfield; East Cleveland; Euclid Avenue and Collinwood.

For years the directors have had an abiding faith in electricity as a motive power for street cars. As early as 1884 they made a preliminary experiment to determine whether the electric system was practicable for their use. A section of conduit about three-quarters of a mile in length was built on Central Avenue, and the Bentley-Knight underground system was installed. One car was operated on this section, but the leakage proved so great that the idea of constructing a conduit system was abandoned, and the plan of equipping the road electrically was shelved for the time being. The failure of the experiment with the conduit was by no means surprising, especially in the light of present experience. The conduit was built of wood, and the general construction would be regarded to-day as exceedingly flimsy. But in those days the necessity for great strength in every detail of equipment was not realized as it is at the present time.

In 1888, the company, having made a thorough investigation of the overhead system, as far as was then practicable, and deeming it well adapted to the requirements of their service, applied to the City Council, and was granted a franchise. In December of that year the first electric line in Cleveland was operated on Euclid Avenue, and the electric system, which has contributed so materially to the prosperity of the city, was thus introduced. The original equipment consisted of sixteen Sprague motor cars.

The fifty miles of track of the company are now laid entirely with girder rail of the Johnson and Wharton types. The weights range from fifty-two to ninety pounds to the yard. The distance between centres of ties in the more recent construction is two feet. The rails are connected by copper rail bonds which are soldered to a continuous ground wire.

With the exception of one line where brackets are used, side poles are employed throughout the system; and these are metal with the exception of those placed on the suburban extensions. The original trolley wire was a No. 4 silicon bronze; that used in recent construction is a No. 0 hard drawn copper.

The company have a varied equipment in rolling stock. Most of the car bodies are of their own manufacture; thirty have been completed in the last fourteen months. Among the makers represented in the rolling stock are: John Stephenson Co., Lewis & Fowler Manufacturing Co., J. M. Jones' Sons, Newburyport Car Manufacturing Co. and J. G. Brill Co. The cars are equipped

with electric motors of the following types: Eighty No. 6 Edison double reduction; ten No. 14 Edison single reduction; one Thomson-Houston single reduction. The single reduction motors are of twenty horse power each, and the double reduction fifteen horse power each.

The company at present are making the wooden truck of the Fulton Foundry Co., of Cleveland, their standard; but the trucks of several other makes are also on the lines. Among the number are those of the J. G. Brill Co.; Sheffield Velocipede Car Co.; Bemis Car Box Co.; John Stephenson Co.; Robinson Electric Truck & Supply Co.

The power station which is located on Cedar Avenue, and of brick, presents an attractive appearance. The dimensions of the first building designed for the power plant were 80 × 100 ft., to which was added later an extension, 80 × 140 ft. with flat roof finished off having battlements rising to about thirty feet from the sidewalk, making the present building an L with a front of 160 ft. and sides of 100 and 140 ft. This building will probably be again extended soon, so as to occupy an area 240 × 140 ft. All future buildings will be of brick with roof of 2 × 4 in. joists laid edgeways and supported on iron trusses. The first stack was 136 ft high with a six-foot flue, and the new stack just completed is 175 ft. high and has an eight-foot six-inch flue.



C. W. WASON,
VICE-PRESIDENT EAST CLEVELAND RAILROAD CO.

The boiler equipment consists of seven Cooper boilers, and an equal number built by the Variety Iron Works Co., of Cleveland. Each of these is 72 ins. × 18 ft., of 130 H. P. capacity, and is designed to supply steam at 100 lbs. pressure. All are provided with the Murphy smokeless furnace and automatic stoker, manufactured in Detroit, which give satisfaction. The Ford boiler cleaner is being tried, and seems to give good results. The pumps are of the Deane duplex and Hughes' patterns, two of the former and four of the latter being employed. Five Berryman heaters, 12 ft. × 40 ins., and Reliance water columns, complete the boiler house equipment.

Water for the boilers is now taken from the city mains, but the railway company have just completed an artesian well, 377 ft. deep, having a bore eight inches in diameter. This well will give a supply of 100,000 gals. every twenty-four hours, with natural rise of water to within seventy-five feet of the surface. The contractors for this well were the Buffalo Well Drilling Co.

The railway company are using for recording the steam pressure at all times, a Bristol recording steam gauge, made in Waterbury, Conn. This makes records upon prepared disks, which show the pressure record for each twenty-four hours, and which are kept on file.

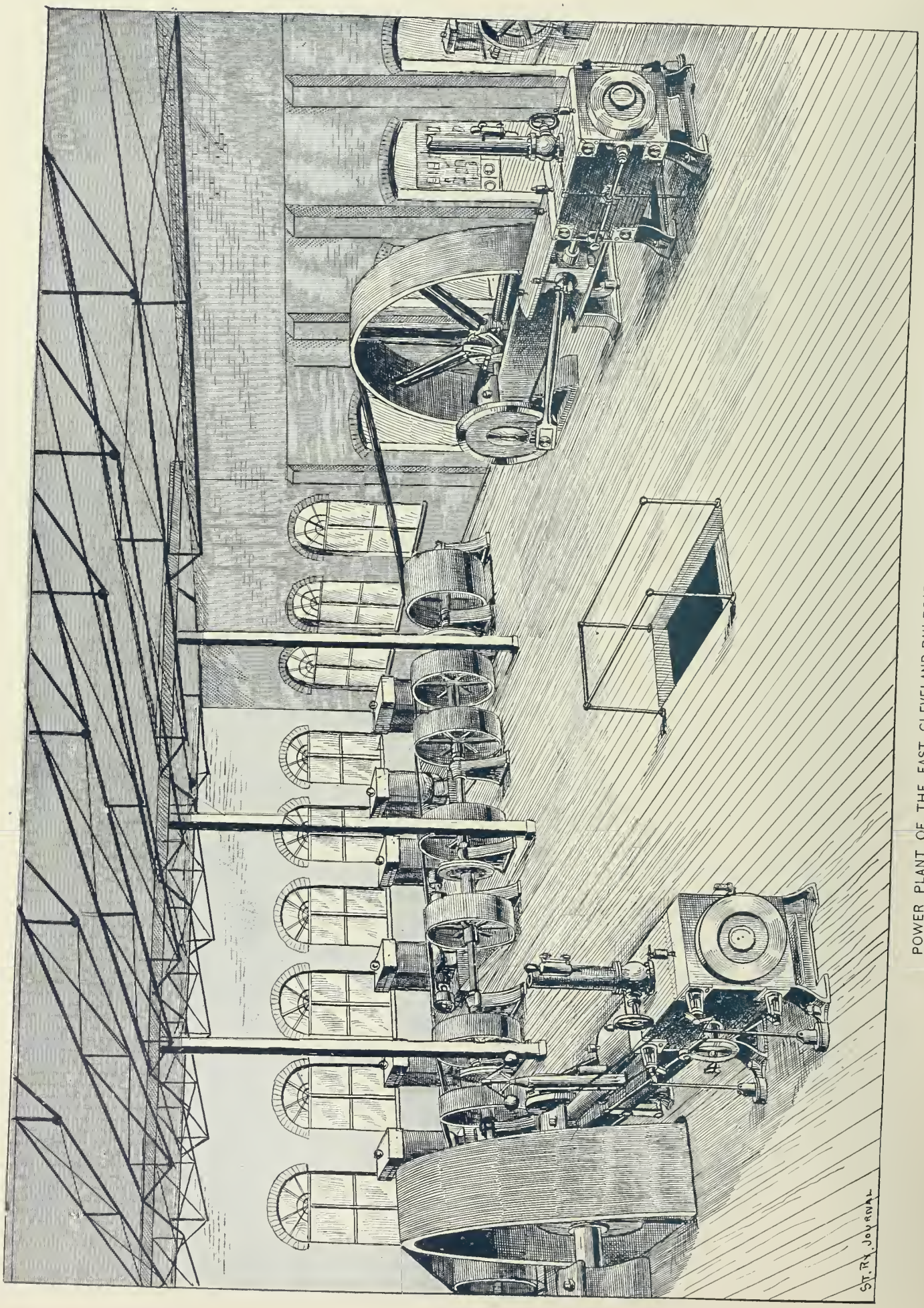
Power is furnished by both high and low speed engines. The former, which were first installed, occupy the old part of the building. The original installation was one 125 H. P. Armington & Sims engine, with two generators of sixty horse power each. This was soon increased 200 per cent., which took care of all the motors for about



HENRY A. EVERETT,
SECRETARY AND TREASURER EAST CLEVELAND RAILROAD CO.

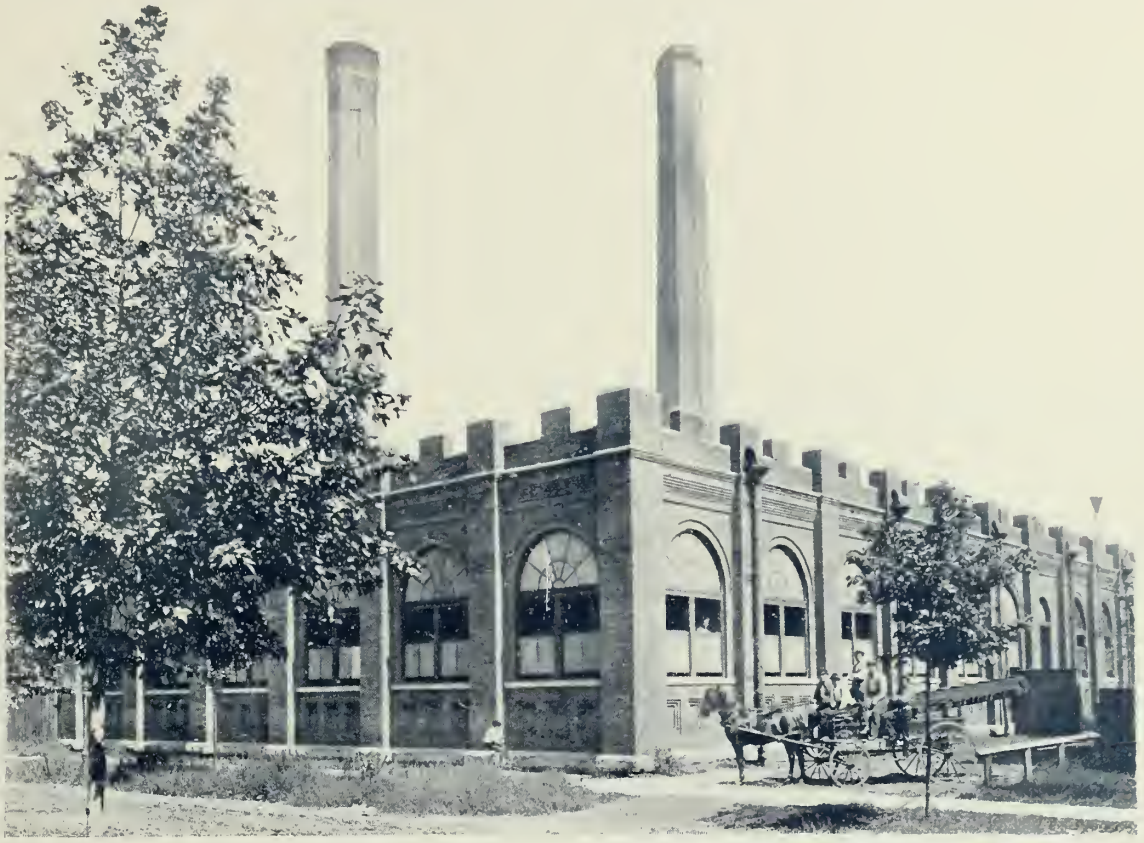


E. DUTY,
SUPERINTENDENT EAST CLEVELAND RAILROAD CO.



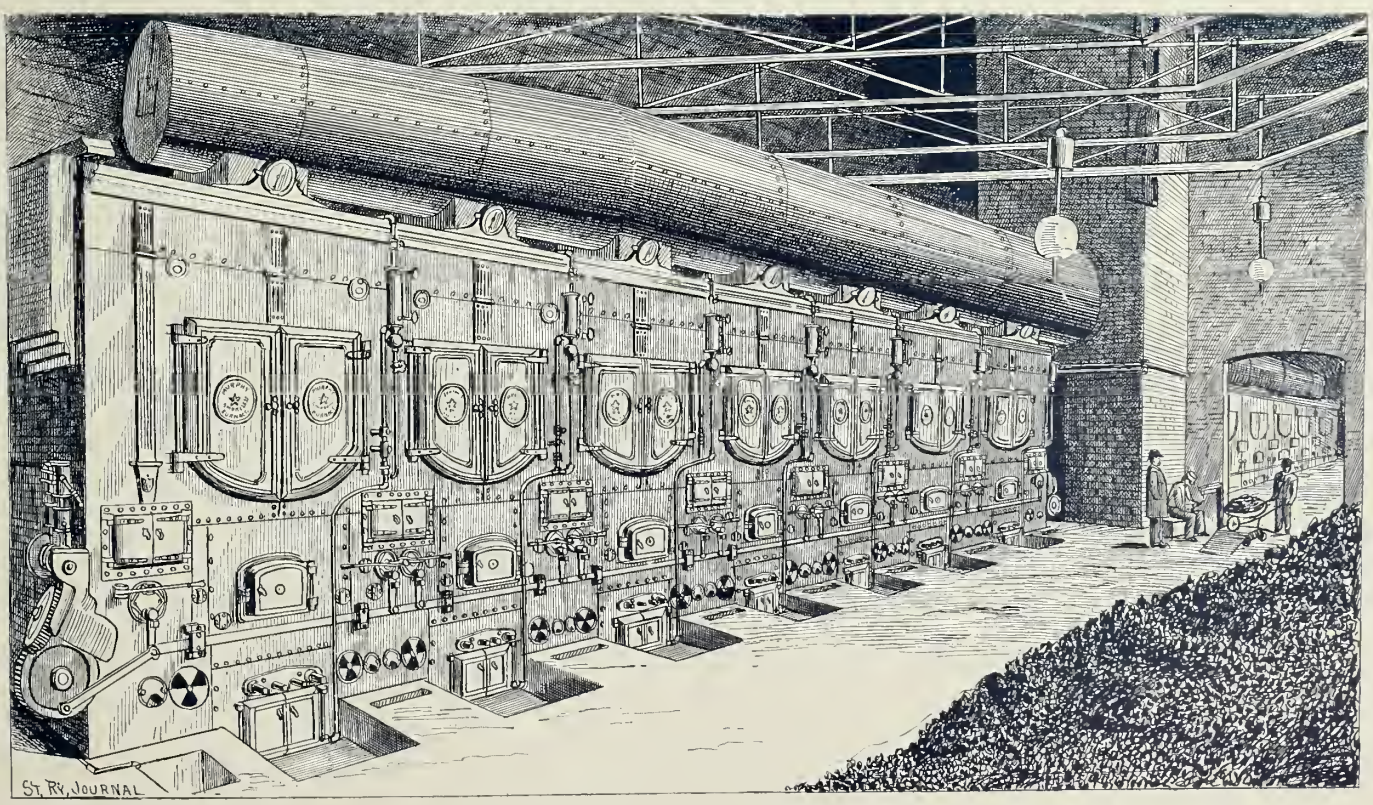
POWER PLANT OF THE EAST CLEVELAND RAILROAD CO.—SLOW SPEED ENGINES.

seven months, after which time the plant was again increased 200 per cent., giving an aggregate generator capacity of 1,000 H. P. About one year later an increase of over 100 per cent. was made, and at present the generator capacity is more than 2,000 H. P. The last increase was made contrary to the general opinion at that time, in regard to the practicability of running low speed engines in connection with high speed engines, but the result has been very favorable, and the management is enabled to judge of the efficiency of the two kinds of plants.



POWER STATION—EAST CLEVELAND RAILROAD CO.

The present steam engine equipment consists of three 250 H. P., 18½ × 18 in. Armington & Sims engines, running at 200 revolutions, and three 125 H. P., 14½ × 15 in. engines of the same type running at 260 revolutions. The slow speed engines are two in number, manufactured by C. & G. Cooper & Co., of Mt. Vernon, O., of 500 H. P.



BOILER ROOM—EAST CLEVELAND RAILROAD CO.

each, cylinders 28 × 48 ins., and with a speed of seventy-two revolutions per minute. The flywheels of these engines are twenty feet in diameter, with a fifty-two inch face and weigh twenty-five tons each. The engines are fitted with a bell crank on the governor, with a movable weight by which the speed can be increased or decreased at will while the engine is running. The effect of the weight is to balance in part the influence of gravity on the governor balls, and the connections are so arranged that should the governor belt break, the steam supply will be cut off, and any tendency on the part of the engine to race will thus be prevented.

All oiling of the engines is done automatically through a series of pipes connecting with a reservoir and having branches with outlets over each oil cup. The waste oil is first put through two filters, then runs by gravity into a tank, whence it is pumped to the reservoir over the boilers, which has a capacity of about eight barrels. From this reservoir the oil runs through a settling T, which has a valve at the bottom, through which all impurities may be drawn out, and thence to every engine in the station. Small branch pipes lead to all bearings. Each pipe is fitted with a small valve by which the flow can be regulated.

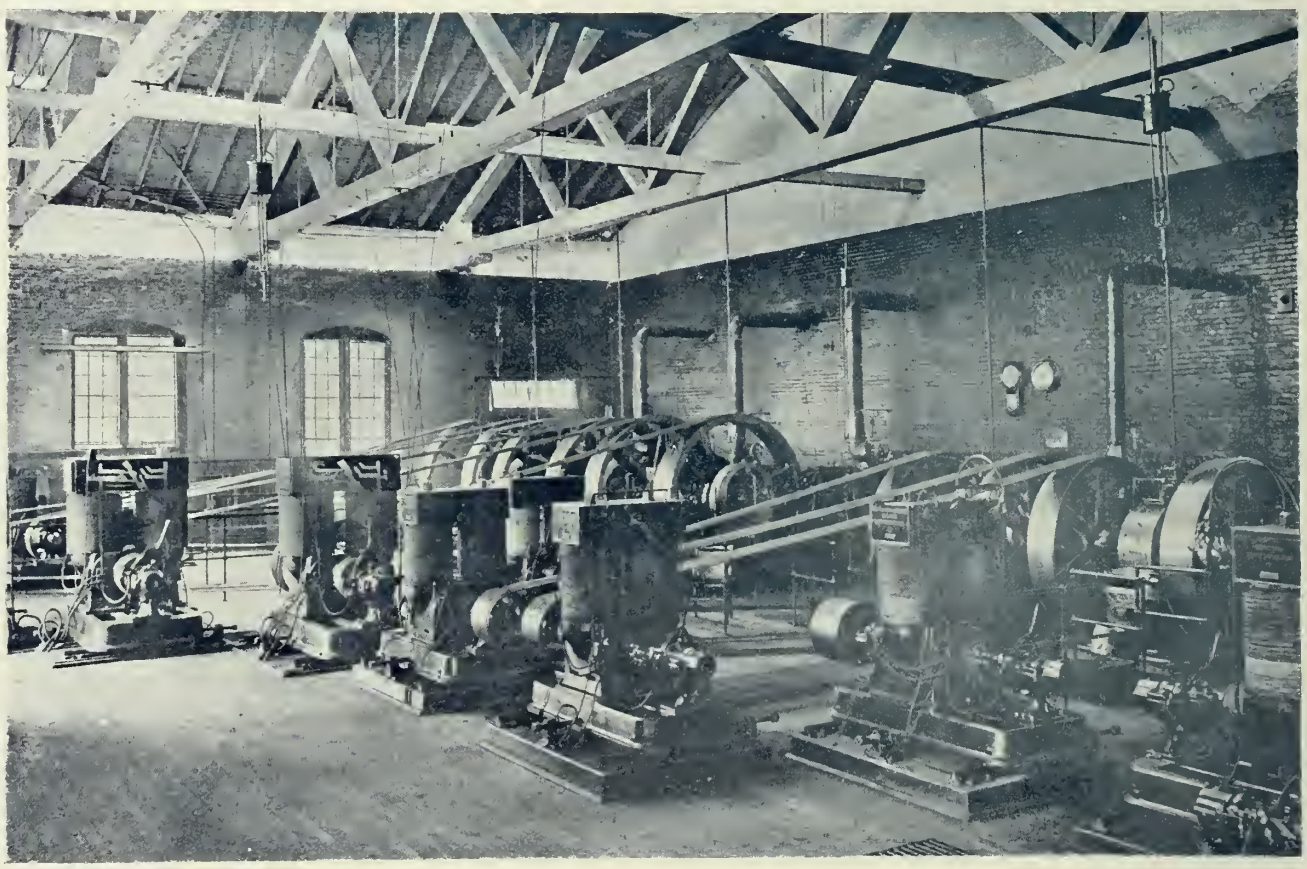
The belting, which is two-ply, was supplied by the Bodifield Belting Co., and gives good satisfaction.

The high speed engines are, of course, belted directly to the generators. The low speed engines are belted to a line shaft furnished by the Hill Clutch Works, of Cleveland, O., and consisting of four lengths, aggregating about seventy-nine feet seven inches in diameter. On this there are six 88 × 29 in. split friction clutch pulleys, so arranged that either of the two engines, which are at the ends of the shaft, can run the entire line, and there being a friction clutch cut-off coupling in the centre, each engine can run one-half separately.

The receiving pulley of the engine next to the old part of the building is on a quill or hollow sleeve, so that if the plant is extended in the future and another slow speed engine is added, it can be shut down without interfering with the running of the line shaft.

The engine nearest the observer in the view of the station interior is belted direct with a cut-off coupling between the receiving pulley and the shaft, by means of which the engine can be stopped while the shaft can be run from the other engine. The receiving pulleys are 74 × 50 ins. The shaft is supported by eleven Hill self-oiling bearings and stands.

As each generator is driven from a clutch pulley it can be stopped or started without interfering with the other machines, and as the engines are entirely independent of one another, the plant is strictly interchangeable, lessening the possibilities of a shut-down to a minimum.



POWER PLANT OF THE EAST CLEVELAND RAILROAD CO.—HIGH SPEED ENGINES.

The generators, which are sixteen in number, are all of the Edison compound wound type, and vary in size from forty to 150 K. W. capacity each. The first six generators installed were of the shunt type, but it was found that the voltage varied so greatly when these were relied upon to supply the current that a change was made to compound winding. The present machines hold the voltage within a maximum range in variation of ten volts. and give excellent satisfaction. Two more generators of the 150 K. W. size will soon be added to the station equipment.

A special device has been adopted to keep the armatures cool while running. The power station is provided with a basement six feet in the clear under the engine and dynamo rooms, and having grated windows. Laid into the generator foundations are tile pipes, four inches in diameter, the upper opening being directly under the armature while the lower end opens into the basement. The air in the latter being always cooler than in the en-

gine room, a stream of cold, dry air is insured through the tile pipes. It has been found by tests that the air in the basement is about twenty degrees below that of the engine room.



TROLLEY AND MOTOR INSPECTION ROOM—EAST CLEVELAND RAILROAD CO.

The power house, motor shops and grounds are lighted by Graves arc lamps, operated from the street railway circuit. These lamps have proved very satisfactory to the company, especially on the ground of economy of power. The company consider themselves the pioneers in lighting in this manner from a 500 volt railway circuit, having had lamps in operation about three years.

The switchboard is in the old part of the building, and is so arranged that it can be extended indefinitely as the plant grows.

Each line section, which, it might be mentioned, includes not more than three miles of double track, is provided with a fusible copper plug switch on the switchboard so that each section may be operated separately or with the others, the feed wires of all the sections being connected together at their outer ends by fuses. The fusible switches employed are of a special construction, designed by Mr. R. M. Fuller, assistant electrician of the company, and manufactured by the East Cleveland company. The peculiarity of this switch lies in the method of supporting it; it is held between a stationary post and an eccentric, at the outer end of which is a lever with a ball or weight. This arrangement compensates for any slack in the fuse wire, at all times insures a sure contact, and makes it easy to replace melted fuses. The company have always used fusible plugs, and regard them as much superior to circuit breakers. They have never had a machine damaged from overload due to short circuit on the line.

The power house is provided with the Wason lightning arresters, two of which are connected to each feed wire on entering the building. These arresters are arranged to be switched on separately, permitting the placing of new fuses at any time. The company have never had a case of damage from lightning in the power house.

The voltmeter is connected to a switch, from which the voltage of any machine can be taken, and each section of line is provided with an ammeter. All the feed wires being connected together at their outer ends, the station attendants are enabled to switch out all but two wires after one o'clock at night, when only the night cars are operated. These two feed wires are provided with a drop, which rings a large bell in case a fuse blows on any section.

The greatest loss on the longest line, which is about six miles from the power house, is never over 10 per cent., and it is the intention of the company as the number of cars increases, to put up additional feed wires, always keeping the loss within 10 per cent.

The company are furnishing two stationary motors between 200 and 300 H. P. They hope to increase this load until it approximates ideal conditions according to their point of view. A curve of the load on the station shows that a heavy demand is made for current in the morning; the curve then falls till about noon, when it rises as people take cars to go home for dinner; the curve then drops until people start homeward at night.



MOTOR REPAIR SHOP—EAST CLEVELAND RAILROAD CO.

It is found that there is practically a coincidence between the hours of greatest demand from the cars and those of minimum load from the stationary motors, and *vice versa*. If the latter demand can be increased materially the tendency would be to keep the plant working at

maximum load at all times, and thus at the point of highest efficiency.

The car shops of the company, located at Lake View, five and a half miles from the centre of the city, are exceedingly complete in arrangement. The building is brick, with a frontage of 360 ft. and a depth of 80 ft. The southern section of the building is used as an inspection department. The track running through this portion of the building forms a part of the terminal loop. The car entering the rooms runs over a pit in which an employe is stationed, who thoroughly examines the motors, and at the same time a second employe on the raised platform is enabled to inspect the trolley. When the inspection is complete, the workman in the pit moves a signal which allows the motorman to start. Stationed at different points on the loop are repair men, who watch the car as it passes them. If they detect anything requiring attention, or notice any rattling about the machinery, they jump aboard, and, being provided with tools which they carry in a belt, they proceed to remedy the fault at once.

Should a motor car require repairs of any serious character, it is switched into the repair department which is located just south of the inspection room. The room is provided with pits and with apparatus sufficiently heavy to handle the motors quickly and with ease. The car is run in over a pit, at the bottom of which a carriage, with a hydraulic jack of a capacity of ten tons, runs on a track. When the motor is lifted off by the jack it can be shifted to any desired point by means of cranes with chain hoists. Gears are removed by screw pressure, by a machine exerting a power of sixty tons, designed by J. E. Lyons, foreman of the shops. Now, as to the results accomplished in the repair shops, as a consequence of the admirable system and labor saving machinery employed, Mr. Lyons states that a motor can be taken out of a car, and the armature and intermediate bearings rebushed in an hour and a half. A motor can be taken from a car within fifteen minutes, and an armature can be substituted in eight minutes.

The machine shop is very completely equipped. Among the special tools used are four lathes, two drills and one shaper, all made by Prentice Bros. of Worcester, Mass.; a 250 ton wheel press made by the Baker Engine & Machine Co., of Geneva, O., and a bolt cutter, manufactured by the Jarlock Manufacturing Co., of Erie, Pa. Three forges are run in the blacksmith shop. The tin shop occupies a corner in the same room. The company manufacture their own headlights, and do all the general repairs on tin work. All the machinery in the plant is operated by a thirty-five horse power Sprague motor which takes current from the railway circuit.

The company make the greater number of cars used on the lines, and therefore the carpenter shop is a very complete department. During the last year twenty-five cars have been built. The south room of the building is used as a paint shop. It is the intention of the company to paint and varnish their cars at least once every year.

In the winding room five men and two boys are employed on armatures and fields.

The building is heated by steam from a boiler made by Parker & Meikle of Cleveland. It is located in the basement which extends entirely under the building and which is used for storage.

WOODLAND AVENUE & WEST SIDE STREET RAILROAD CO.

Capital stock ..... $2,000,000.
No bonds.
Miles of track
Horse 32

President, M. A. HANNA,
Vice-President, C. F. EMERY,
Secretary, J. B. HANNA,
Assistant Secretary, K. HANNA,
Treasurer, H. P. EELLS,
Superintendent, GEORGE G. MULHERN,
Assistants, A. E. DUTY and EDWIN HANNA.
Electrical Engineer, THOMAS SHEEHAN.



GEORGE G. MULHERN,
SUPERINTENDENT WOODLAND AVENUE & WEST SIDE STREET RAILROAD CO.

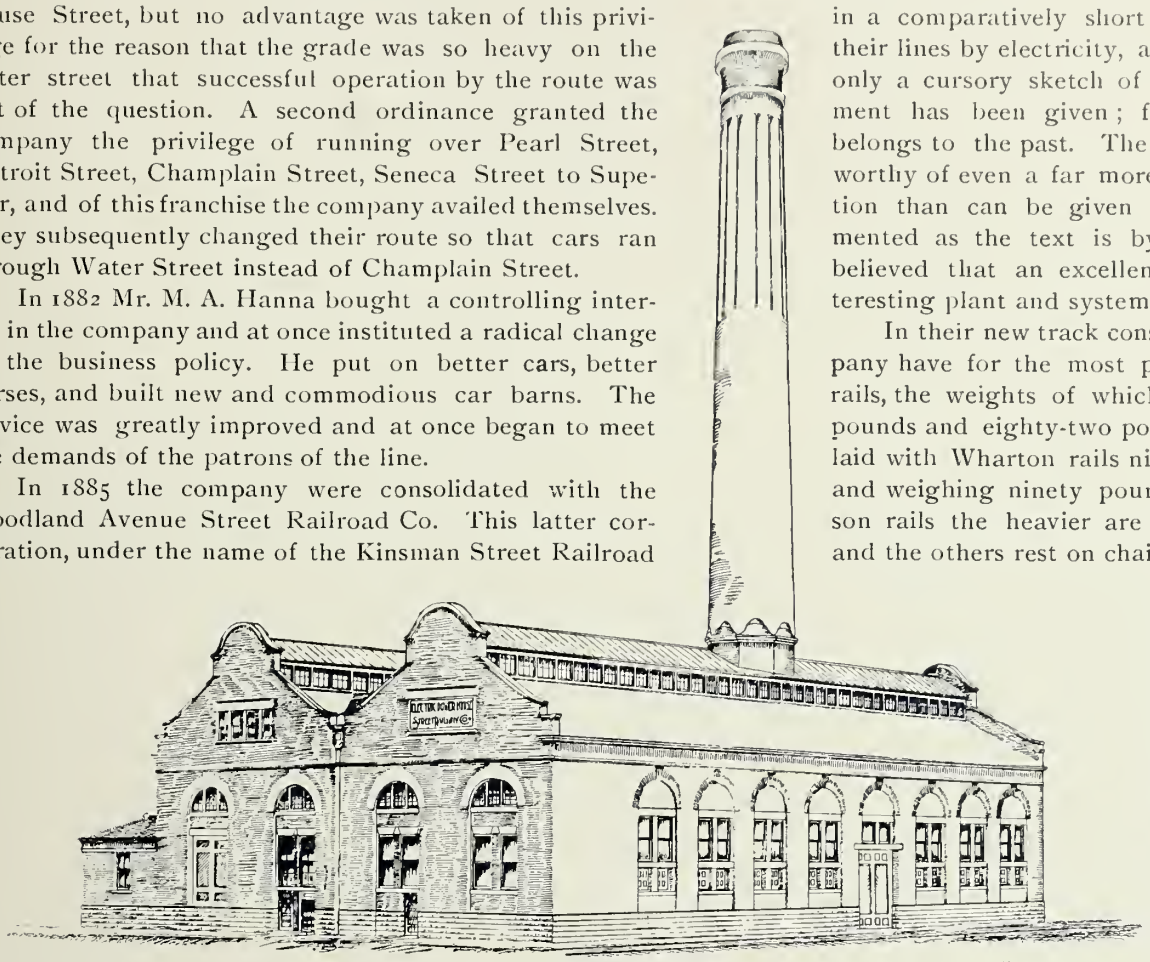
Any one who glances at the preceding table of data regarding the Woodland Avenue & West Side Street Railroad Co., is likely to draw an incorrect inference. The railway, it is true, is to-day operated by horses, but it is on the point of becoming an electric system. Had it not been for the series of unfortunate delays which seem almost inevitable accompaniments of street railway enterprises, the several lines would have been electrically operated before this time. It had been hoped by the management that operation would be begun at least before the convention of the American Street Railway Association met at Cleveland; but while this proved impossible, it is believed that a careful inspection of the plant, even in its present incomplete state, will prove to be of great interest. This is true, especially in view of the fact that the company have come rather late into the field, and their plans have been formed only after a mature examination of street railway systems throughout the country.

The Woodland Avenue & West Side Street Railroad Co. are the successors of two railway companies, each of which contributed a half of the name by which the present company are styled. The West Side Street Railroad

Co. were organized in 1866 by D. P. Rhodes. The original franchise granted the corporation gave them the right to operate over Main Street bridge and up Lighthouse Street, but no advantage was taken of this privilege for the reason that the grade was so heavy on the latter street that successful operation by the route was out of the question. A second ordinance granted the company the privilege of running over Pearl Street, Detroit Street, Champlain Street, Seneca Street to Superior, and of this franchise the company availed themselves. They subsequently changed their route so that cars ran through Water Street instead of Champlain Street.

In 1882 Mr. M. A. Hanna bought a controlling interest in the company and at once instituted a radical change in the business policy. He put on better cars, better horses, and built new and commodious car barns. The service was greatly improved and at once began to meet the demands of the patrons of the line.

In 1885 the company were consolidated with the Woodland Avenue Street Railroad Co. This latter corporation, under the name of the Kinsman Street Railroad Co., secured a charter in 1859. Their franchise gave them the right to run down Woodland Avenue—then Kinsman Street—to the Public Park and return.



EXTERIOR OF POWER STATION—WOODLAND AVENUE & WEST SIDE RAILWAY.

The officers of the consolidated company were the same as those who are now in charge: M. A. Hanna, president; J. B. Hanna, secretary, and George G. Mulhern, superintendent.

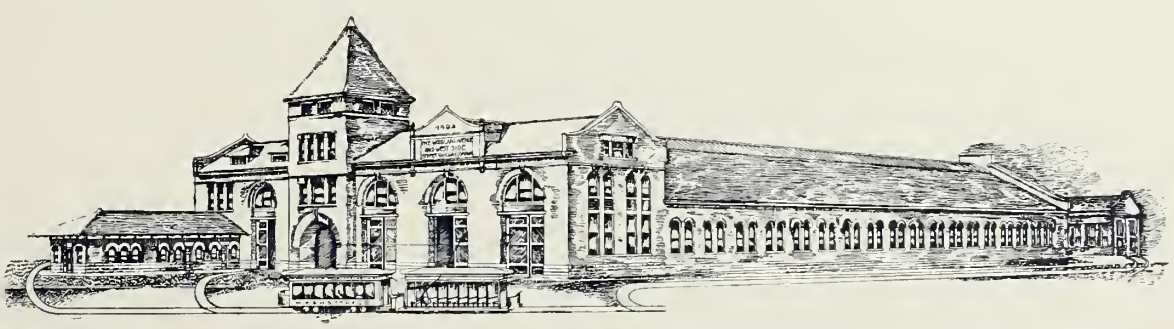
The company at present operate four horse car lines, the aggregate mileage of which is thirty-two miles. The lines are: Woodland Avenue, Pearl and Lorain Streets; Kinsman and Fulton Streets; West Madison and Franklin Avenues; Detroit Street and West Cleveland. One hundred and eighteen cars, made by the Brownell Car Co., J. M. Jones' Sons, J. G. Brill Co., Lewis & Fowler Manufacturing Co. and the operating company, are used in the service. After the installation of the electrical system, these cars will be used as trailers; only new cars will be used in connection with the motors.

The company have been using five car barns, of which four are located on the West Side, and the fifth comprises a series of buildings at Woodland and Willson Avenues.

It has been previously stated that the company will, in a comparatively short time, operate all their lines by electricity, and for this reason, only a cursory sketch of the present equipment has been given; for, practically, it belongs to the past. The new equipment is worthy of even a far more extended description than can be given here, but, supplemented as the text is by illustration, it is believed that an excellent idea of the interesting plant and system can be gained.

In their new track construction the company have for the most part used Johnson rails, the weights of which are ninety-eight pounds and eighty-two pounds. One mile is laid with Wharton rails nine inches in height and weighing ninety pounds. Of the Johnson rails the heavier are spiked to the ties, and the others rest on chairs. Oak ties 5 × 8 ins. are laid at distances of two and a half feet from centres. It has been decided to break joints, and a tie is laid within eight inches on each side of these points. Special attention has been paid to tamping, and this work has been thoroughly done. The pavement is the ordinary Medina stone.

Each rail is wired by a No. 00 galvanized iron wire, and the joints are bonded on both the inside and outside of the rail. To provide a good ground in even the driest weather, the wire is run into the soil about twelve feet at points about 1,000 ft. apart, and connection is made with sewer pipe, or a coil of wire is left in the earth, if no metallic connection is found.



NEW CAR HOUSE—WOODLAND AVENUE & WEST SIDE RAILWAY.

Side pole construction was adopted for the entire line, and metal poles will be used throughout the system. On forty-foot streets the three sections of the poles are four inches, five inches and six inches standard sizes, respectively; on the sixty-foot streets and on curves the sizes are five inches, six inches and seven inches extra heavy. The poles are treated with a coat of paint inside and outside, and the section which is to be buried receives a second

coat. Their length is twenty-eight feet, of which six feet is underground. The poles were furnished by the Electrical Construction & Supply Co.,of Pittsburgh. The pole top is that of the Railway Equipment Co., of Chicago, who furnished the entire overhead equipment with the exception of the wire, including hangers, glass insulators, etc.

The trolley wire is of the best Lake Superior copper, and the gauge is No. o B. & S. Most of the feed wire has a cross section of 500,000 circular mils. The entire wire and feeder contract was awarded to the McIntosh-Huntington Co., of Cleveland, who purchased their supply of the Western Electric Co., of Chicago. The company decided to start with forty electric cars, and the order for the bodies and trucks was given to the J. G. Brill Co. The length of the bodies will be twenty-one feet, with platforms four feet six inches, making the cars thirty feet over all. They are to be finished in mahogany with birch decorations for the ceilings. Doors at the side near the step are provided to facilitate getting in and off. Plate glass will be used in the windows and cut glass in the ventilators. The latter will be of a new design similar to those used in steam railroad coaches. Wilton carpet will cover the seats. Illumination will be provided by ten incandescent lamps, one on each platform, and four each on two chandeliers within the car.

The motors will be of the Westinghouse single reduction type. Two motors of twenty-five horse power each will operate each car.

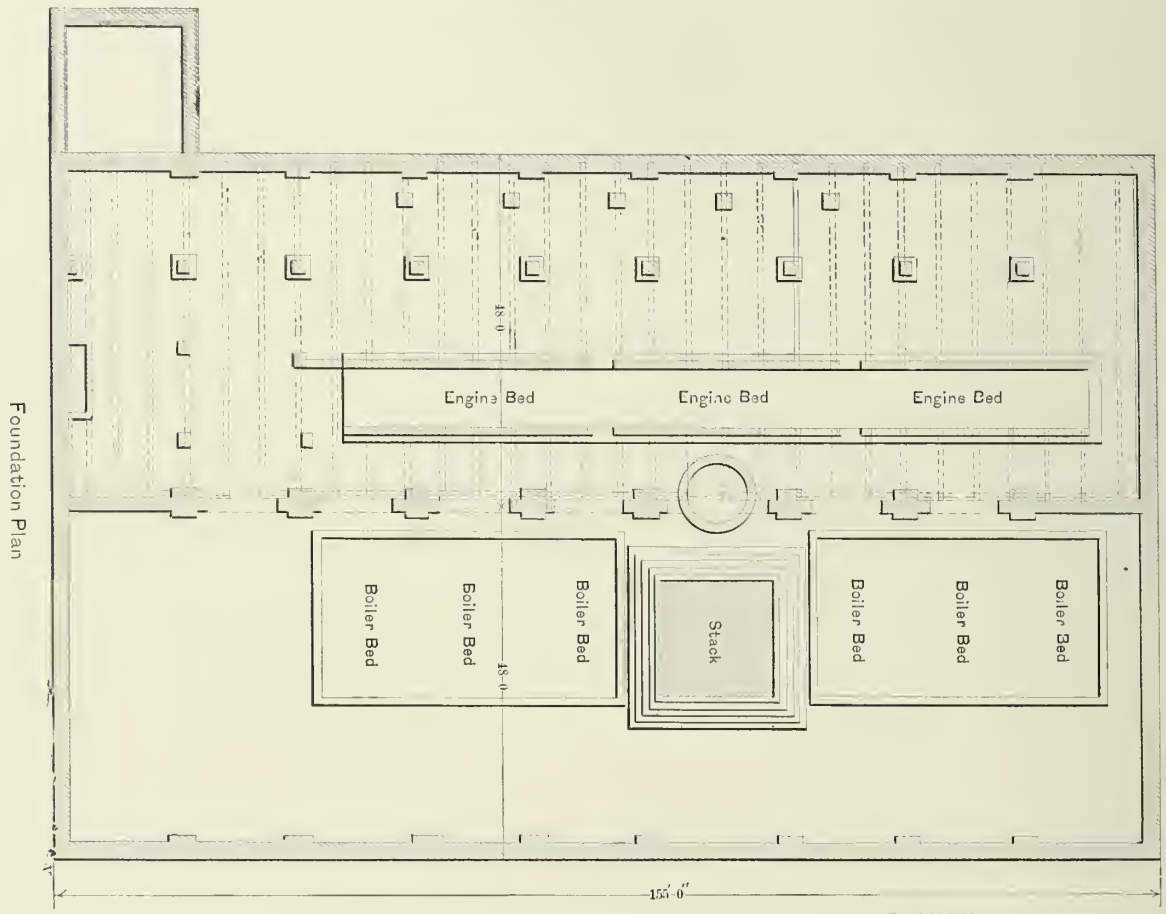
The power house embodies a number of features which render it of especial interest. In its equipment it will be unique, and its operation will be carefully watched by railway men. The management determined upon departing from the ordinary practice only after extended study, and they believe their plant will show a marked economy in working. The building is located on the the West Side, about 300 ft. from the Cuyahoga River, from which water is brought for condensing purposes in an eighteen inch main. The structure can readily be seen from the Superior Street viaduct.

The building has a frontage of 160 ft. and a depth of 140 ft. It is one story in height, and is built of brick with stone trimmings. As the illustration shows, the structure is covered by two separate roofs, one over the boiler room and the other over the engine and generator room. The smoke stack rises to a height of 175 ft., and rests on a foundation built on piles.

To provide an abundance of air, a space of five feet will be left under the flooring ; the latter will be constructed of I beams with arches of tile, and covered with cement. Steam will be generated in three boilers of the Scotch marine type, of a capacity of 500 H. P. each. The engines will be three in number, of the marine type, and triple expansion. They will run with two foot stroke and 140 revolutions, making the piston speed 560 ft.

Coupled to an extension of the engine shaft at each end will be a Westinghouse multipolar generator of 250 H. P., designed to run at 140 revolutions. The direct connection of triple expansion engine and generator has certainly not been attempted in this country heretofore, but the company are confident that the best results will be accomplished. The engines and boiler were constructed by the Globe Iron Works Co., of Cleveland. The engines were originally designed for marine service, but the company consider that they embody a number of substantial points of excellence for street railway service.

The switchboard will be a novel construction. The foundation will consist of a series of pillars on which will rest an I beam. On the latter will be laid a course of tar-



PLAN OF POWER STATION—WOODLAND AVENUE & WEST SIDE RAILWAY.

red wood from which will rise a solid brick wall forming the switchboard. The face and ends will be built of enamel brick set very close. The brickwork will be ten feet six inches in length, and will be completed by ornamental framework of antique oak, making its total length thirty-six feet. The measuring instruments, which are to be of Westinghouse type, are to be bolted through the brickwork, and connections through it will be made by means of rubber tubing.

In charge of the electrical installation is Mr. F. W. Waterman of the Westinghouse company of Pittsburgh, who has been most successful in designing much of the work, and who is responsible for a great many details which will be thoroughly appreciated when the system is in operation.

The company have built extensive new car house and shops at the corner of Lorain Avenue and Henley Street, about four miles from the downtown terminus. The structure is brick with stone trimmings, and will be complete in its arrangement and equipment. The illustrations present a perspective view of the structure which is divided into two buildings joined at the front by a tower rising to a height of seventy feet. The total depth is 372 ft. and the frontage is 160 ft. on Lorain Street. Back of the tower the shops and car house are separated by a fifteen-foot alley. The terminal loop is a track passing about the buildings and through an inspection room at the rear equipped with pits and overhead platforms for inspection purposes. The cars stop at the waiting room for passengers, shown at the left in the perspective view. The arrangement of tracks is such that cars may be readily switched at three points from the main track in front into the car house, and by a system of switches to any point in the building. They can in the same way be switched from the building at the rear. For 150 ft. at the rear of the car house, the cars are run over pits, the tracks being supported on I beams. The shops will be equipped with the most approved machinery for repair work.

CLEVELAND CITY CABLE CO.

Capital stock	$4,000,000	
Bonds	1,884,000	
		$5,884,000
Miles of Track :		
Cable	19.25	
Horse	13.	
		32.25
Number of passengers carried during the year ended June 31, 1892		7,900,000

President, Frank DeH. Robison,
Vice-President & Treasurer, John J. Shipherd,
Second Vice-President, George H. Holt,
Secretary, W. Parsons,
Assistant Secretary, G. A. Schriefer,
Superintendent, M. S. Robison.

DIRECTORS :

Frank DeH. Robison, M. S. Robison,
John J. Shipherd, George H. Holt,
Charles Hathaway, G. E. Taintor,
G. D. L'Huilier.

Over three years ago the Cleveland City Cable Co., acquired possession of the Superior Street railway and the St. Clair Street railway, both of which were operated by horses. The new company determined to introduce on a portion of their system improved transit facilities, and the work of introducing the cable on Superior Street and Payne Avenue was at once begun. These two lines, of which the aggregate length is nineteen and a quarter miles, were first operated by cable in December, 1890. The St. Clair Street line is still traversed by horse cars, but steps have been taken to equip it with electricity.

The track construction and the underground work generally for the cable system is of the most substantial character. The conduit, which is eighteen inches in depth, is made of English Portland cement and was laid up about folding cores. The cast iron yokes, weighing 365



JOHN J. SHIPHERD,
VICE-PRESIDENT CLEVELAND CITY CABLE CO.

lbs each, are placed every five feet and rest upon a foundation of concrete. The chilled carrying pulleys are sixteen inches in diameter and are spaced thirty-five feet, apart. The curve pulleys, which have removable rings with chilled grooves, are forty-two inches in diameter.

The track is laid with Wharton girder rail weighing seventy-eight pounds to the yard, the joints resting directly upon the yokes. The slot rails are of the Z type and are placed an inch higher than the track rails, so that a watershed is formed. The tracks and the space between tracks are paved with granite blocks.

The power house of the company is located on Superior Street near Madison Avenue, and the building is one of the most ornamental structures used for the purpose in the country. It is artistically built of pressed brick, with high clock tower and office front, with a smoke stack at the rear reaching a height of 150 ft. The plant was designed by the late Col. Wm. H. Paine, assisted by Robert Gillham.

Steam for the station is generated in three Babcock & Wilcox boilers of 362 H. P. each, the fuel being crude oil which is piped directly from Lima, O., to an iron reservoir in the station. The oil is delivered to the furnace in the form of a spray under a pressure of from five to eight pounds, and is combined at the burner with a jet

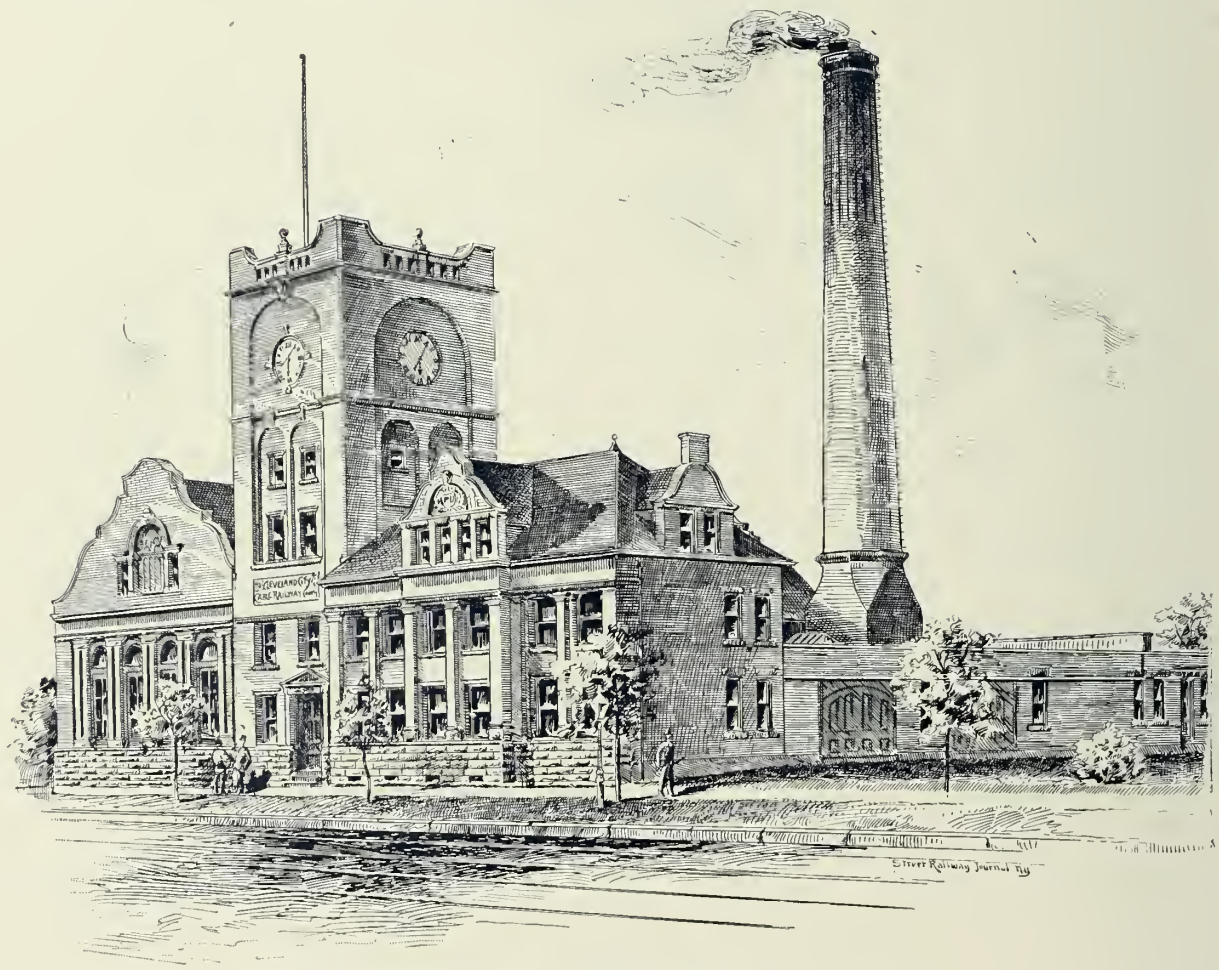
of live steam from the boilers. The oil flows by gravity from the reservoir to a small circulating pump, by means of which a portion is forced to the burners, the rest flowing back to the storage tank.

Two engines built by Wm. Wright of Newburgh, N. Y., each of 1,250 H. P. with cylinders 38×60 ins., furnish the power for driving the ropes. The flywheels are twenty-four feet in diameter and weigh sixty-five tons each. Each engine is able to carry the entire load, so that one is always held in reserve.

The main shaft is sixteen inches in diameter, and is ninety feet in length. The method of transmitting the power from this shaft to the winding drum is somewhat novel. The object of the designers of the plant was to dispense with the auxiliary shaft ordinarily used, and diminish the number of gears without sacrificing at the same time the overhanging feature for the drums. The desired end is attained by leading the main shaft between the different sets of winding drums to which, by means of pinion and gear, it transmits its power, the engines being attached at either end. The pinions on the main shaft are about five feet in diameter and twelve-inch face, engaging on either side with gears thirteen feet in diameter with the same width of face, mounted on the winding drum shafts. Each set of drums varies in diameter, depending upon the different speeds of cable required.

The plant is designed for driving six independent cables, but only four are yet in position, as shown. To provide for placing additional wraps upon the drums without cutting the cable, the main shaft is divided into sections measuring thirty feet each, which are connected together by means of coupling and steel keys. Each section terminates in a large disk, two-inch spaces being allowed between the faces. The disks are then connected by a key set into the face of each disk which is held in place by two large bolts passing through the coupling keys. In case it is required to put an additional wrap on the drums, the key is removed, and the rope passed through between the faces of the disk, when the keys are readily replaced. The whole operation may be performed in a brief period of time. The shaft is also provided with powerful friction clutches for the purpose of cutting out any set of winding drums.

The winding drums are provided with Walker differential rings, and all the winding machinery for the plant was supplied by the Walker Manufacturing Co., of Cleveland.



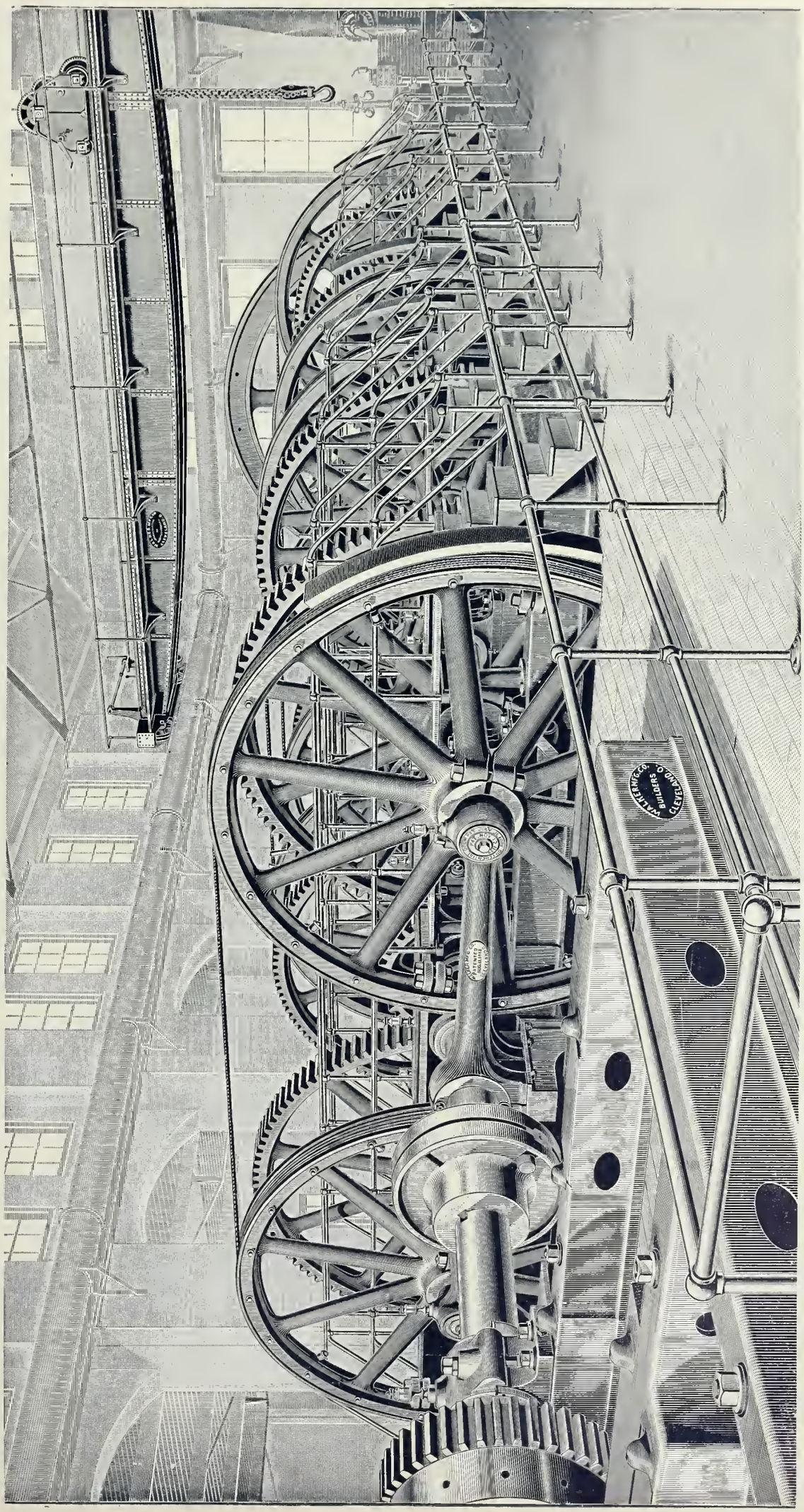
POWER STATION OF THE CLEVELAND CITY CABLE RAILWAY.

The tension carriages, four in number, are located in a well lighted room 80×100 ft., directly back of the engine room. Each carriage consists of a twelve-foot sheave mounted on a frame twenty feet long and three feet wide, which is carried on four twenty-four inch truck wheels. The track extends the entire length of the room. Each carriage is provided with a sheave drum by which it is drawn back by the pull from circular weights weighing several thousand pounds each. The latter, which are changed according to the load, are slotted so that they may be easily and quickly removed. The weights on the several lines range from 4,000 to 7,000 lbs. Provision has been made in the room so that the number of tension carriages may be increased to six.

An overhead traveling crane, capable of lifting the heaviest piece of machinery in the plant, is an interesting and desirable adjunct to the station.

One of the interesting features of the system is the auxiliary machinery located underground in Superior

Street, near the post office. An auxiliary rope, running at a speed considerably less than that of the main cable, is required for the downtown route of the line, which turns from Superior Street into Water Street. At the end of the latter street is a grade of sufficient length so that cars are switched from one track to the other by gravity. The design of the auxiliary machinery, which is similar to that of the drums of the driving plant, occupies a space below the surface about thirty by ninety feet, the street being supported by means of steel I beams with brick arches laid in cement mortar. The main Superior Street cable, at a speed of twelve miles per hour, enters the vault, thence with half wraps embraces the two twelve-foot overhanging driving drums, shown in the left of the figure, thence to an end sheave in the same vault, and by the south track tube returns to the station. The shafts of the auxiliary drums are provided with pinions four feet in diameter with ten-inch face, which engage with gear wheels ten feet in diameter having the same width of face, which are mounted on the shafts of the auxiliary driving drums which are also



INTERIOR OF POWER STATION—CLEVELAND CITY CABLE RAILWAY.

twelve feet in diameter (shown on the right), all the shafts being ten inches in diameter. The initial drum shafts are also provided with friction clutches. By this arrangement the speed of the auxiliary cable is normally six miles per hour. From the auxiliary drums the cable passes to the tension carriage, with twelve-foot horizontal sheaves mounted on an incline of twenty degrees in the same pit, but not shown in the figure. The auxiliary machinery is mounted upon cast iron girder frames resting upon brick foundations, the side section of the frames being 12 × 14 ins. and provided with adjustable pedestal boxes. All the drums are overhanging with struts.

The lengths of the four cables are as follows: Western Superior Street, 24,300 ft.; Eastern Superior Street, 23,900 ft.; auxiliary, 7,850 ft.; Western Payne Avenue, 24,050 ft.; Eastern Payne Avenue, 26,300 ft. The ropes are of the John A. Roebling's Sons Co's. make.

The Superior Street road is a straight line extending to Doan Street. The Payne Avenue line follows Superior Street for a considerable distance and then branches off to the south. The two sections of cable necessary for the Payne Avenue branch of the system, are operated from the power station, running for a distance of 2,500 ft. through two twenty-inch blind conduits made of vitrified pipe.

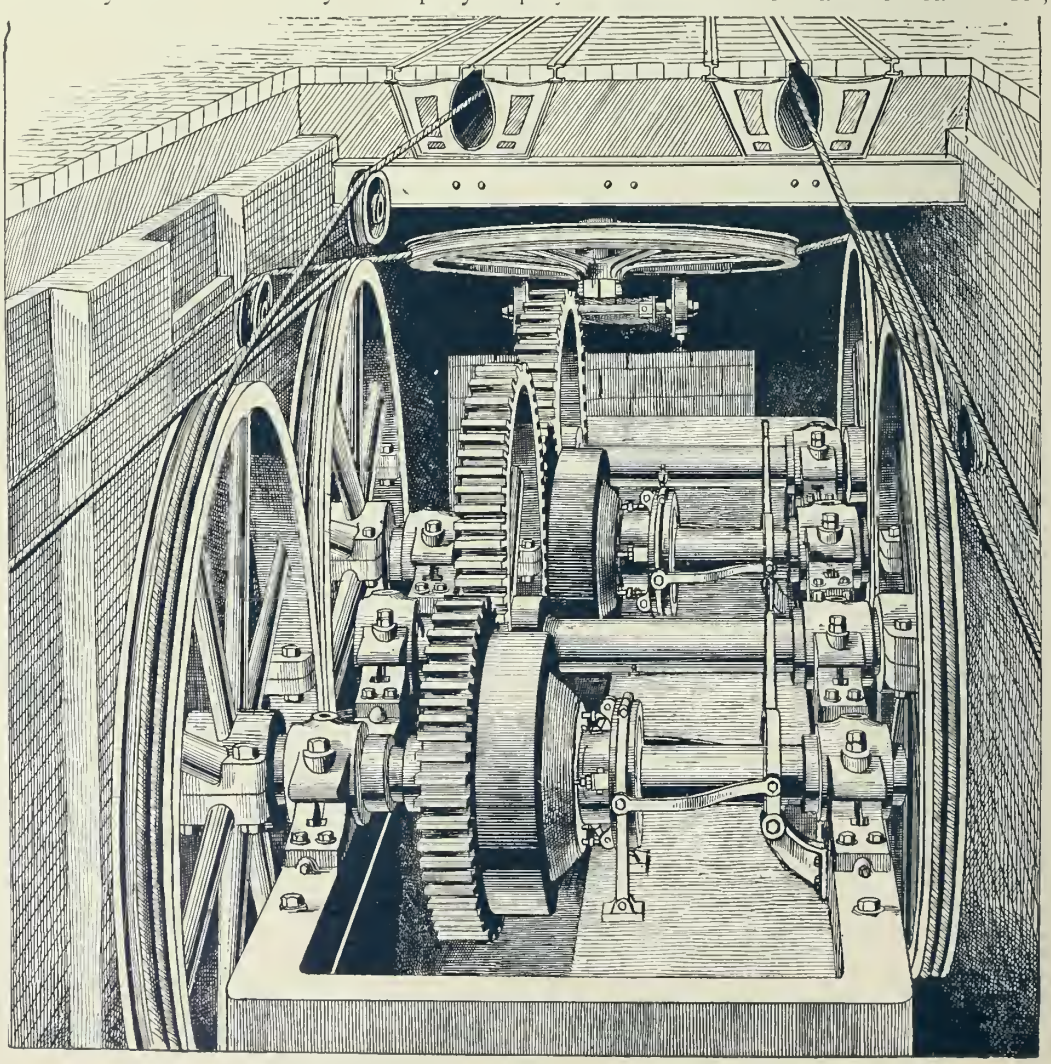


STREET SCENE DURING THE CONSTRUCTION OF THE CABLE LINES.

The main cables on Superior Street and Payne Avenue run at a speed of twelve miles per hour. The cable east of the power house runs at a speed of fourteen miles per hour.

The company own forty-seven grip cars of the Stephenson make; they are provided with a special pattern of grip designed by the late Col. William H. Payne, and with Johnson automatic brakes. The passenger cars, which are 131 in number, were manufactured by the J. G. Brill Co., and J. M. Jones' Sons. Stephenson, Dorner & Dutton, and Brill trucks support the cars.

The principal car house of the company is located at the eastern terminus of the Superior Street line. The building is a brick structure one story in height with a frontage of about 200 ft., and a slightly greater depth. Six tracks are laid within the car house, and four transfer tables, made by Alfred G. Hathaway, of Cleveland, are provided for shifting cars from one track to another. The cable company employ the transfer table in all their car houses, and thirty are used in Cleveland. When cars enter the building, when coming from the city, they are run over a



PIT MACHINERY FOR DRIVING AUXILIARY CABLE—CLEVELAND CITY CABLE RAILWAY.

cement lined pit where they are thoroughly washed and inspected. Thence the cars are shifted to the outgoing track.

BROOKLYN STREET RAILROAD CO.

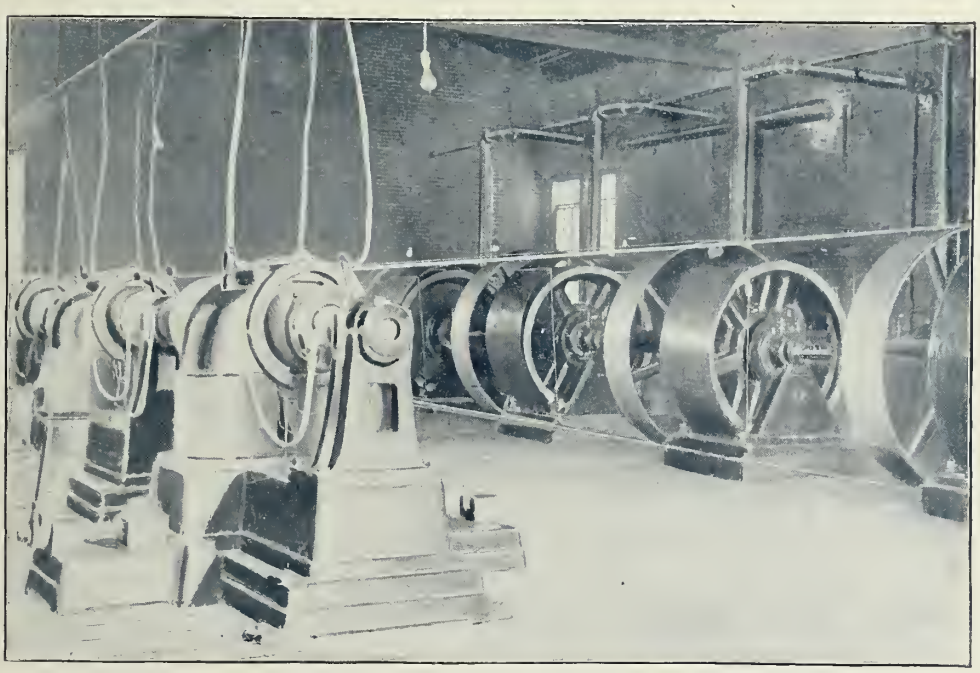
Capital stock.....$600,000
Bonds.....600,000
$1,200,000

Miles of Track :
Electric.....30

President, Tom L. Johnson,
Vice-President, A. L. Johnson,
Secretary & Treasurer, H. J. Davies,
Superintendent, Samuel Harris.

DIRECTORS :

Tom L. Johnson, John F. Whitelaw,
A. L. Johnson, W. B. Hale,
H. J. Davies, L. A. Russell,
A. I. du Pont.



SCOVILL AVENUE POWER STATION—BROOKLYN STREET RAILROAD CO.

SOUTH SIDE STREET RAILROAD CO.

Capital stock.....$300,000
Bonds.....300,000
$600,000

Miles of Track :
Electric.....10

President, A. L. Johnson,
Vice-President, Tom L. Johnson,
Secretary & Treasurer, H. J. Davies,
Superintendent, Samuel Harris.

DIRECTORS :

A. L. Johnson, H. J. Davies,
Tom L. Johnson, W. B. Hale,
John F. Whitelaw.

It will be noticed by reference to the preceding lists of officers that the Brooklyn Street Railroad and the South Side Street Railroad companies are under the same management. The two roads are practically operated as one system, and it is customary in Cleveland to consider the Brooklyn company alone as operating all the lines.

The Brooklyn Street Railroad Co., was incorporated in 1869. The company built and operated a single track horse car line from Spring Street, in the village of Brooklyn, northerly along what was then Columbus Street, now Pearl Street, to Lorain Street, in the city of Cleveland, a distance of about two miles. The incorporators were : Adam W. Poe, John S. Fish, A. Clark, B. F. Tyler and Seymour Trowbridge. In 1879, Mr. Tom L. Johnson acquired a controlling interest in the stock of the company, and steps were at once taken to extend the road from Lorain Street to the Superior Street viaduct and thence to the Public Square. The tracks in Pearl Street, between the viaduct and Lorain Street, were owned by the West Side Street Railroad Co., who refused to permit the Brooklyn company to use them. Prolonged negotiations and litigations resulted, the Brooklyn company finally securing the right to run their cars to the Public Square, paying the West Side company a rental for the use of their tracks. In the meantime, Mr. Johnson transferred his passengers at the corner of Pearl and Lorain Streets to omnibuses, and so carried them to the centre of the city. The road was subsequently extended through Scovill Avenue into the eastern part of the city, and from Scovill Avenue south on Willson Avenue and other streets to Forest City Park. The distance between the present termini of the main line of the road is about ten miles.

The South Side Street Railroad Co. was incorporated in 1872, and for years operated a road on a small scale. Bobtail cars, each drawn by a single horse, formed the rolling stock, and a six-cent fare was charged. In 1885 Mr. Johnson and his associates secured possession of the property. At present the road extends from the village of Brooklyn by way of Pearl Street, Clark Avenue, Jennings Avenue, the Central Viaduct, Ontario and Superior Streets to the centre of the city, running through one of the most desirable portions of the city. The South Side company also operate a line on Scranton Avenue and Seneca Street, two and a half miles in length.

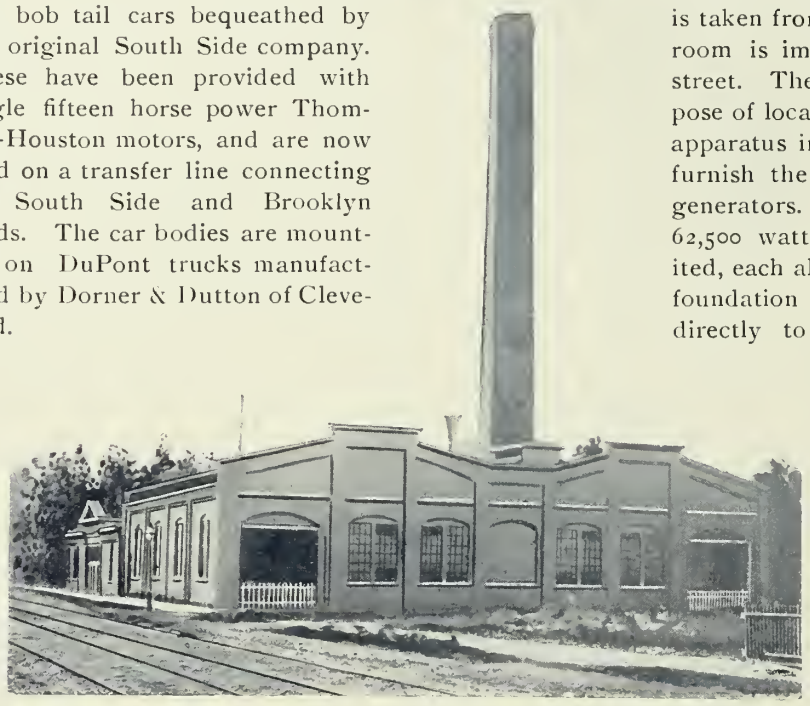
The company meet with a number of heavy grades on their lines. On the main line four grades as high as 6 per cent. are encountered. On the Scranton Avenue line there are two 8 per cent. grades extending for a distance of 1,000 ft. each. Cars running on this route are operated without trailers, and as a measure of precaution, each car is provided with a track brake of the company's own design.

In the summer and fall of 1889 the motive power for operating the cars was changed to electricity, and both systems are now electrically equipped. The track is laid with Johnson girder rail, a part weighing fifty-two pounds to the yard, and the remainder seventy-eight pounds

The lighter, which was laid for horse car service, is to be replaced by rail of a heavier weight.

The overhead system is built with side pole construction throughout. The original overhead work was done by the Thomson-Houston Electric Co., but since that time the company have done all work of this kind, and now manufacture all the appliances and devices for the overhead equipment.

The two companies own and operate seventy motor cars and ninety-two trailers. These are all of the Stephenson make with the exception of a few bob tail cars bequeathed by the original South Side company. These have been provided with single fifteen horse power Thomson-Houston motors, and are now used on a transfer line connecting the South Side and Brooklyn roads. The car bodies are mounted on DuPont trucks manufactured by Dorner & Dutton of Cleveland.



SCOVILL AVENUE STATION—BROOKLYN STREET RAILROAD CO.

Most of the motor cars are equipped with two Thomson-Houston double reduction, fifteen horse power motors. In addition, five cars are equipped with Wightman motors, one is operated by Westinghouse motors, and one by a Short gearless motor.

The companies own three power houses, one located on Pearl Street near their office, one on Canal Street near the Central Viaduct, and one at the corner of Scovill Avenue and Florence Street. Originally each of these stations supplied its own district, but at present the lines are connected together, all three plants feeding into the general network. The Scovill Street station is the most pretentious structure in appearance, as it was built specially as a power station. It was completed with the apparatus ready for use in May, 1890. The structure has a frontage of eighty-eight feet, with a depth of forty-eight feet. The smoke stack is 165 ft. in height. The steam for the station is generated in three boilers eighteen feet in length, and of 150 H. P. capacity each, made by the Variety Iron Works Co. of Cleveland. They are equipped with the Roney mechanical stoker. Slack is used as fuel. Water is taken from the city mains.

The room in which the engines and generators are located is seventy-five feet in width and forty-eight feet in depth. It is well lighted, and the plant is conveniently arranged. The 16 × 24 in. engines are five in number, and were manufactured by the Straight Line Engine Co., of Syracuse, N. Y. The engines are connected by belts, made by the Bodifield Belting Co., of Cleveland, to five Thomson-Houston generators of 62,500 watts capacity each. The switchboard, which is of the company's make, is supplied with Thomson-Houston instruments.

The largest power station of the Brooklyn company is that situated on Pearl Street adjoining the general offices. The boiler room contains five boilers of 150 H. P. each, made by the Variety Engine Works Co., of Cleveland. Butman furnaces are used with Jarvis settings. Until recently the company secured water from their artesian well, but finding that it caused a great amount of scale in the boilers, it has been discarded, and the supply is taken from the city mains. The engine and generator room is immediately in front and looks out upon the street. The machinery has been arranged with the purpose of locating as large an amount of power generating apparatus in the space as possible. Five Ball engines, furnish the power for driving the Thomson- Houston generators. The latter are ten in number, each of 62,500 watts capacity. As the space is extremely limited, each alternate machine has been placed on a raised foundation four feet in height. They are connected directly to the engines by Bodifield belts, each engine driving two machines by two flywheels.

The third station is located on Canal Street, and the equipment is similar to that employed in the Pearl Street plant. Six boilers of 150 H. P., of the Variety Iron Works Co., generate the steam. Power is supplied by seven Ball engines of 125 H. P., each of which is connected to one of seven Thomson-Houston generators by a Bodifield belt.

The companies own four car houses; one located in Brooklyn, one on Pearl Street, one at the Ciark Avenue terminus and one on Willson Avenue.

BROADWAY & NEWBURGH STREET RAILROAD CO.

Capital stock.....$1,000,000
No Bonds
Miles of track
Electric..... 26

President, Horace E. Andrews,
Vice-President and Superintendent, John J. Stanley,
Secretary and Treasurer, Dr. Edwin Fowler.

DIRECTORS:

Horace E. Andrews, Dr. Edwin Fowler,
John J. Stanley, Samuel Andrews,
Charles J. Seabrook.

The company have been operating a street railway since 1873, although the incorporation was effected some time before. The beginning of the enterprise was modest enough, for at first only four cars were run. The route which was then followed was a portion of the present Broadway line, the terminus being at Union Street. The road was subsequently extended to Newburgh, the present terminus of the road, and in 1885 the use of horses was discontinued and the Sprague electric system was installed. Twenty-five motor cars were put into service, the bodies being furnished by the J. G. Brill Co. The

Belt line, which was equipped from the first as an electric system, was put into operation in April, 1891.

The company have recently discarded the last of their light rails, and can boast of a splendid track construction throughout their entire system. All the rails are of the



JOHN J. STANLEY,
VICE-PRESIDENT BROADWAY & NEWBURGH STREET RAILROAD CO.

Johnson Co's manufacture. Twenty miles are laid with rails weighing eighty-two pounds to the yard, and the remainder is laid with the latest type of ninety-eight pound rail. The latter is spiked directly to the ties, the former resting on Johnson chairs. Oak ties measuring 5 × 8 ins. are used except at the joints, on each side of which, at a distance of about eight inches, a tie measuring 5 × 12 ins. × 7 ft. is laid. In the most recent construction the company have followed the practice of breaking joints. Prior to this the joints have been made even. As to the relative advantages of breaking joints and laying them even, the superintendent, Mr Stanley, is not prepared to express an opinion. His experience generally is that each method has its advantages and disadvantages which so nearly counterbalance each other that it is hard to express a preference. In laying the last rail during the hot weather, no allowance whatever was made for expansion, the ends being butted up snugly to each other.

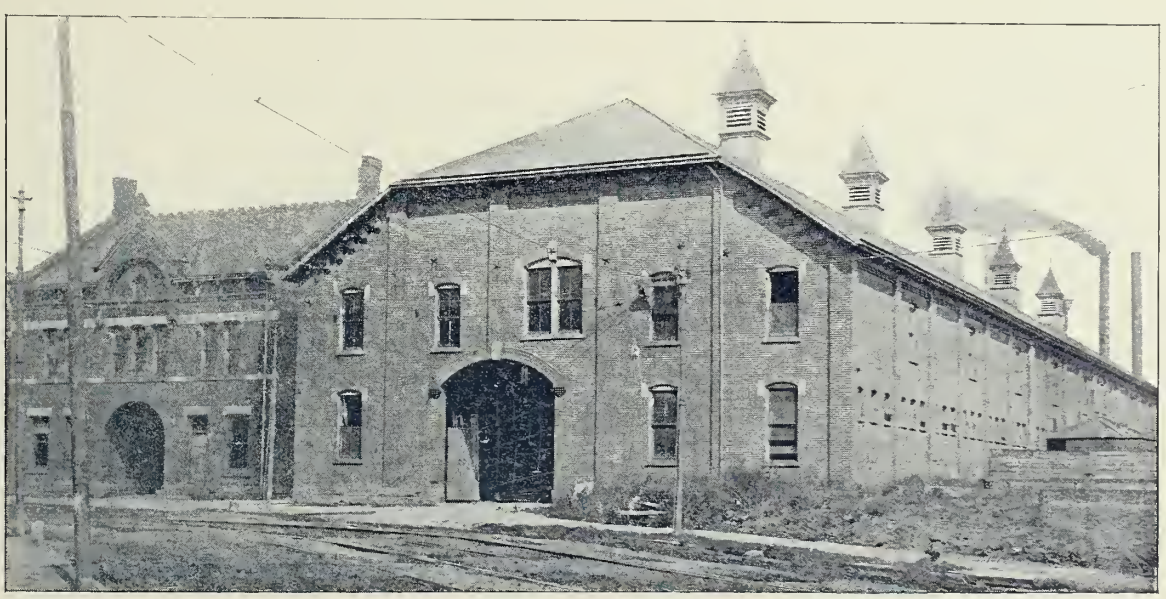
Side metal pole construction is followed throughout the system. The trolley wire is of silicon bronze, which, with all the overhead construction, was put up by the Cleveland Construction Co.

The rolling stock of the company consists of the following motor cars: Twenty five Edison (Sprague), twelve Short, of which eleven are double reduction and one single reduction, and one Westinghouse single reduction. The bodies for the motor cars were built by the J. G. Brill Co. All the cars are mounted on single Brill trucks, although twelve of the car bodies are twenty-one feet in length. The cars now used as trailers were constructed by the same company and by J. M. Jones' Sons.

The power station is located on Broadway, corner of Ætna Street, about four miles from the Public Square. The site is particularly advantageous inasmuch as it is very nearly in the centre of the system, and is in proximity to the heaviest grades which the motors are obliged to surmount. The building in which the power plant is located is a brick structure 325 ft. × 62 ft.

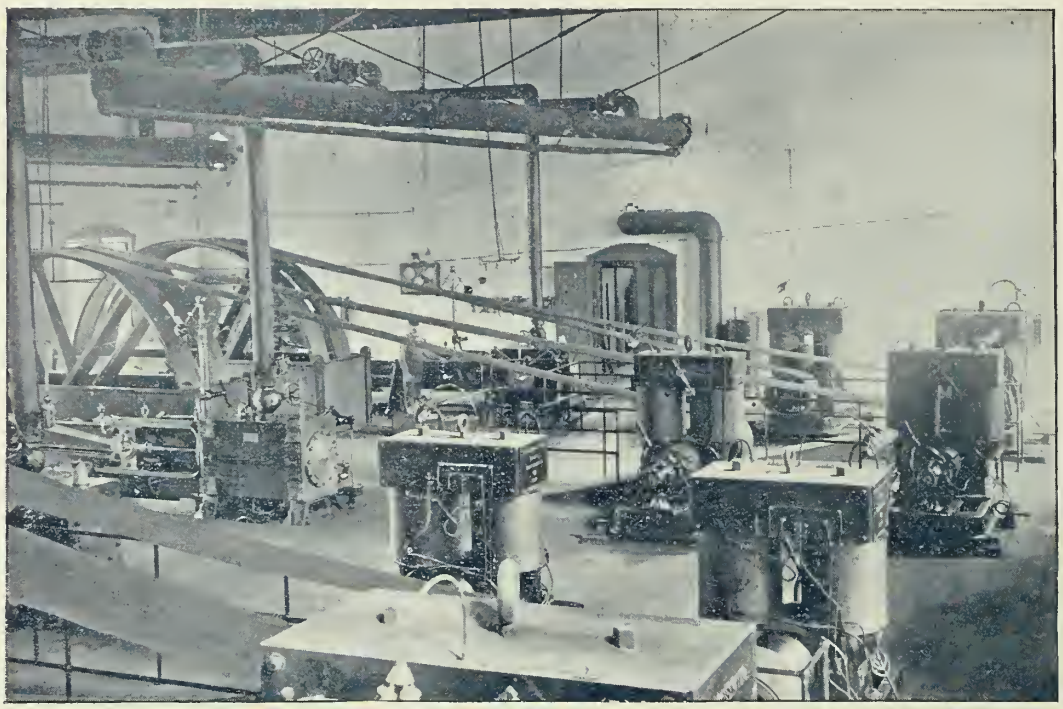
The boiler room occupies the rear section of the building, directly back of which are railroad tracks. Coal is brought to this point in cars, and is shoveled into the rear windows of the boiler room. The boilers are five in number, each of 200 H. P., and were constructed by the Variety Iron Works Co. of Cleveland.

In the adjoining section is located the engine and generator room. This part of the plant is of peculiar interest inasmuch as the four Reynolds-Corliss engines, made by the E. P. Allis Co. of Milwaukee, Wis., are belted directly to the dynamos. This method of connection is found to give excellent results, and the plant is unquestionably one of the most economical in the city. The largest of the engines is of 600 H. P., and the flywheel, which makes seventy revolutions per minute, has a diameter of twenty-four feet. The face of the flywheel is made with a double crown, and it is connected to two No. 80



GENERAL OFFICES AND POWER STATION—BROADWAY & NEWBURGH STREET RAILROAD CO.

Edison generators of a capacity of 150 K. W. each. The pulleys of the latter are thirty-six inches, and their speed about 550 revolutions.



INTERIOR OF POWER STATION—BROADWAY & NEWBURGH STREET RAILROAD CO.

The other three Allis Reynolds-Corliss engines are of 250 H. P. each, and each has double sixteen-foot flywheels, making eighty-eight revolutions per minute. They are belted to six Edison 80 K.W. generators with pulleys twenty-six inches in diameter, and have a speed of about 700 revolutions.

The belts, which are twenty-four inches in width on the larger engine and eighteen inches wide on the smaller engines, were made by the Charles Munson Belting Co. of Chicago, and the Chicago Belt Co.

Current is distributed by a handsome, marbleized slate switchboard, constructed by the W. B. Cleveland Co., of Geneva, O. It is provided with the latest forms of circuit breakers and lightning arresters of the Cleveland type. The arrangement is such that when a circuit breaker acts, the attention of the engineer is immediately called to the fact by the ringing of a gong.

The front section of the building is used for storing cars which are shifted from one track to another by means of Hathaway transfer tables.

Adjoining this structure is a large brick building, in the front of which are located the general offices of the company, back of which are store rooms and paint shop.

The principal car house is located on Miles Avenue, in Newburgh, at the terminus of the Broadway line. This structure was carefully planned to meet the requirements of the service, and it has proved highly convenient in arrangement and appointment. The structure is brick, and it serves a variety of purposes. All cars pass through it on a track forming part of the terminus loop, and this track and an adjoining one to which cars can be switched if light repairs are necessary, are provided with pits extending the entire length of the building. The cars are inspected and ordinarily are washed each trip.



CAR HOUSE—BROADWAY & NEWBURGH STREET RAILROAD CO.

Outside the building, at the rear, the loop track spreads into a number of tracks leading to the repair

shops which adjoin the car house proper. Extending the entire length of the repair department is a cement lined pit, at the bottom of which a hydraulic jack, mounted



MOTOR REPAIR SHOP—BROADWAY & NEWBURGH STREET RAILROAD CO.

on a truck, travels on a track. By means of the jack, motors can be readily lifted from under the car bodies. For lifting the car bodies, a frame with screw jacks at each corner is provided. This appliance, which was designed by Mr. John J. Stanley, has been found to be extremely servicable. Cranes and chain hoists are available for moving the motors.

The machine room is adjoining ; here are located a drill and lathe made by Strong & Turney, of Cleveland, and a fifteen horse power Sprague motor, which furnishes all the power required, taking the current from the railway circuit. In this section of the bnildiug is located the armature winders' rooms.

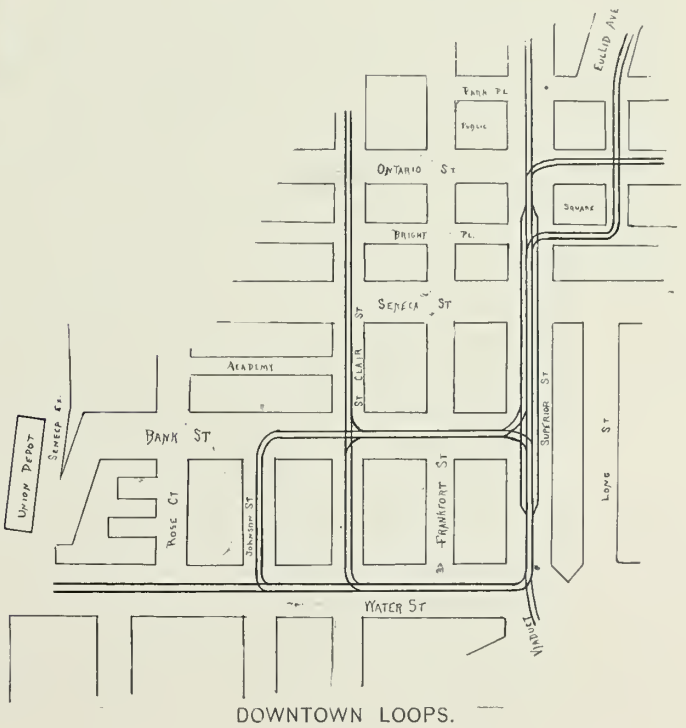
No oil is kept inside the building, but for storage purposes a small oil house has been erected in the rear of the main structure.

Superior Street and the Loops.

When Gen. Moses Cleaveland, the founder of the city ordered the original surveys, he fortunately provided Cleveland with a magnificent main thoroughfare. Stretching 120 ft. from curb to curb, Superior Street affords sufficient accommodation for vehicles of all classes. Its extreme width gave to all the railway companies an opportunity to reach the very centre of the city, although four tracks are necessary for this purpose. With this occupation of the street by cars there is still an abundance of room for other vehicles. During the busy hours of the day as many as 700 cars pass hourly a given point on Superior Street, counting those passing in each direction, so that extensive terminal facilities are required.

Of the four tracks on Superior Street, the two outer are traversed by the cars of the Brooklyn and South Side companies and the Woodland Avenue & West Side Railroad Co. The Cleveland City Cable Co., the East Cleveland Co. and the Broadway & Newburgh use the two inner tracks. All cars follow a loop with the exception of those attached to the cable, which turn from Superior Street into Water Street and make a gravity switch at the end of the latter.

There is only a single trolley wire over the tracks traversed by the electric cars, and a joint arrangement is, of course, essential. The principle is followed that each company shall use their own power as far as possible, but on the common wires the supply is provided as follows : The Brooklyn Street Railroad Co. furnish power over the two outer tracks on Superior Street, the East Cleveland company send the current from their power station to the Bank Street loop and around the southwest driveway on the Public Square. The Brooklyn company keep alive the wire through the centre of the square, and thence through Ontario Street to the Central Market House, where their own and the cars of the Broadway & Newburgh Company diverge. The East Cleveland company and the Brooklyn company own in common the poles and



DOWNTOWN LOOPS.

wires on the Bank Street loop and on Superior Street west of the Public Square.

While this is the general arrangement, the circuits are so provided by switches that the distribution scheme can be materially varied, and, in case of necessity, power from one power station can supply the entire system of loops.

Each company keep a report of the number their cars using current in this system, and settlement is effected monthly on the car mile basis.

THE SHORT ELECTRIC RAILWAY COMPANY.

SKETCHES OF ITS HISTORY, ITS MACHINERY AND THE MEN WHO MANAGE IT.

The Short Electric Railway Co. conducts one of the leading enterprises of the convention city, an industry known the world over wherever the street railway exists. Despite the present magnitude of the business, its history covers but a brief period. While it may be stated in the conventional and time honored way that the company has sprung from an extremely modest beginning, it may also



OFFICES OF THE SHORT ELECTRIC RAILWAY CO.—INTERIOR AND EXTERIOR.

be added that the date of this origin is a recent one. In brief, it may be said that the entire record is included in the present rapid transit era. The sudden rise of the company into prominence is a counterpart of the rapid development of the electric railway system, the extension of which has occasioned so many rhetorical flourishes.

Since the Short company has been actively engaged in its particular work, it has repeatedly designed apparatus of more than ordinary interest, mechanically and electrically, and the introduction of several of its machines marks the dates of radical advancement in railway motor construction. Its facilities for manufacture are to-day unsurpassed, but the spirit of improvement is still dominant, and even within the last few weeks new types of machinery have been constructed embodying changes designed to contribute to the efficiency of apparatus already regarded as wonderfully efficient. To the genius and indefatigable energy of Prof. Sidney H. Short are due the growth of the enterprise and the development of the system which bears his name; but at the same time the fact should not be forgotten that a most important contributing factor in the company's prosperity has been the active association with the Brush Electric Co. with its splendid manufacturing plant and almost unlimited facilities.

The history of the Short Electric Railway Co. began legally in July, 1889, when it was incorporated with a capital stock of $5,000,000; the preliminary steps, including the development of the railway system, are traced in the



SIDNEY HOWE SHORT.

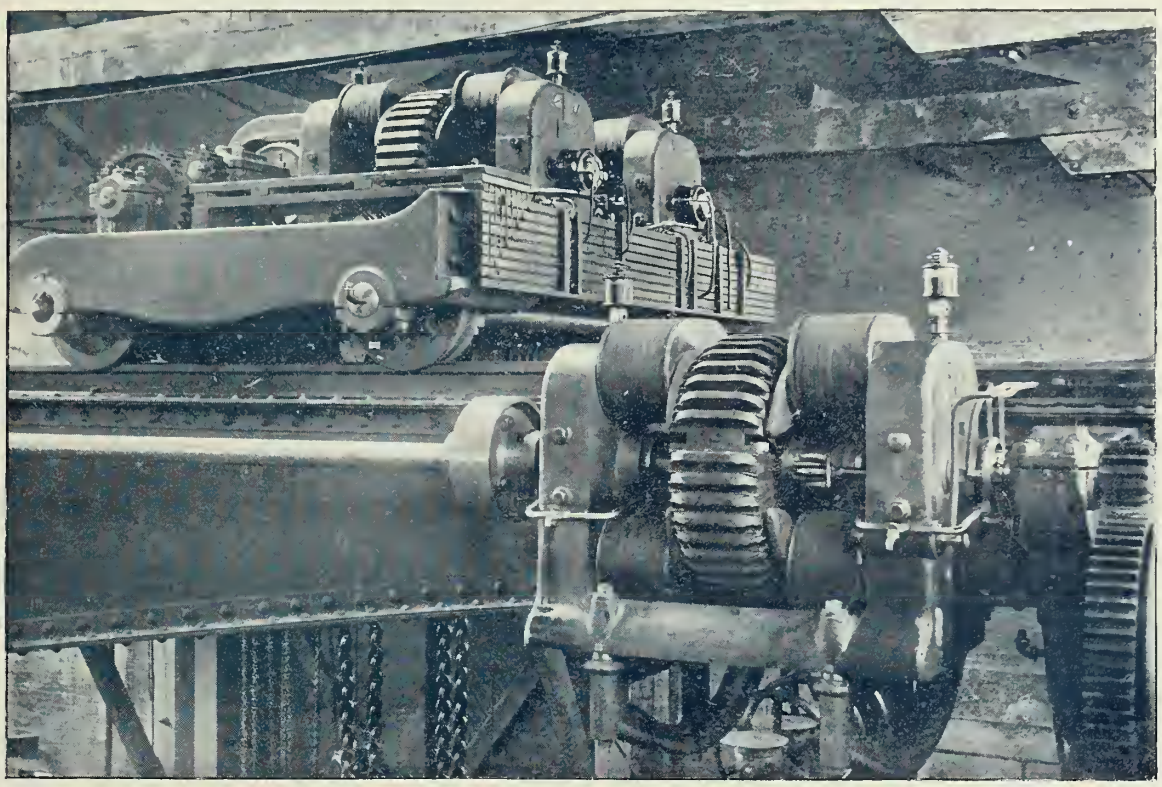
sketch of Professor Short's life, presented elsewhere in this issue. The Brush Electric Co. subscribed to a large share of the stock, and contracted to manufacture the apparatus of the new company. The time of the organization was opportune. The few electrical roads that were then considered in successful operation had attracted a much larger degree of attention than any excellence in method of construction or in electrical machinery warranted. At the same time the stockholders of horse car companies anxiously desired a change from animal power to some better form of car propulsion, and the public keenly shared in this spirit of anxiety. The almost eager willingness of street railway companies to install apparatus which they knew to be in an experimental stage only, and their adoption of every device promising to be an improvement in electrical equipment, stand in strong contrast to the reluctance, skepticism and absolute ignorance that blocked the introduction of the steam railway locomotive.

The rapid introduction of street railway apparatus, and the experience which its care and operation developed, led to greater discernment and caution in the purchase of electrical machinery. The Brush company, with Professor Short as general electrician, and manufacturing under his supervision, fixed the standard for superior workmanship and fine electrical and mechanical designing. The business of the company was at the same time well managed under the direction of Professor Short, president, J. Potter, vice-president, and Wells W. Leggett, secretary and treasurer.

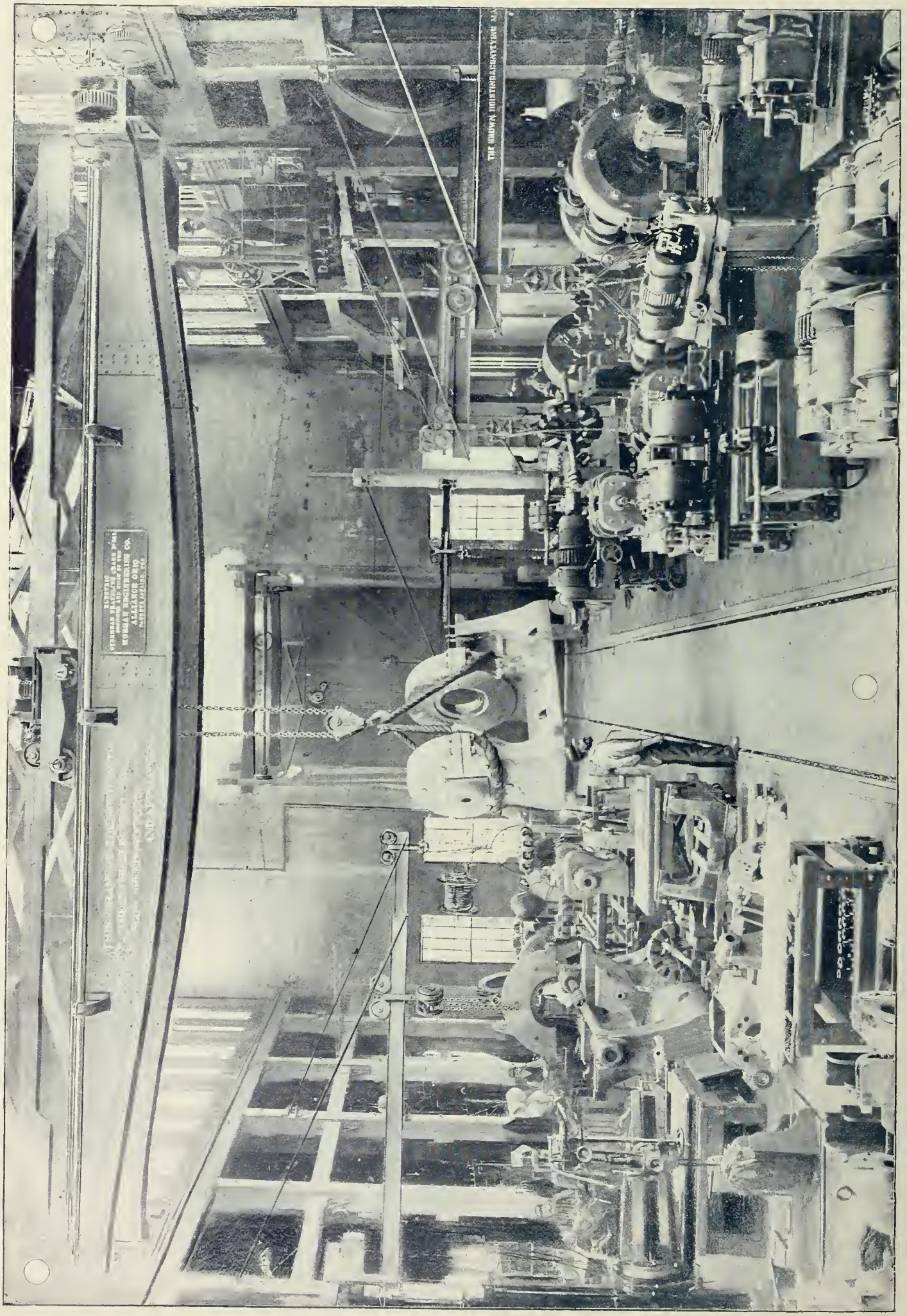
The first road built by the new company was at Muskegon, Mich., in 1889, and its successful completion was followed by the installation of the system in Pittsburgh, Cleveland, Indianapolis, Jamestown, N. Y., Johnstown, Pa., Louisville, Ky., Pottsville, Pa., and Rochester, N. Y.

Here was a business of three-quarters of a million and the results were accomplished, as some one said, "with the ridiculously small working force of the general officers and one special agent." No manufacturer of railway motors will forget the sale of the 200 motors at Rochester, which created a positive sensation, for at that time, an order for such an equipment was unprecedented. The fact was commented upon in almost every technical journal in the world, as an event of marked significance. The construction of motors for the Flower City and other localities, brought a tremendous pressure to bear upon the factory, and the facilities were found to be inadequate to the demand. Double shifts of men were arranged, and the railway department was kept in operation seven days in the week.

The motor turned out at that time was of the double reduction type, and though this is a machine practically of yesterday, it seems almost ancient in the light of present developments. But antique or not, the machine has performed its work efficiently and economically, up to the present the cost of operation being less than one cent per car-mile. Meanwhile work on the single reduction motor was quietly progressing, and the first of these machines was put into operation on the Brooklyn line in Cleveland, in midsummer, 1891. This was followed almost immediately by the first gearless machine, an original type, which was so unexpected that its introduction fairly created consternation among manufacturing companies. The motor was exhibited at the last convention of the American Street Railway Association, at Pittsburgh, where it was examined with the greatest interest by electrical engineers and street railway men. It was at first regarded with some suspicion by the electrical fraternity, but its record in operation has demonstrated that the inventor's belief in it was well founded. Its hill-climbing qualities and its ease in running were features that especially attracted attention. The first gearless motors are now in operation on the Brooklyn system in Cleveland, and the second shipment was sent to the Lindell line, in St. Louis, where the machines are in daily service.

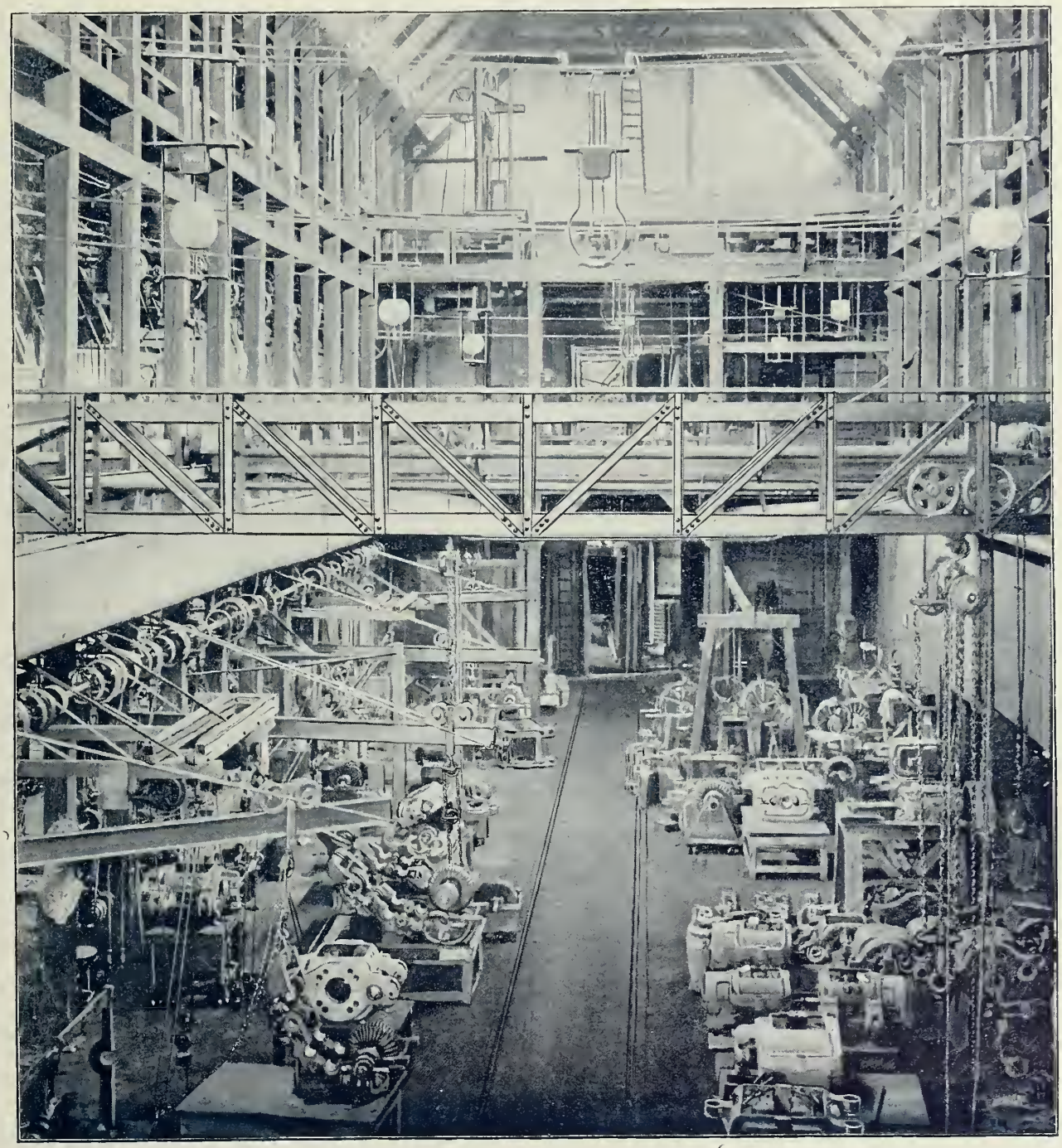


MOTORS ON THE TRAVELING CRANE.



MACHINE SHOP, SHOWING TRAVELING CRANE CARRYING FIFTY INCH GENERATOR FRAME.

The first form of gearless motor, in spite of the success which attended its operation, was not in all respects satisfactory to Professor Short, and he set to work to modify the form with the purpose of decreasing the speed and increasing the efficiency. The result is a strikingly interesting six-pole machine which will be exhibited at the coming convention. Its percentage of efficiency is the highest thus far obtained in any commercial street car motor. The gearless is pre-eminently the characteristic machine of the Short company, and under a separate caption a description of the new motor is presented in this article. The reference here is simply incidental as relating to the history of the company.



ASSEMBLING ROOM.

At the same time that the motors were being subjected to the perfecting process, the most careful attention was paid to the development of the generator. The latest types in point of construction and in efficiency in operation leave little to be desired. A prominent street railway manager some time ago remarked with emphasis that in his opinion the Short company could not make a successful generator, although the perfection of its motor was unquestioned. That belief has now been so materially modified by striking proofs that his opinion as now expressed is a fairly overwhelming endorsement of the generator.

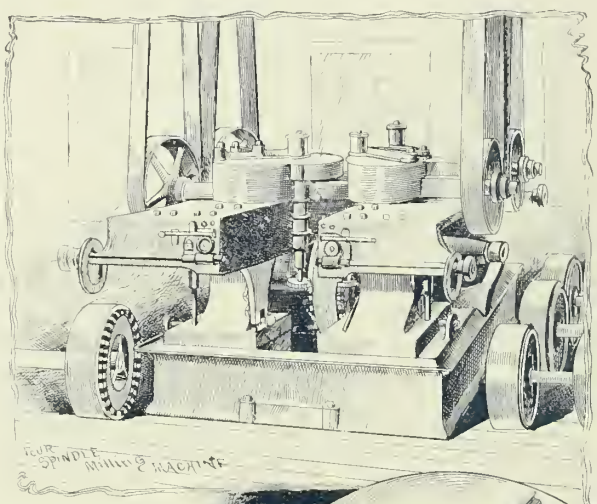
With the extension in the business of the company, there has been a corresponding increase in the working forces, and in the company as organized to-day there is represented as high financial, legal and selling ability as can be found in any corporation in the country, including Edward E. Higgins, general manager; William Hazelton, 3d., assistant general manager, and William B. Bolton, general counsel. In March last a change was made in the list of officers. Mr. J. Potter became president and assumed the active management, while Professor Short, previously president and general electrician, assumed the latter office exclusively for the Brush and Short companies.

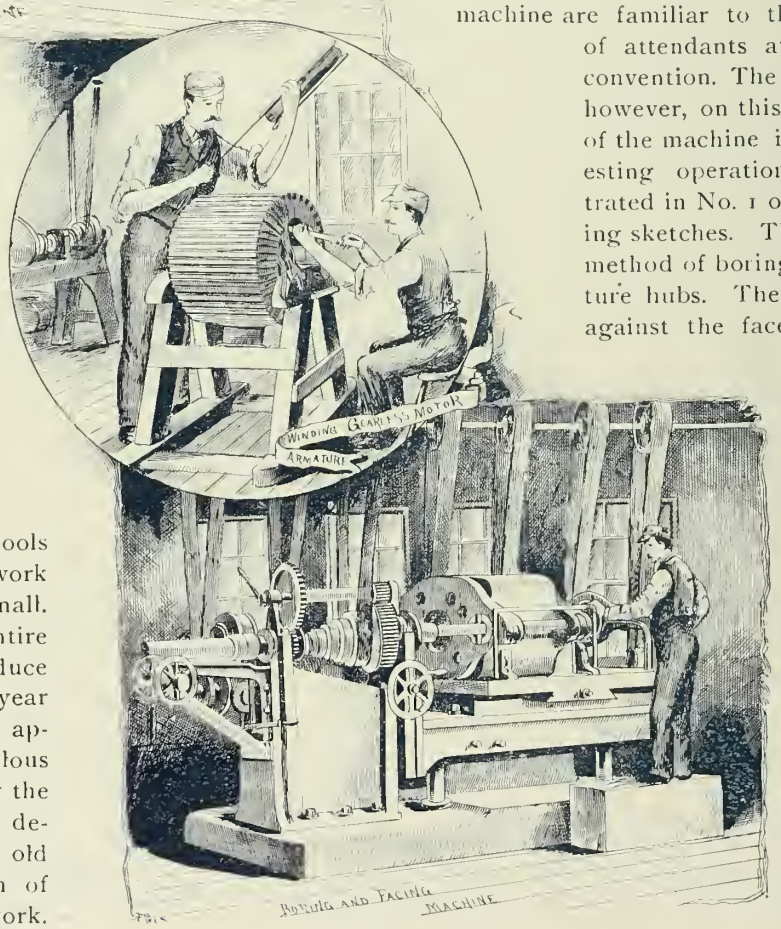
There is a constant increase in the number of roads

nsing the Short apparatus. In 1891 the number of companies aggregated twenty-five, and at the present time the total has been increased to fifty-four.

WHERE THE SHORT APPARATUS IS MANUFACTURED.

It would be a difficult task to attempt an adequate description of the plant in which the Short railway apparatus is constructed. The vastness of the works, the variety of operations, the multiplicity of special machinery, the scores of ingenious appliances, simple in operation but difficult of explanation, the nicety in the adaptation of means to ends, combine to make any detailed description profitable, or in fact practicable. It is proposed to note merely a machine here or an operation there that arrested the attention of the writer in a necessarily brief visit to the works, for any examination of the plant that is limited to days is more than superficial.





FIGS. 2, 3 AND 4.

Generally, it may be stated that when the manufacture of the Short apparatus was undertaken in the shops, the tools previously adequate for the work were found to be entirely too small. It was necessary to modify the entire machine shop and to introduce changes which have within a year and a half radically altered the appearance of the works. A marvelous improvement has been made by the introduction of tools of recent design, by the rearrangement of old machines, and by the adoption of splendid facilities for handling work.

Whoever is fortunate enough to pass the watchful guardian of the gate naturally first visits the machine shop, of which a view is presented herewith. Besides the bewildering array of machines located so closely that they almost touch each other, one is first attracted by the traveling crane which silently carries its ponderous weights from one point to another. It is related, as illustrating the noiselessness of the monster machine and the ease with which it is controlled, that an artist who visited the shop to make a sketch stood in the centre aisle wholly oblivious of his surroundings. The crane he had noticed was behind him at the end of its course. Happening to glance up he saw the chains with their burden of half a score tons directly in front of him. Startled for an instant, he realized that the operator had caused the load to make a detour about him; but as the story runs, his keen appreciation of what might have happened had not the machine made the proper turn destroyed his ability to make his sketch.

In the illustration the crane is holding aloft a casting weighing about ten tons for a fifty-inch generator designed for direct connection, which in all probability will supply current at the World's Fair next year.

The crane was built by the Morgan Engineering Co. of Alliance, O., and has a capacity of ten tons. It is equipped with three Brush slow speed motors, one of ten horse power and two of five horse power each, specially designed for the work, the complication of gearing being dispensed with.

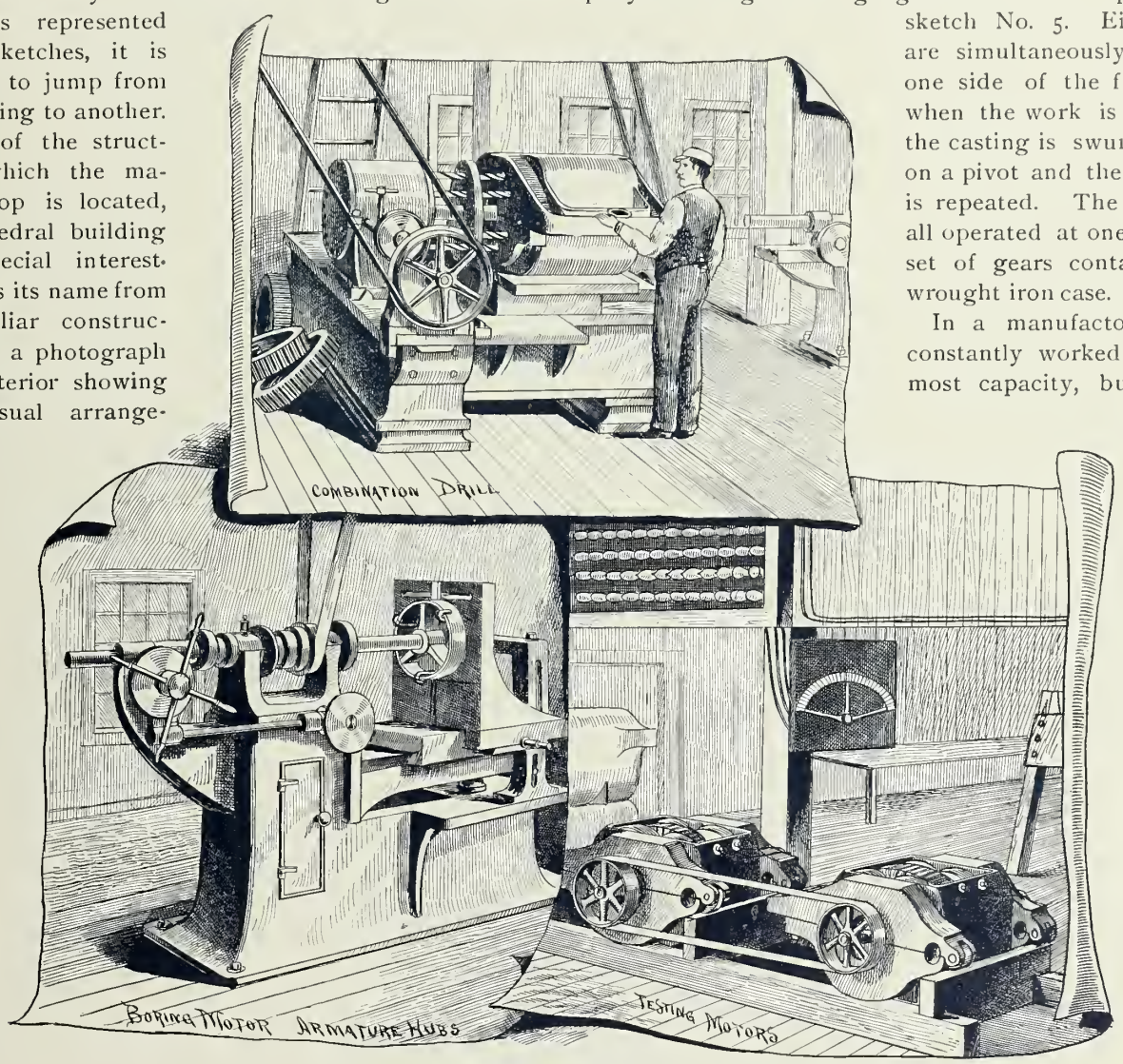
If a complete description were contemplated of the Short motor armature, a beginning might be made with the hub, but it is assumed that the characteristics of the machine are familiar to the great majority of attendants at a street railway convention. The preliminary work, however, on this fundamental part of the machine involves an interesting operation which is illustrated in No. 1 of the accompanying sketches. The view shows the method of boring or trueing armature hubs. The casting is placed against the face plate which is vertical and at right angles to the bed of the machine. It is fastened and centered by hoop bolts, its position being such that the opening for the armature shaft is turned absolutely true.

The next step is to place the hub on the mandrel of a lathe on which the periphery is turned true; then to wind on the Norway sheet iron core with tissue paper, separating the successive layers, the last eight or ten layers of iron being of extra width ; and then the core is ready for the four-spindle milling machine shown in the next sketch, No. 2.

This ingenious machine was designed especially for cutting out the slots in the armature core, and it performs its work with amazing rapidity and fidelity, while at the same time it occupies but little more floor space than a single spindle miller. In a plant that, to one unacquainted with the works, seems crowded almost to the point of confusion, compactness is a great desideratum in

any device. An inspection of the machine shows that it has four horizontal shafts, each of which is belted independently to a countershaft, and each is connected to a vertical shaft by beveled gears. Attached to each of the latter are cutters all in the same horizontal plane. The core is mounted on a shaft passing through the centre of the machine and is rigidly held. Special adjustments make it possible to mill cores of different sizes, and to insure absolute accuracy in the slots both in width and in their relation one to another.

To follow any sort of order in referring to the several operations represented in the sketches, it is necessary to jump from one building to another. Outside of the structure in which the machine shop is located, the Cathedral building is of special interest. It derives its name from its peculiar construction, and a photograph of the interior showing the unusual arrangement is reproduced herewith. Here are located the assembling and shipping departments. Considerable machine work is performed on the ground floor; while in the galleries the winding of armatures and field magnets is carried on. It is equipped with an overhead traveling crane to facilitate handling heavy machinery.



SKETCHES 1, 5 AND 6.

In the balcony can be watched an operation that at the present time is of special interest. Sketch No. 3 illustrates the winding of the armature for the new gearless motor, of which a description appears elsewhere. The armature is mounted on a temporary shaft resting on a stout wooden horse, so that it may be easily turned as the work progresses. It will be noticed at a glance that it is considerably wider than that of the original gearless, and it may be added that it is designed to present its periphery instead of the sides to the pole pieces. It has ninety-two bobbins, from each of which lead two flexibles, making 184 commutator connections.

The next sketch (No. 4) graphically tells its own story of the mode in which S. R. G. motor frames are bored and faced by a horizontal boring machine. The holes in the casting are trued for the axle and armature shaft bearings.

The holes in the motor frame through which pass the bolts for holding the field magnets, must, of necessity, be accurately drilled. To perform this operation with rapidity and exactness, *i. e.*, so that the direction of the sixteen holes may be in alignment, Mr. Hassan of the Short company has designed the gang drill shown in operation in sketch No. 5. Eight holes are simultaneously drilled in one side of the frame, and when the work is completed the casting is swung around on a pivot and the operation is repeated. The drills are all operated at one time by a set of gears contained in a wrought iron case.

In a manufactory that is constantly worked to its utmost capacity, but is still unable to meet the demands upon it, rapid methods of completing the varied necessary incidental operations are desirable, and even essential. One of these short-cut expedients is illustrated in the manner of testing motors (sketch No. 6.) Two machines are inspected at the same time by running one as a motor and connecting it to a second machine which is operated as a generator. The sketch shows the means that are employed. Both motors are mounted on a substantial framework, and attached to each armature shaft is a temporary pulley with a belt connecting the two. A switch is at hand for turning on the current which may be varied at will, while the machines can be inspected under the changing conditions. The load is carried by a bank of incandescent lamps which are found to constitute the best form of resistance.

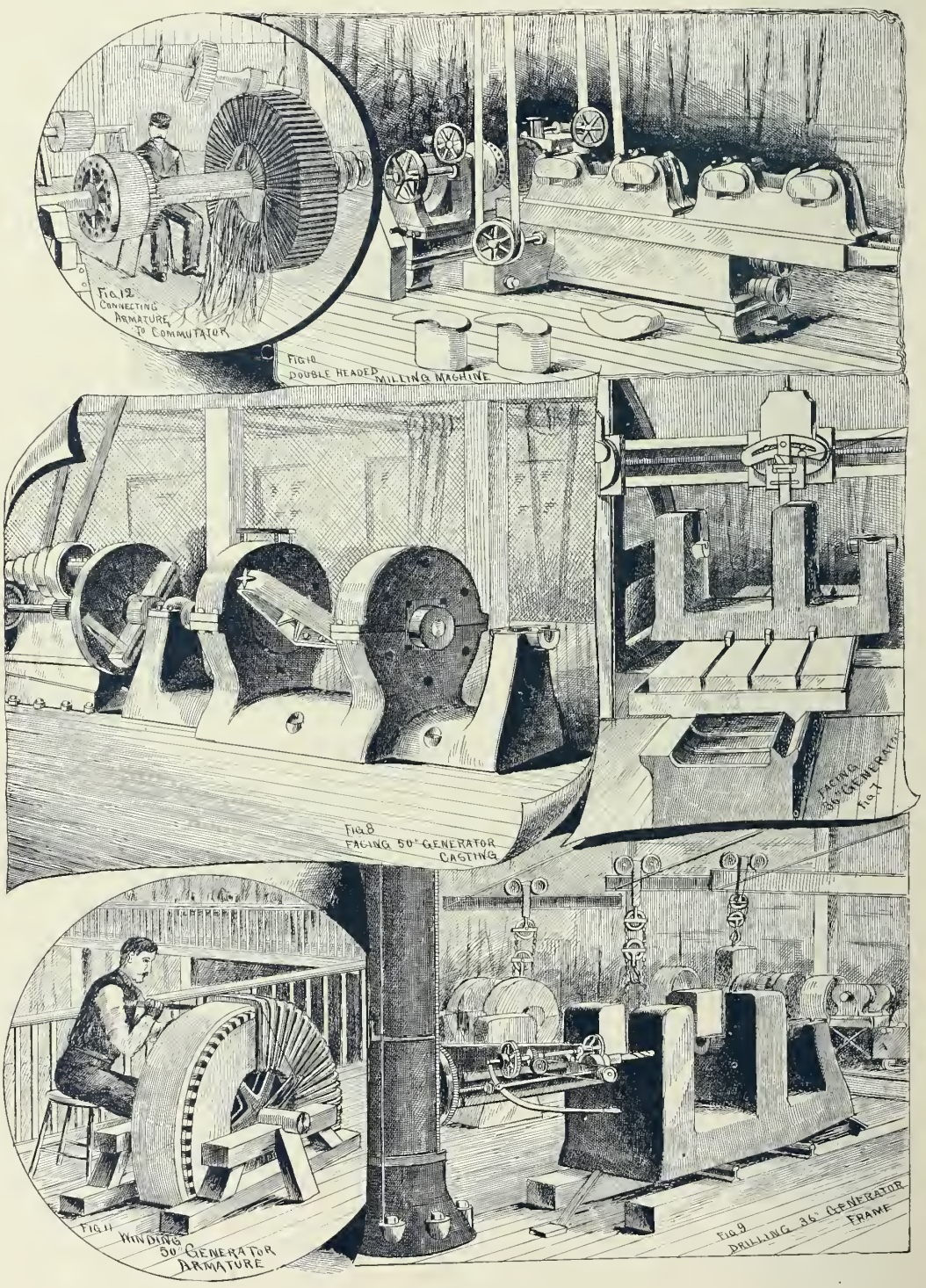
Many railway companies at the present time require large power units, and their construction by the Short company involves a series of operations that are full of

interest as illustrating the marvelous precision and accuracy of the special machinery, and the ease with which heavy work is performed. The inspection of the work here referred to, takes the visitor back to the machine shop. Until within a year and a half the largest planer in the works had a width of sixty inches. In sketch No. 7 is represented a planer just double that width, facing the inside of a thirty-six inch generator frame, so that it may present an absolutely true surface for the mounting of the field coils.

A special lathe (sketch No. 8) is available for facing the inside of the casting for the fifty-inch generator. The operation, as conducted, is interesting and somewhat unusual. The head stock is of the ordinary pattern, but it is so mounted that its inclined base may travel on a corresponding inclined foundation. It can be raised or lowered by the adjusting screws at each end of the base, so that it may be accommodated to the different sizes of generators. A shaft passing through the generator or frame is mounted on the generator bearings, and is connected by a dog to the lathe. A tool holder is mounted on the shaft, and the feed is automatically governed by a novel device. Attached to the outer end of the feed screw is a head with four projecting arms. At each revolution of the shaft one of the arms strikes against a pin on the frame, giving it a quarter turn.

There is no more interesting operation to be seen than that performed by the universal drilling machine (shown in sketch No. 9) boring a thirty-six inch generator frame for field magnet bolts. The nice methods of adjustment, the marvelous accuracy in alignment of the holes on each side of the frame—for the error must not exceed, at the very outside, one thirty-second of an inch—and the rapidity with which the work proceeds, combine to attract the visitor. The heavier castings rest in front of the machine on T rails, which are leveled, and are shifted by jack screws, the smaller generator frames are placed, when drilled, in a pit at the base of the machine.

The double headed milling machine (sketch No. 10) is of novel design, and was built expressly for facing pole pieces. In this view four thirty-six inch magnet cores are shown clamped to the bed plate, but the machine is so designed that sixteen motor magnet cores may be substituted for the four larger castings. Two cutter heads face both ends of the cores at the same time. The feed is automatic, and the machine is one of the great labor savers in the plant.

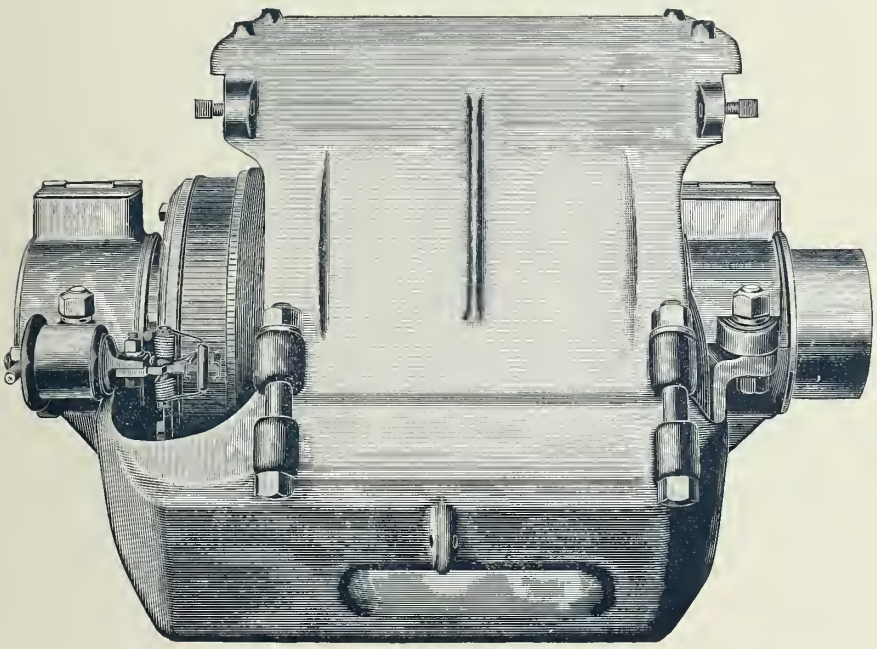


SKETCHES 7 TO 12.

When the present visit to the works was made, one of the interesting operations to be seen in the gallery in the cathedral building was the winding of the 300 H. P. generator armature (sketch No. 11). The amount of work incident to this part of the machine seemed almost endless, as every step requires the most careful and painstaking attention. Each of the 150 bobbins terminates in two flexibles, and the mode in which the latter are con-

nected to the commutator is shown in sketch No. 12. Over the armature shaft is placed a wooden sleeve which is thoroughly taped. The flexibles, which are insulated carefully, are carried across the sleeve and are soldered to wires tapped into the commutator bars. After the connections are made the flexibles are carefully taped and bound.

Made from carefully worked out designs in a manufactory with a splendid machinery equipment, it is not surprising that the Short apparatus has been successful even though many of the first steps have been taken on the unlucky day of the week. But Friday is not regarded with suspicion by the Short company; in fact a contrary view obtains, and most of the new types have been originally started on the sixth day of the week. That he might bid defiance to the popular superstition and indulge in a pet theory of his own, some one in the Short company whose identity will not be disclosed here, caused



NEW GEARLESS MOTOR—END VIEW.

the initial trial of the gearless motor to be made at 11:40 Friday night in order that it might not be postponed till the following day.

A word about Professor Short's connection with the actual work in the manufactory: At the present time his attendance in the machine shop is not so constant as a year or more ago. His apparatus has reached the point of development at which the machines no longer require his careful, constant attention. But he has been an indefatigable worker; patient and persevering, he has worked out with marked success the problems that awaited his solution. Patience and good humor were the two traits that, one of the men assured the writer, had particularly attracted his attention as characteristic of Professor Short. After attacking a problem for a long time and finally seeing his ideas assembled in concrete form, he found more than once that a workman had made a botch of some incidental part that necessitated the postponement of the test and caused the loss of valuable time. Upon such occasions as this, the informant put it, "most inventors would execute the irritated dance of an infuriated ourang-outang," but Professor Short would always laugh at the mishap and simply remark: "Try it again." Professor Short's even temperament and his willingness to work have made him wonderfully popular with the men, and at many different times they have proven themselves ready to perform services in the way of extra work at the cost of no little self sacrifice. Many a time it has been necessary to run the factory at night to rush through some special work, and the knowledge that it was for Professor Short caused the men to swallow cheerfully a large dose of overwork.

A NEW GEARLESS MOTOR.

The gearless motor is a machine peculiarly identified with the Short Electric Railway Co. It is only a little over a year ago that the first machine of this type was introduced, and while it proved under the severe conditions of actual service to be of exceptional efficiency, the inventor saw a chance for development and improvement.

The machine and the subsequent slightly modified types that quickly followed the introduction of the machine attracted such wide spread attention, and were so fully described, that a brief reference is essential in this connection only as prefatory to a description of a new gearless motor exhibited for the first time at the present convention. The original gearless was a four-pole machine flexibly mounted directly upon the car axle. The magnets were presented to the sides of the armature. As has been stated, this machine performed good work, but it was heavy and its construction was such that thirty-six inch wheels were necessary on the truck. The second type of machine was somewhat different in construction. The armature was mounted on a hollow shaft connected with the axle by means of a flexible driving device. The armature and magnets were practically the same as in the first machine, and as before, thirty-six inch wheels were necessary.

This machine was exhibited at the Pittsburgh convention of the American Street Railway Association a year ago, and was inspected with the greatest interest by railway men. In the next type the pole pieces were presented to the face of the armature instead of to the sides, and the armature was somewhat modified in form. Its face was wider, while the diameter was diminished so that thirty-three inch wheels could be used.

This brief description brings the development of the gearless up to the present latest type which is here illustrated for the first time. This motor is a six-pole machine weighing, complete, 2,300 lbs. The frame is cast from steel in two sections ; the upper half is supported by the truck ; the lower half is hinged to the upper, and may be swung down when a car is over a pit, so that inspection is rendered easy. The lower half of the frame is cast without any opening up to the level of the centre of the axle, so that the motor may run through water and slush without any possibility of their penetrating inside the frame. Practically, therefore, the machine may be considered a waterproof motor.

The armature is twenty-one inches in diameter, and, as in previous types, is mounted on a six-inch hollow shaft through which passes a four-inch axle. To the end of the armature shaft is a flexible driving device for connection with the car axle.

The diameter of the armature is sufficiently decreased

in the new type so that thirty-inch wheels may be used with a clearance of three inches between the bottom of the motor frame and the track.

As already stated, the machine has six poles which are presented to the face of the armature. The latter is built with ninety-two bobbins, with sixteen turns of wire on each, which are connected to 184 commutator bars. The armature is designed to run at 120 revolutions per minute when developing twenty horse power.

Two of these motors will exert an horizontal effort of 1,500 lbs. in starting a car with eighty amperes, and with from eighteen to twenty amperes will propel an ordinary car at a speed of about twenty miles an hour.

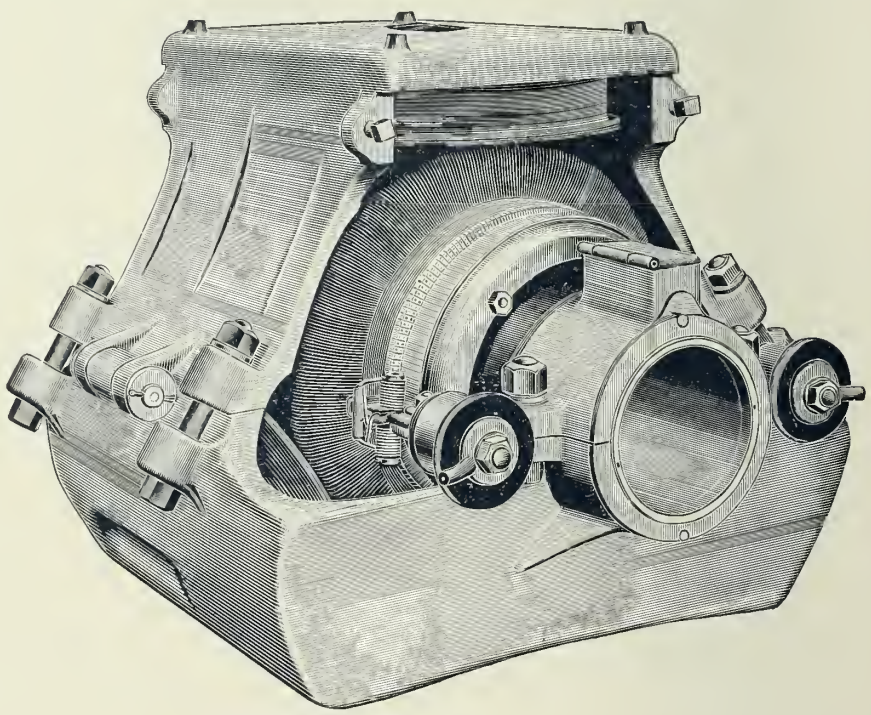
PROF. SIDNEY HOWE SHORT.

While the name of Prof. S. H. Short is familiar to everyone interested in the electric railway motor, the personal history of the man is known to but few. He is thoroughly identified with the development of a railway system whose sudden rise into popularity is the strongest proof of its excellence. He has been progressive as an inventor, as those most familiar with the development of the apparatus bearing his name best appreciate. Personally he is a worker of the most pronounced and aggressive type, and to his faithful industry and tireless patience, combined with his peculiar genius in his particular field, a great part of his marked success can be ascribed. By his associates and his employes he is held in the highest esteem, and the reason is not difficult to find. He is singularly unassuming and kindly in manner and blessed with a serviceable temper that stands the annoyances, delays and disappointments that invariably beset the inventor.

He was born in Columbus, O., in 1857, and received his early education in the public schools of that city. His first experiments in electricity commenced when he was a boy in kilts. His mother states that she found him in the yard one rainy day holding the upper part of a lightning rod away from the broken lower end, by means of a stick of wood, and watching the play of electricity across. He studied in the Capital University, and later in the Ohio State University where, after five years of study, he was graduated in 1880. His graduation was delayed one year, owing to the fact that Professor Mendenhall was called to the University of Tokio, Tokio, Japan, and that Mr. Short filled the position of laboratory director during the first year of his absence.

It is probable that his first interest in electrical matters was aroused when, a boy in the public school, he listened to Professor Mendenhall's recitations in physics. All his other school work was neglected for this pleasant pastime, and his time out of school was spent in utilizing the old wire and batteries he purchased from the Western Union Telegraph Co., and in constructing small devices with which he decorated his home; indeed all the money that he could earn by running errands was invested in material of this kind. At one time all the house clocks were connected with a device by which they could be wound at one time and from one place. This ingenious appliance lasted until a stroke of lightning ruined it and at the same time all the house clocks. A system of burglar alarms was spread through the house, which caused much excitement on several occasions, but which was never called into use from the outside. He also began working with telegraphy, because of the interest inspired by Mr. Charlie Ross, at that time the head of the Western Union Telegraph Office in Columbus, O, and from whom he obtained supplies of worn-out material. At one time he had telegraphic sounders attached to the head and foot of his bed with wires running into the room through the windows.

While attending the Centennial in 1876 he carefully examined the Bell telephone of that date, and discovered that he had already constructed in the laboratory of the Ohio State University what was practically the same device; his apparatus, however, was used merely for transmitting sound, and so far as he remembers, no attempt was ever made to transmit speech over it. On his return to Columbus from Philadelphia, he perfected and patented a long distance telephone transmitter, of which the patent was subsequently sold to the Gold Stock Telegraph Co.



NEW GEARLESS MOTOR—SIDE VIEW.

A vagrant interest in arc lamps, which at that time were coming into favor in Columbus, led to his device, (patent No. 209,625) of an arc lamp, but no use was ever made of the invention. During several summer vacations before his graduation, Mr. Short was employed in placing the electric light fixtures in the old Comstock Opera House, and also through the influence of a political friend high in authority in the State Capitol. The Opera House has since been burned, but the wiring in the State Capitol remains in use to this day.

The fascination exercised over him by Professor Mendenhall was continued in the State University, when the latter took the chair of physics. Here, in the well supplied physical and chemical laboratories he began the close and serious work of a student. Mr. Short spent almost his entire time, days, nights and Sundays, in the laboratory with Professor Mendenhall,and during the summer vacations traveled with him through the state, conducting the experiments for the lectures before teachers' in-

stitutes, which have made Professor Mendenhall one of the most popular of scientists throughout the state. The boy's ingenuity and skill in producing effects with meager appliances were shown very clearly on these trips, where his small outfit was set up and taken down in haste and adapted to the poor facilities which, at that time, were the rule, even in the best equipped schools of the state. An electric lantern and a large Grove battery were the most important pieces in his supply of apparatus. It was during one of these summer trips, when his work had been unusually severe and continuous, that the intense light from the lantern temporarily blinded the lad, and for two weeks much apprehension was felt lest his sight should be permanently impaired. This proved not to be the case, however, and he was soon busy with his work again.

After graduation, he went at the end of the summer vacation to the Denver University, of which he became vice-president and professor of physics and chemistry. He held the combined chair for two years, but by this time the work had so increased as to make it absolutely necessary for him to have assistants. Soon after reaching Denver, Mr. Short suffered from a violent attack of illness, caused by the poor water of the city. On his recovery he immediately made an analysis of the water, which, when published, threw the whole city into alarm and led to a controversy in which chemists in different parts of the United States, the city authorities, the water works' officials and public sentiment were all involved. The result was that one of the water works plants was shut down entirely, and provision was made with the utmost dispatch for an abundant supply of pure water which was obtained at some distance from the city. The prominence which he achieved during this controversy led to a great deal of chemical work during the next two or three years. He analyzed stomachs for traces of strychnine, soil for traces of silver, iron or gold, and as a result of these studies discovered on the plains just outside of the foothills and near Morrison, Colo., materials suitable for a cement of superior quality and higher grade than the celebrated "Portland." A company was immediately organized, and the work of manufacturing began. Almost the entire output of the works was sold to the Denver & Rio Grande Railway Co., which has since purchased the entire plant and is conducting the manufacture. Mr. Short also analyzed materials for glass, at the instance of a large company prepared to begin the manufacture of glass in or near Denver. This project never materialized, as the railway companies threatened to haul glass from the East free of charge rather than allow a rival plant to be established in the West.

He resigned the chair of chemistry in the Denver University in 1883. By a special arrangement with the Board of Trustees, his time during the years when he taught in the University was his own for personal work after three o'clock every afternoon; hence it was that while he was still in the University he had worked up his plan for an electric railway, building his first road—a single track with turn-outs—in the large basement room of the University building. This road was put in operation in the spring of 1885, and by its novelty attracted many visitors. It is safe to say that hundreds of people in Denver went round and round the old basement of the University on the crude car, which was set up over these first Short motors. Mr. Short wound both the motors and the dynamo in the laboratory, doing the work himself.

In 1885 his interest in practical electric railway work, and his confidence that he could succeed in it were strong enough to induce him to resign his position in the University. He immediately went to work on a surface road, conduit system, on Tremont Street. His next work was to lay an electric line built with a conduit on Fifteenth Street, running to Capitol Hill in one direction and across to North Denver in the other. This road, despite the almost insuperable obstacles in the way of operating a conduit system, was operated with series motors with some success for several months by the United States Electric Co., now the Denver Tramway Co. The power house, fitted up in temporary and inexpensive fashion, was on Fifteenth Street, at about the middle of the line. The success of series motors in connection with the conduit system, while encouraging to Mr. Short as an electrician, was not of sufficient importance to induce him to remain in Denver. In 1887, he returned to Columbus, O., and entered into partnership with N. B. Abbott, of the Abbott Paving Co., one of the most successful and best known business men in the state, the firm name being S. H. Short & Co. The first work of the firm was to construct a short line, two and a half miles in length, from the North High Street Railway to the Fair Grounds. On this line the overhead system was used with series motors and practically the same appliances that had been used in Denver. Leaving this road partially completed, Mr. Short went to St. Louis, Mo., in 1888, and constructed a line—an overhead series system—on South Broadway, which, although operated for more than a year with great success, was displaced to make room for an extended cable system. In June, 1889, he made Cleveland his home, where he organized the company which now bears his name, the Brush Electric Co., taking a large share of the stock, and contracting to do the manufacturing. Of Mr. Short's work in his present position an outline has been presented in the sketch of the Short company and, therefore, is omitted here.

He is a fellow in the American Society for the Advancement of Science, has the title of B. S. from his Alma Mater, belongs to the Cleveland Electric and Union and Country Clubs, and is a member of the Electrical Commission of the World's Fair.

J. POTTER.

Mr. J. Potter is president of the Short Electric Railway Co. and treasurer of the Brush Electric Co. He is a native of the state of Ohio, and son of the Rev. Dr. L. D. Potter, of Glendale, near Cincinnati, a man widely known in educational circles throughout the country. He was graduated with honors from Princeton College in 1877, and later received the degree of M. A. from the same institution. He had a strong taste for the natural sciences, and was selected by competitive examinations as a member of the scientific expedition sent out by Princeton Museum in 1877. For several years he was master in the noted Lawrenceville school, and subsequently read law, but was not admitted to the bar as he had determined to engage in commercial affairs. He became identified with the electrical industry in the fall of 1881, when he made an engagement with the Brush Electric Co., of Cleveland, to take charge of its business in Japan, China and other oriental countries. After several months of practical preparation in the Cleveland factories and Mr. Brush's laboratory, he sailed from San Francisco for Japan in April,

1882. Although several English companies had endeavored to get a foothold in the Orient, Mr. Potter was, in fact, the pioneer of the electrical industry in that part of the



J. POTTER,
PRESIDENT SHORT ELECTRIC RAILWAY CO.

world. He made his residence in Yokohama, and within a year had built up a large and lucrative business. He made large contracts with the Japanese government for lighting docks, arsenals, etc., and established the first central station electric lighting plants in Japan and China. In 1884 he was recalled to take the office of treasurer of the



EDWARD E. HIGGINS,
GENERAL MANAGER SHORT ELECTRIC RAILWAY CO.

Brush Electric Co. Shortly after his return he was elected director of the company. Mr. Potter was one of the incorporators of the Short Electric Railway Co., and became a director and vice-president. About six months ago he was chosen president of that company. Mr. Potter manages the financial affairs of both the Short and Brush companies. Although a young man, he belongs to that small number of men who have been engaged in the electrical field from the beginning, and his name and face are familiar to almost all those engaged in electrical enterprises. He has been unusually successful as a financier, and is well known in financial circles in New York and Cleveland.

EDWARD E. HIGGINS.

Edward E. Higgins, the general manager of the Short Electric Railway Co., was born in Chelsea, Mass., in 1864. He attended the public schools of that place, and subsequently entered the Massachusetts Institute of Technology, from which he was graduated. He was connected with the Standard Electric Co., of Vermont, and left the position of assistant electrician to become the New York State agent of the Sprague Electric Railway Co., in 1888. Subsequently he was special agent of the railway department of the Edison company and resigned to accept the



WILLIAM HAZELTON, 3D.,
ASSISTANT GENERAL MANAGER SHORT ELECTRIC RAILWAY CO.

managership of the Short Electric Railway Co. Mr. Higgins has been for some time in Europe. He is a member of the New York, Buffalo and Cleveland Electric Clubs and of the Union League Club, of Cleveland.

WILLIAM HAZELTON 3d.

William Hazelton, 3d, is the assistant general manager of the Short Electric Railway Co. He is thirty-three years of age and was born in Philadelphia. He was educated at Swarthmore College, and was prepared for entrance to the Naval Academy at Annapolis, but decided to follow a business life. He was first identified with the electrical industry at the time the Sprague Electric Railway Co. was organized. The firm of Chadbourne, Hazelton & Co., of Philadelphia, represented that company in Pennsylvania, and made a splendid reputation in securing contracts. Subsequently this firm took hold of the Wenstrom motor, and later the partnership was dissolved. Mr. Hazelton accepted a position with the Short com-

pany, first representing the company in Pennsylvania. Subsequently he moved to Cleveland to accept the office that he now holds. He is a member of the Union League of Philadelphia, the Electric Club of New York, and the Cleveland Athletic Club.

S. M. HAMILL.

Mr. S. M. Hamill is the secretary and general manager of the Brush Electric Co. He was born in Lawrence-



S. M. HAMILL,
SECRETARY AND GENERAL MANAGER BRUSH ELECTRIC CO.

ville, N. J., and prepared for Princeton in the well known school in that place. He was graduated with the degree of B. A. by Princeton in the term of 1880, and since that time has received the degree of M. A. After leaving college he taught for three years in the Lawrenceville school, during a portion of which time he studied law. Having a desire for active business pursuits, and determined to go to work, he secured, in 1884, a position as clerk on the freight platform of the Chicago, Burlington & Quincy Railway Co., in East St. Louis, and subsequently became private secretary to the agent, clerk in the paymaster's office, and in the first vice-president's office in Chicago. In 1886 he was in charge of the large grain elevators owned by the Chicago, Burlington & Quincy Railway Co., in Peoria, Ill., from which place he went to Cleveland to accept the position of assistant secretary of the Brush Electric Co. Three years later he was elected secretary and moved to New York City and assumed charge of the general Eastern business of the company. At the last annual meeting of the company he was elected a director, secretary and general manager. Mr. Hamill is also president or secretary and director in a number of local electric light companies, and at present receiver of an electric company in Pittsburgh, Pa. While in Princeton he was one of the founders of the Ivy Club, and is a member of the Electric and University Clubs of New York, and of the Electric and Union and Country Clubs, of Cleveland.

FRED. A. SCHEFFLER.

Fred. A. Scheffler, the superintendent of the works of the Brush Electric Co., was born at Galion, O., December 20, 1858. The family removed to Paterson, N. J., when he was quite young, and he lived in that city until he was sixteen years of age. After graduating from the Paterson Seminary, he was engaged as a draughtsman in the repair shops of the Long Island Railroad shops at Hunter's Point, where he remained two and a half years. During the following years, until 1881, he was employed by the Rhode Island Locomotive Works, Brown & Sharpe Manufacturing Co., Harris-Corliss Engine Co., and James Beggs & Co., of New York. Mr. Scheffler entered the electrical field in 1881, accepting a position in the engineering branch of the isolated department of the Edison Electric Co., then at 65 Fifth Avenue. While in this capacity, he designed the mechanical part of the second electric locomotive built by Mr. Edison for his experimental work at Menlo Park. After four and a half years' service with the Edison company, Mr. Scheffler accepted the position of superintendent of the Erie City Iron Works. Six years later he was called to Pittsburgh, where he was acting superintendent of the Westinghouse Electric Co., until 1890, when he accepted the position he now holds.

REPRESENTATIVES.

No small share of the success of the Short Electric Railway Co. is due to the energetic efforts of its representatives. Among this number are: E. J. Wessels, general Eastern agent, New York; C. C. Curtiss, special agent, Cleveland; Frank A. Rogers, Cleveland.

BRUSH ELECTRIC CO.

In the sketch of the history of the Short Electric Railway Co., and in the description of the manufacture of

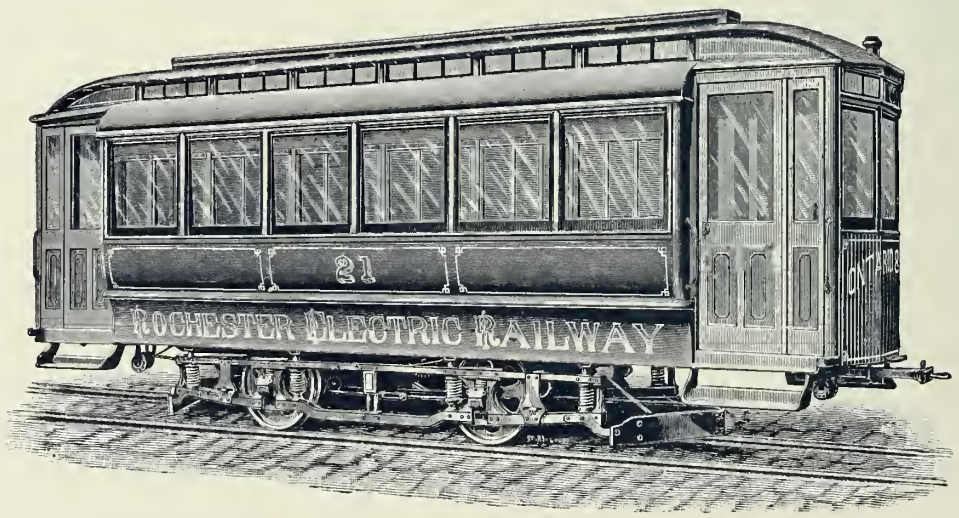


FRED. A. SCHEFFLER,
SUPERINTENDENT BRUSH ELECTRIC CO.

its apparatus, much has been written that might very properly be included in any reference to the Brush Electric Co. As it has already been stated, the latter corporation is largely interested in the Short company, and in its splendid plant the railway apparatus is constructed. The Brush Electric Co. is one of the pioneers in the electrical work, and the growth of its plant is a striking illustration

of the wonderful development of the electrical business. Although a pioneer, the history of the company does not extend farther back than 1876, when an electrical business was established by the Telegraph Supply Co. When Charles F. Brush became interested in the company, and when it was proposed to manufacture apparatus in accordance with his splendid inventions, a different corporation name was necessary, and a much greater capitalization was essential. In 1880, the name was changed to the Brush Electric Co., with a capital of $3,000,000. George W. Stockly and Mr. Brush were the controlling spirits in the enterprise, and the former, until a comparatively recent date, was the president of the company. During the brief period since the company was formed, it has performed a large share of the work incident to revolutionizing the artificial illumination of the world. It has built up a business, in whose branches over $25,000,000 is invested, and its lights are shining in almost every large city in the United States and Canada, throughout Europe, in South America, China, Africa, Madagascar, New Zealand, Australia, India; in fact, where are Brush lamps not to be found?

In the reference to the Short company, a general description of the manufactory of the Brush Electric Co. was presented. The plant, which has grown as the business extended, now covers seven acres. Every facility that ingenuity can devise or money purchase for the manufacture of dynamo-electric machinery, lamps and carbons, has been added to the equipment. The buildings are: Main machine shop, 265 × 122 ft.; cathedral building, 200 × 100 ft.; power building, 120 × 110 ft.; carbon house, 600 × 62 ft.; pattern room and carpenter shop, 120 × 70 ft.; lumber room, 80 × 50 ft.; coke house, 160 × 60, and many other smaller structures.



ELECTRIC CAR EQUIPPED WITH SHORT MOTORS.

WALKER MANUFACTURING CO.

WHERE MACHINERY FOR CABLE RAILWAYS IS MADE.

TO the cable engineer the most interesting works in Cleveland are those of the Walker Manufacturing Co. But a visit to the works is of interest not alone to those connected with cable plants; the character of the work performed, the ingenious devices employed, and the ponderous machinery in operation constitute features novel and interesting to every one in the least mechanically inclined. The great establishment, with its famous machine shops and foundries covers nine acres of ground, and forms a plant, which in point of arrangement and completeness of equipment, is unsurpassed in the United States, and probably in the world.

A person who visits the works ordinarily makes a beginning at the office of Mr. John Walker, the founder, general manager and vice-president of the company, where the essential credentials are to be secured. The office itself is an interesting place, with its models of rope drive and gear drive, cable machinery, differential drums, 1,000 H. P. friction clutch, and the almost priceless picture of James Watt's workshop, which Mr. Walker secured while traveling in Europe last year. A view of the room is presented herewith. Mr. Walker is at his desk conversing with the manager, Mr. W. H. Bone, while Mr. Samuel Groves, Mr. Walker's assistant, stands at the right.



On the floor above the drawing office is located a roomy, well lighted and admirably designed apartment. The draughtsmen are divided into three sections. One division is engaged on cable machinery and general en-gine work under the supervision of Mr. Ernest C. Barth; a second group is occupied with hydraulic machinery and electric cranes under the direction of Mr. John R. Bitner; and a third is concerned with gears under the supervision of Mr. Robert Bone.

On the way to the machine shop



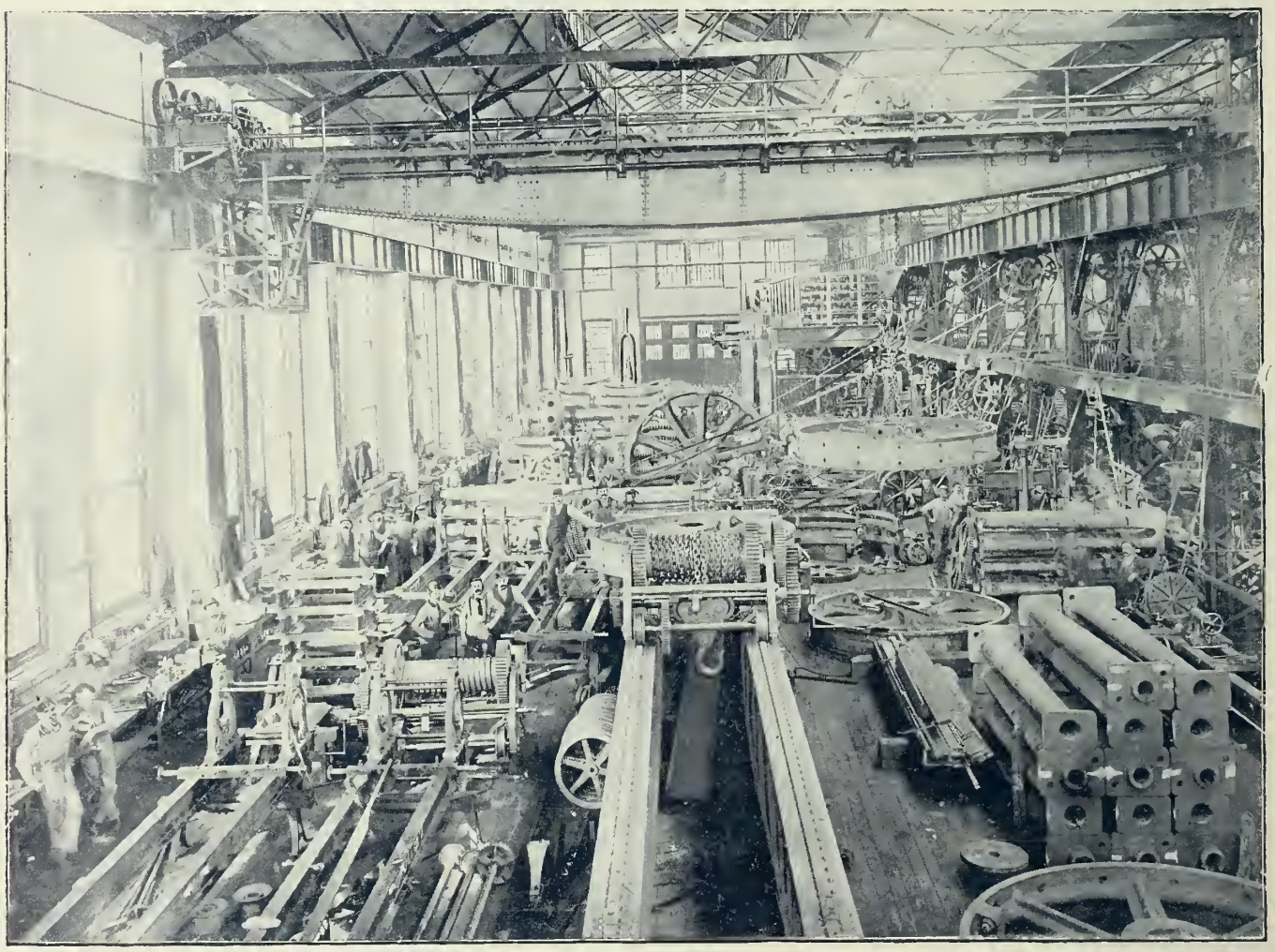


DRAUGHTING ROOM—EXTERIOR OF MANUFACTORY—OFFICE OF MR. WALKER.

the visitor is conducted to a large room constructed like a vault, with heavily barred iron doors. Here are stored the designs and drawings of machinery now in operation the world over.

MACHINE SHOP.

The immense machine shop, said to be the finest in the United States, is 170 ft. in width, and is built in three bays each fifty-seven feet wide. Two are 288 ft. in length, and the third is 430 ft. long. The roof, which is supported between the sections by massive wrought iron pillars, is fifty-four feet high from the floor to the highest point, and is constructed of iron. That the shop is well lighted may be judged from the fact that the glass in the roof cost $1,400.



BAY NO. 1—MACHINE SHOP.

Each bay is provided with a thirty ton, rope power, traveling crane of improved construction built by the Walker company. The cranes are driven by a 24 × 48 in. Corliss engine, and the tension on the Manilla ropes is regulated by an ingenious device with triple sheaves fixed at the gable end of the shop.

It is not proposed to present a detailed description of the several departments of the works, but to note rather some of the work of interest to the railway engineer, which was in progress at the time the writer visited the manufactory. At the very outset the visitor receives two strong impressions; one, of the formidable character of the machinery designed to perform the heaviest kind of work, and one of the marvelous accuracy which is manifest in all the operations, no matter how large the scale.

In bay No. 1 was noticed a twenty-five ton, hand power, traveling crane, ready for shipment, which is to be set up in one of the new Chicago cable power houses. In process of construction were five large carriages and tension regulating appliances (Upton's patent) for the five sets of cable machinery to be operated in Baltimore. A short distance away were the massive bed plates or frames designed for the same plant. Each of the bed plates is forty-four feet long and twelve feet wide, cast in one piece, and weighs sixteen tons. The machinery, for some reason, could not be shipped at the time it was completed, and the question of its disposition was rather serious. Mr. Walker conceived the idea of piling it up, as shown in the illustration, after it had been tested and approved.

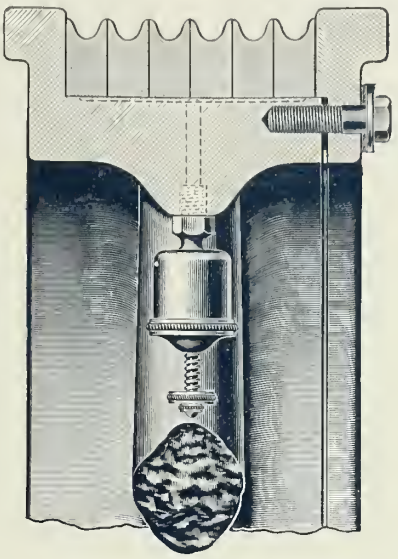
One of the prominent features of bay No. 2 is a giant turning lathe with a seventy-two inch swing and a bed forty feet in length. It can carry between centres a shaft forging weighing twenty-five tons. To the left is a mammoth planer with a table twenty-seven feet long and twenty-six foot stroke. On the table were bolted eight large segments for a twenty-four foot rope pulley, the joints of which were simultaneously planed, thus insuring uniformity of cut and size throughout the series.

In the middle of the bay was a 1,000 H. P. friction clutch six feet by four inches, mounted upon a shaft eighteen inches in diameter and twenty-five feet in length. Near by is the floor where the huge clutches are assembled, fitted inside the rope drums and carefully tested.

Some idea of the amount of work performed in the

works may be gained from the statement that at this time the value of machinery being constructed in bay No. 3 aggregated $149,000. There were to be seen, tier upon tier, rope drums, finished differential rings, fifty ton flywheels and steel gears awaiting shipment to cable stations in New York, Chicago and Baltimore.

In this part of the shop are turned, faced and bored the wrought iron rings for the Walker differential drums which have made the name of the company famous throughout the engineering world. An engraving of the latest design of drum is shown herewith. By the use of this invention in the power station, it is stated that the life of a steel cable is increased from six to twenty months with a saving in power of 37 per cent. With such a record for economy in material and power, it is not surprising that the differential drum has attained great popularity among cable engineers, and that it is regarded as one of the most essential and fundamental elements in a cable equipment. During the last five years 118 drums have been made, thirty-four of which have displaced solid drums, and at the present time forty-eight are in process of manufacture. The drum has recently been tried with success in the haulage plants in an English mine, and the latest application is in the cable machinery on the top of the Catskill mountains.

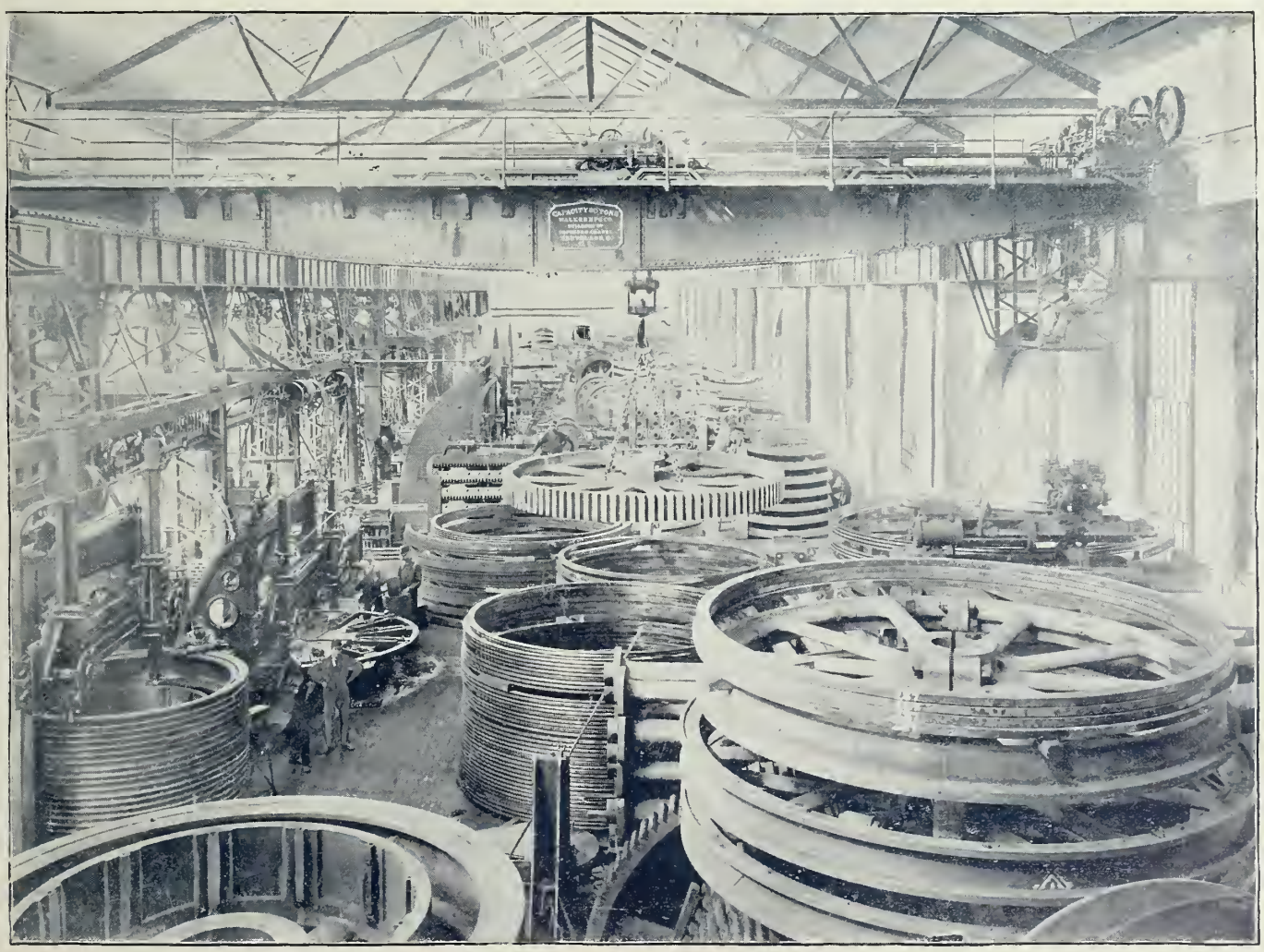


LATEST DESIGN WALKER DIFFERENTIAL RING.

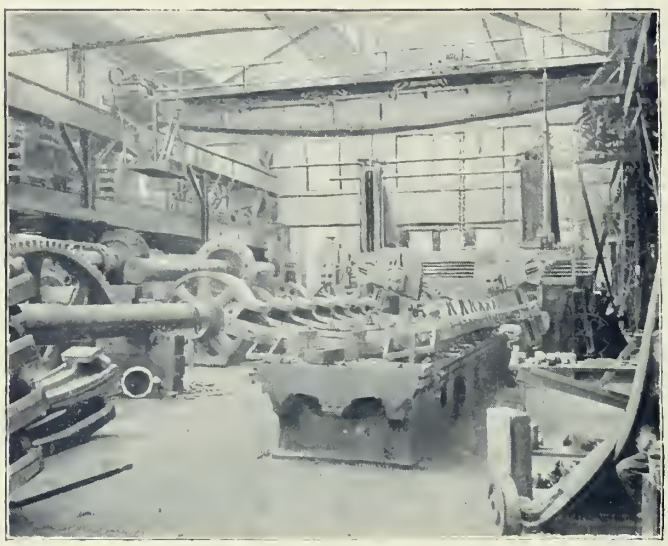
It is predicted that a great field of usefulness for the drums will be found in factories and mills where rope transmission is employed, as no little trouble is now experienced as a result of the unequal strain on the individual ropes. The difficulty resulting from the stretching and wear of the ropes, causing excessive lengths and unequal diameters, may be overcome to a very large extent by the use of the differential drum.

In bay No. 3 is also located the Gleason gear planer which was cutting the teeth of a steel pinion seventy inches in diameter and five in pitch.

Another machine of interest, because of its great dimensions, is the pit lathe, eighty-six feet in length, twelve feet wide and twenty-five feet deep. At the time the writer visited the works there were swung on their own shafts from the lathe two huge rope driving pulleys twenty-four feet in diameter with eight grooves in each. As the pulleys revolve, the grooves are turned to a gauge by four tools at each side. The rope drive pulleys built for a cable plant in New York City recently turned on the shaft are the largest ever made in this country, measuring thirty-two feet in diam-



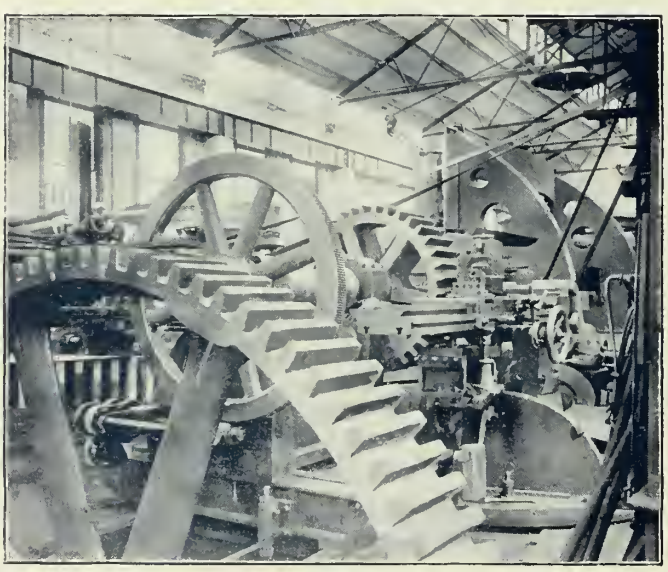
BAY NO. 3—MACHINE SHOP.



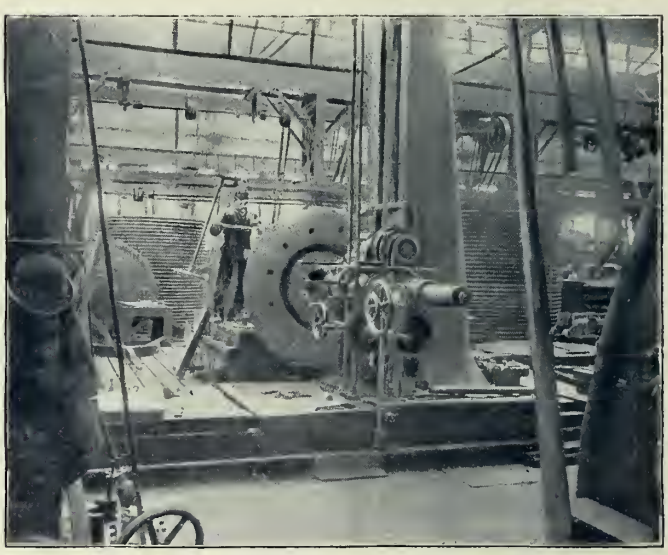
PLANING ANGLES CABLE DRUM SEGMENTS.



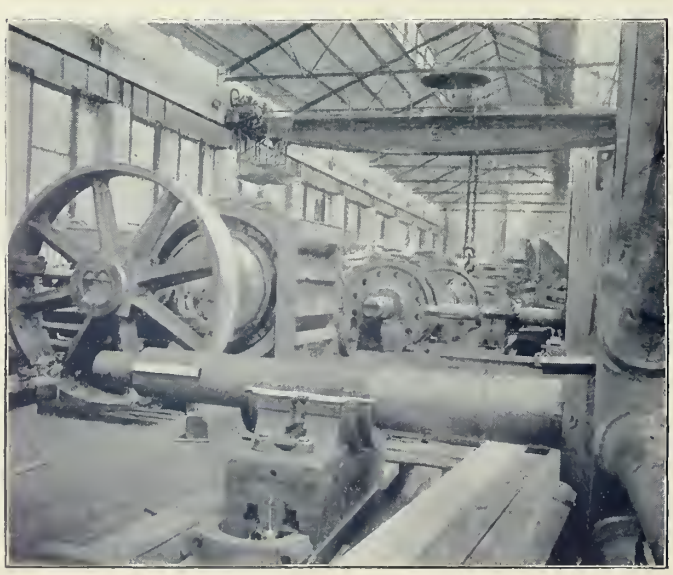
BUILDING UP A THIRTY TWO FOOT CABLE DRIVING DRUM.



CUTTING PINION TEETH.



BORING A CLUTCH



TESTING A 1,000 H. P. CLUTCH.

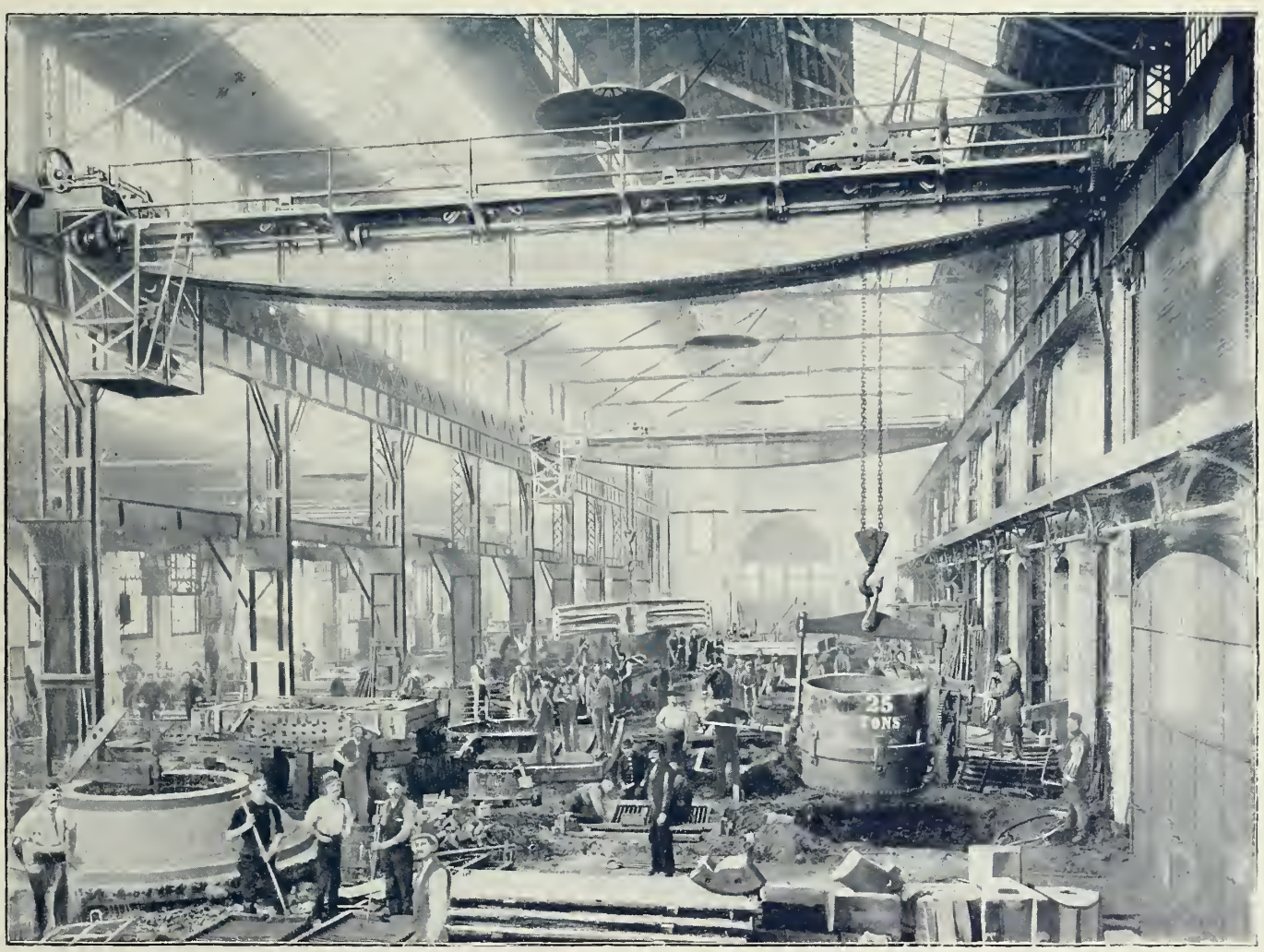


PINIONS AND CLUTCHES FOR THE THIRD AVE. ROAD, NEW YORK.

eter and eight feet four inches in width, with thirty-four rope grooves, and weighing, when complete, 104 tons each.

Opposite the pit lathe a 1,000 H. P., Weston-Walker friction clutch, the most powerful ever made for cable work, was tested. It was fitted inside a rope drum and turned in its axis on temporary journals at a speed of fifty revolutions per minute.

In an establishment in which ponderous weights must constantly be handled, shipping facilities are desirable and even necessary. The means adopted in the Walker shops are unique. A railway track passing through the building is sunk so that the car tracks are level with the floor. By this arrangement the loading of cars by means of traveling cranes is quickly and easily accomplished. One of the shipments for a New York road was to be seen in the yard. It consisted of a pair of centres, shaft and couplings for a rope pulley, and was all in one piece, weighing thirty-six tons.



FOUNDRY IN THE WALKER WORKS.

THE FOUNDRY.

The foundry of the company, which has been described as the model plant of the kind in the United States, is 300 ft. long and 118 ft. wide, and is built in three bays, the centre one being fifty seven feet in width and forty-one feet in height to the tie beams and sixty-two feet to the highest point of the roof. Here are produced the huge castings for the ponderous appliances constructed in the machine shop. These immense weights are shifted by two thirty ton, rope power, traveling cranes, operated at such an altitude as to lift a twenty-four foot casting vertically out of a pit and carry it from one end of the foundry to the other. The side bays are provided with two twelve ton traveling cranes, operated by separate engines. The absence of smoke, due to good ventilation, is remarkable, while the lighting during the day is all that could be desired, and in striking contrast to the gloom of the adjoining No. 2 foundry, with its limited window space and primitive wooden roof. The metal for the foundries is supplied from four Walker improved cupolas, two sixty inches in diameter and one seventy-two inches, the fourth eighty-four inches in diameter. The form and arrangement of the tuyeres is the result of long experience and scientific experiment. The cupolas are both rapid and economical, melting an average of 13.10 lbs. of iron per pound of coke. Unlike most foundries, the system of fan blast is discarded, the blast being supplied from a vertical blowing engine of the type used in blast furnace plants. The two air cylinders are 48 × 30 ins., the steam cylinder 14 × 30 ins. The engine, which was built by the company, is extremely simple, and delivers a steady, even blast, ranging from five to eight ounces, with eminently satisfactory results.

All the coke, iron and limestone for cupolas is elevated by hydraulic power, developed in a fourteen inch accumulator of fourteen feet stroke, with an average pressure of 1,000 lbs. per square inch, by differential pumps working at a speed of 150 revolutions per minute, without shock or jar. The elevator is calculated to raise a load of 12,000 lbs. The core ovens and carriages are of the most modern design. The ovens are 24×30 ft. and

20×30 ft. respectively, and are heated by underground flues; the carriages are operated by gearing and crank handles, the old fashioned pinch bar being relegated to the memories of ancient days.

In various parts of the foundry are to be noticed mechanical sand sifters, working at 125 strokes a minute, evi-



J. B. PERKINS,
PRESIDENT WALKER MANUFACTURING CO.

dently excellent labor saving machines. The system of storing sand, is an economical and convenient system, and involves a series of brick vaults underneath the yard, with outlets into the foundry, and manholes for dumping the sand fixed in the yard floor. Large casting pits are located at various parts of the foundry floor, ranging from twenty-four to twelve feet diameter, and as deep as twenty-five feet. Facilities for casting are on a large scale, the capacities of the crane ladles ranging from three to twenty-five tons. They can be poured from either side, and the operating mechanism is safe, powerful and effective. The foundry is heated in winter by hot air, delivered from a Sturtevant blower, through an inlet forty-two inches square, which is capable of displacing 50,000 cu. ft. of air per minute. Probably the most interesting features in these foundries are the pulley moulding machines in No. 2, and the five gear moulding machines in No. 1. The accuracy and speed with which work is executed by these machines are marvelous.

A sketch of the Walker Manufacturing Co. would be manifestly incomplete if it excluded references to the men who have made it one of the most noted engineering companies in the country. The officers are: President, J. B. Perkins; vice-president, John Walker; manager of the works, W. H. Bone; secretary and treasurer, Z. M. Hubbell.

J. B. PERKINS.

Standing at the gateway on the northern side of the works the visitor obtains a view of one of the finest stretches of bay scenery in the country. On the cliffs, some two miles away, can be seen "Twin Elms," the handsome residence of J. B. Perkins, the president of the Walker Manufacturing Co., who owns nearly the whole of the lake frontage to be seen. Mr. Perkins has been prominently identified with the architectural improvements in Cleveland, and has built a number of the largest business blocks in the city. He is a prime mover in the great scheme of environing the city by a boulevard thirty miles in length. He is president of the Hackney Hammer Co., and is largely interested in the Hill Clutch Works. His business enterprises are almost without number, and he is considered one of the ablest financiers of the state of Ohio. He still finds time, however, to raise fine horses. He is an expert horseman, and is at the head of the Cleveland cavalry troop. He is responsible for many deeds of philanthropy, but so unostentatiously are they performed, that few people ever learn of the facts.

JOHN WALKER.

John Walker, the founder and the vice-president, comes of a line of expert British mechanics, and was born August 3, 1847, at Middleborough, on the northeast coast of England. His father, James Walker, was a plain iron founder, who could sleek a mould, fix a core or pour a casting as well as any man in the iron districts of England. The son was educated first in a common school, and after a course of study in the private academy of Thomas Ainsworth, a teacher of the old school, he served seven years and a half apprenticeship in the workshops of Vaughan & Co., the largest iron concern in the world, with a capital of $15,500,000.

When twenty-four years of age Mr. Walker came to the conclusion that his chance for advancement would be much greater in the United States than in England, and coming to this country he settled in Philadelphia. While he was in the employ of William Seliers & Co. of that city, he invented his famous gear scale for setting out graphically the form of teeth for gear wheels. Subsequently Mr. Walker was connected with Wright & Co. of Newburgh, N. Y., then with Poole & Hunt of Baltimore, and later with Nordyke & Marmon of Indianapolis. In 1882 he determined to organize a company for the manufacture of specialties under his own patent rights. He was successful in interesting Mr. J. B. Perkins, General Leggett, commissioner of patents under Grant, George W. Gardner, ex-mayor of Cleveland, Mr. H. T. Taylor and Mr. T. Kilpatrick, and September 20, 1882, a company was formed which is known the world over as the Walker Manufacturing Co.

It was almost five years after the company was formed, that the great invention was conceived with which Mr. Walker's name is identified, and for which the Walker Manufacturing Co. is specially renowned. At that time Mr. Walker happened to be in a cable power



JOHN WALKER,
VICE-PRESIDENT WALKER MANUFACTURING CO.

house in Kansas City, Mo., and was watching the sparks flying from the winding drums, due to the friction of the cables. The question arose, how could this disastrous wear and tear be prevented. On the spur of the moment he conceived the idea of a drum with differential rings. Going to his room at the hotel he made a sketch of his conception, and a photograph of the original drawing may be seen at the works to-day.

W. H. BONE.

The manager of the Walker Manufacturing Co., Mr. W. H. Bone, was born in Petersburg, Va., October 6, 1857. At the age of fifteen he entered the employ of Poole & Hunt as an apprentice draughtsman, and in the course of seven years obtained the rudiments of the extensive knowledge of gears and power transmitting machinery, which has since earned for him the title of a specialist in this branch of engineering. After three years as chief draughtsman with Nordyke & Marmon, of Indianapolis, he was induced by Mr. Walker, in 1882, to lend his aid to the small industry started on the southern shores of Lake Erie ; and upon the re-organization of the company, on the present large scale, in 1890, he was appointed manager, which post he now fills, looking after the details of the business, and more particularly the gear department.

Z. M. HUBBELL.

The secretary and treasurer of the company, Mr. Z. M. Hubbell, was born September 16, 1843. He is one of the best authorities on matters financial in the Forest City, and is often engaged as an expert to unravel complicated accounts. Seven years' experience in the tax



W. H. BONE,
MANAGER WALKER MANUFACTURING CO.



Z. M. HUBBELL,
SECRETARY AND TREASURER WALKER MANUFACTURING CO.

office, besides extended service as freight agent and also cashier of the New York, Pennsylvania & Ohio Railway Co., has eminently fitted him for the important position which he now holds. He was interested in the company at the time of the organization of the Walker Manufacturing Co., and he largely planned its unique system of bookkeeping and methods of finance. He is the private secretary of Mr. J. B. Perkins, has served two terms on the local Education Board, is a member of the Library Board and a member of the Order of Knights and Ladies of Honor.

Lake Shore & Michigan Southern.

The Lake Shore & Michigan Southern Railway Co. have contributed more than any railroad corporation to the prosperity and growth of Cleveland. Since the road connected Buffalo and Chicago in 1853, there has been a marvelous growth all along the line. In that period Cleveland has increased in population from 17,000 to 300,000, and the wealth of the city has multiplied in a far greater proportion. What is true of the Forest City is true of all the Lake Shore cities. Chicago has grown from 30,000 to 1,400,000, if the school census is to be believed; Detroit from 21,000 to 206,000; Toledo from 3,829 to 83,000; Buffalo from 42,000 to 260,000. Without the co-operation of the Lake Shore road this prodigious development would have been out of the question. The most interesting portion of railway history of the West centers in the records of this company. The corporation is the result of the consolidation in 1869 of four different companies, and these latter came into existence after such a vast number of consolidations that one is bewildered in consulting the record.

The Lake Shore may be regarded as a Cleveland enterprise, as the general offices are located in the city at the corner of St. Clair and Seneca Streets. The company operate to-day a system of 1,445 miles, and the total mileage, including second and third tracks and sidings, is 2,512 miles, of which 92 per cent. is laid with steel rails. During 1891 a total of 12,000,000 tons of freight was moved and about 6,000,000 passengers were carried. The road is famed for its splendid passenger service and the speed of its trains. The board of directors is composed of William K. Vanderbilt, Cornelius Vanderbilt, Frederick W. Vanderbilt, Samuel F. Barger, John E. Burrill, Darius O. Mills, Edwin D. Worcester and Hamilton McK. Twombly, all of New York; Charles M. Reed of Erie, Pa.; Rasselas Brown of Warren, Pa.; John Newell of Cleveland, John De Koven of Chicago, Hon. James H. Reed of Pittsburgh. William K. Vanderbilt is chairman of the board, John Newell, president and general manager, and Edwin D. Worcester, vice-president, secretary and treasurer. The administrative details are in the hands of President John Newell, P. P. Wright assistant general manager; Nicholas Bartlett, local treasurer and assistant secretary; Addison Hills, assistant president; Cyrus P. Leland, auditor; W. H. Canniff, general superintendent; P. S. Blodgett, general freight agent, and A. J. Smith, general passenger and ticket agent.

The Ford-Washburn Storelectro Co.

The Ford-Washburn Storelectro Co. of Cleveland is best known to street railway men by its storage battery car, which has been running on the different lines in that city. Its operation has been satisfactory not only to the inventors but to street railway men. The car is twenty feet nine inches in length inside, twenty-eight feet over all, and was built by the J. G. Brill Co. It is now eight months since the car was put into service, and though subjected to severe tests, the batteries are in as good condition as when first used. The car is operated by a thirty-five horse power, Ford-Washburn, series wound motor weighing 2,000 lbs. The motor is geared to both axles, and can be run from either end in either direction, and at seven variations of speed, by an ingenious method of battery commutation.



GEORGE A. FORD.



GEORGE A WASHBURN.

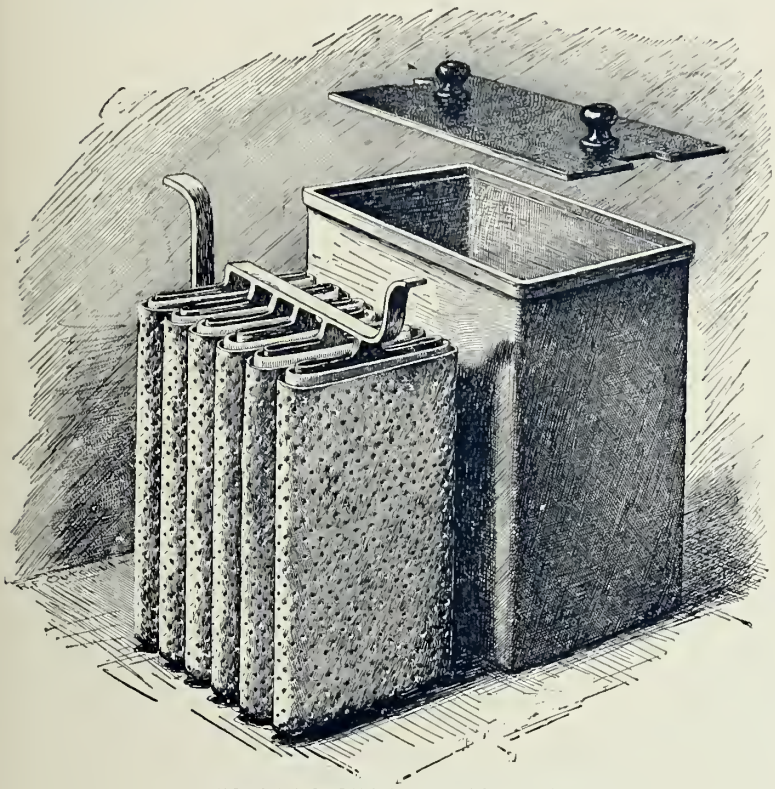
The battery equipment consists of 180 cells of 150 ampere hours' capacity each. The cells are twelve inches in height and $4\frac{1}{2} \times 8$ ins., and each weighs, with acid and rubber box, forty pounds. The batteries are carried under the seats, and are slid on trays into position through suitable openings in the ends of the cars, instead of at the sides.

In view of the many failures that have attended storage battery traction, how happens it that the Ford-Washburn car has proved so successful in service? An answer to the query involves a reference to the causes of failure, and a description of the novel type of battery devised by George A. Ford and George A. Washburn. Generally, it may be said that the success of the car has been the result of the peculiar construction of the batteries. The ordinary form of battery is commonly short lived because of faults which are soon developed. Plates buckle as the result of the contraction and expansion of the material on the grids. When buckling does not occur, the active material is likely to become loose, and at the loose points sulphating begins. At the same time if any portion of the material falls out, the capacity of the cell is diminished, even if a short circuit with disastrous results does not follow. With these causes at work the fact that the life of storage batteries of the ordinary form is usually short is not surprising.

To construct a battery in which these disintegrating causes would not be present was the problem that the inventors sought to solve. The result is a battery constructed on novel lines without grids and without plates. As the illustration shows, the cell contains six sets of elements, each corresponding to a pair of plates in the grid form. The positive and negative elements are separated by a thin porous cup through which the electrolyte may percolate, but which acts as an effective barrier to the passage of the active material. The porous cup is covered on the outside with a thick layer of active material around which is a sheet of perforated lead. The perforations admit of a free circulation of the acid. Within the porous cup is placed a sheet of lead similar to that on the outside, but smaller. The space between it and the cup is filled with active material. The sheets of lead act as conductors merely for the active material on each side of the cup, that on the outside forming the negative plate, and that on the inside the positive. All the negatives in a cell are connected by a strip at the bottom, which is extended to the top as shown at the left in the illustration, and the positives are similarly connected at the top, forming the positive pole. While by this construction buckling, loosening of active material and consequent short circuiting are prevented, it may be asked if, with the porous cup, the internal resistance is not high. The Ford-Washburn company answers the question in the negative, and to prove the statement asserts that discharges of the cell, on a dead short circuit, in the presence of experts, and through an ammeter of negligible resistance, have given readings up to 400 amperes, gradually declining to 350, where the ammeter needle stood for a time. It is evident that with an electromotive force of two volts and a current of 350 amperes, the internal and external resistance together cannot be more than .0058 ohm.

The car has made an excellent showing on the trial

trips, and has maintained a speed of from fifteen to twenty miles an hour. Upon a recent trip over the lines of the Woodland & West Side and East Cleveland street railway companies, the car, with



FORD-WASHBURN STORAGE BATTERY.

thirty-five passengers, covered sixteen miles, with an average ampere reading of 20, and voltmeter reading of 350, and 3.3 miles were run in twelve minutes; during the rest of the trip trolley cars were in the way. On the route named there are twenty-three sharp curves and ten grades, ranging fron 2 to 5 per cent. The car has drawn a loaded trailer up a 1½ per cent. grade at the rate of fifteen miles per hour. With one charging the car can run, it is said, on ordinary track, for a distance of forty miles. At a test made in Cleveland the cost of coal for charging the battery was one-half cent per car mile, with coal at $1.40 per ton.

George G. Mulhern, superintendent of the Woodland Avenue & West Side Street Railway Co., of Cleveland, after riding on the car, wrote to the Ford-Washburn company his impressions of his inspection. He says, among other things: "It has thoroughly demonstrated its practicability for street car uses, both in the speed obtained and perfect control in operation. I have ridden as fast as twenty-five miles per hour on your car, and even at this rate of speed there seemed to be no material diminishing of the power. I have witnessed the stopping and starting of the car upon sharp curves and heavy grades, and this was accomplished without difficulty."

The Ford-Washburn Storelectro Co. engages in the construction of electrical machinery generally, with factory and offices at Frankfort Street. The officers of the company are: George A. Ford, president; J. F. Pankhurst, vice-president; W. H. Marshall, treasurer, and E. S. Ford, secretary; and the executive committee is composed of George A. Ford, L. A. Cobb, George Hoyt, J. F. Pankhurst and Luther Allen.

Handling Iron Ore.

The rapid unloading of vessels at the ore docks forms one of the most interesting sights in Cleveland. The means employed are, to be sure, not peculiar to the city, but in no place can the operation of the ingenious apparatus designed for hoisting and conveying ores, be seen to better advantage. The ore industry is an enormous one in Cleveland. Forty years ago the first shipment of ore from the mining districts of Michigan was received and consisted of half a dozen barrels weighing, perhaps, two tons. Since that time the shipments have reached the enormous total of 900,000 tons annually. By far the greatest proportion is handled by the buckets running on the slender movable bridge tramways similar to those shown in the cut, page 15. The method of operation is exceedingly simple. The buckets are lowered by wire rope into the vessels, where they are filled by the shovelers. They are then hoisted to the tramway, and as the carriers may be tripped at any given point the contents may be deposited at the desired place. The total length of the tramways in use at the Cleveland & Pittsburgh



FORD-WASHBURN STORAGE BATTERY CAR.

Railroad Co's docks at Cleveland is 300 ft. The system of handling ores is that of the Brown Hoisting & Conveying Machine Co., of Cleveland. With their machinery a vessel reaching its dock at 6 A. M. can leave at 6 P. M. after discharging 3,000 tons of ore. Fully 75 per cent. of all ore shipped on the lakes is handled by Brown machinery.

Fulton Foundry.

There is, doubtless, scarcely a street railway company in the country that has not at some time or other sustained relations with the proprietors of the Fulton Foundry of Cleveland. Coming into the field at an early date, and making a specialty of street railway work, the firm is well known the country over. The business was started in 1865, and Mr. S. M. Carpenter, who has been connected with the firm from the outset, is now the senior member. Associated with him at present are Mr. C. J. Langdon and Mr. W. E. Haycox.



FULTON FOUNDRY

From the first, the firm made car wheels and heavy castings for steam and street railways. At present the Fulton Foundry is, perhaps, best known by the truck that bears its name, but in addition there are manufactured in the plant crossings, switches, turnouts, chairs and knees, as well as wheels of peculiar construction.

The foundry, of which a view is presented herewith, is divided into three departments: Machine shop, wheel shop, foundry and wood working shop.

The machine shop is supplied with the latest improved appliances for performing the work in hand. Special tools are provided for turning axles, boring wheels and pressing them on axles, and for drilling, forging and finishing the iron work for motor trucks.

The wheel room is devoted entirely to the manufacture of wheels for use on street and steam railways. A superior grade of charcoal iron is employed for this purpose; in fact, it is stated by experts that the special combination of iron used by the Fulton foundry gives results that cannot be surpassed. It is a fact, perhaps, not universally known, that ores coming from different parts of the country cannot be successfully used separately in the manufacture of wheels. It is only by a combination that the best results can be obtained. By an extended series of experiments the proprietors of the Fulton Foundry hit upon a combination that has proved extraordinarily well adapted to the purpose. It produces an even chill, and it tends to reduce to a minimum chill checks. On the tread of the wheel a chill three-quarters of an inch in thickness is produced when at the same time the spokes and the hub are found to be of very soft metal. Where such results can be obtained, very little improvement can be expected in the manufacture of wheels.

The firm are now making a new wheel, devised by Mr. W. E. Haycox, with an independent brake rim. It is a well known fact that the wear of a brake shoe upon the tread materially lessens the life of a wheel. To prevent this shortening of life the independent rim has been added. It is cast on the inside face of the wheel, having a diameter somewhat less than that of the wheel proper, so that it can readily pass guard rails on curves. It adds but a few extra pounds to the weight of the wheel, and is claimed to add from 60 to 70 per cent. to its life.

In the foundry all the heavy castings are made for railway work. These include crossings, crossovers, switches, curves, turnouts, chairs, knees, etc.

The wood working shop is devoted to the manufacture of trucks and small cars; the latter are made for a variety of uses. The trucks of the Fulton Foundry have gained a wide reputation for durability, and for the peculiar construction which calls for little in the way of repairs. One of the companies now using the truck on their lines recently made the statement that they proposed to dispense with the services of several truck repairers, as with the Fulton Foundry truck they were not required. One company states that a truck has been in constant use for fourteen months and has not been in the repair shop. The great feature of the truck consists in the fact that the frame is wood—white oak. With this framework it is claimed that the bolts hold better than with steel. The brake is strong and substantial, and without a superior for street car work.

The Robison patent drawbar, manufactured by the

Fulton Foundry, is giving entire satisfaction wherever it is in use, as it constitutes an absolutely tight coupling between motor and trail car. It is a radial drawbar, and when it is used cars can be backed around the shortest



S. M. CARPENTER.

curve without danger of causing a car to leave the track. It is, unfortunately, the fact that when the link and pin are used, employes seem to manage to collect all pins on one car and all links on another. When the time to attach a trailer comes, either a link or a pin is missing, and there is, consequently, delay, to the great disgust of the passen-



C. J. LANGDON.

gers. With the drawbar of the Fulton Foundry it is impossible for incidents of this kind to occur, as employes cannot detach any part of it, and it is always complete when it is necessary to attach a trailer. The cars of the East Cleveland Railroad Co. are equipped with these drawbars, and the Woodland Avenue & West Side Street Railroad Co. have also ordered their equipment from the Fulton Foundry.

The Haycox patent brake head and slippers are manufactured by the firm. They are found to be most convenient and labor saving brake shoes. The brake head is made to fit any style of motor truck or horse car gear, while the slippers are all alike. This fact is especially appreciated by companies using several different trucks.

The Haycox door fastener is a well known product of the Fulton Foundry. It is used quite extensively by the East Cleveland Railroad Co., and by other roads throughout the country. Its special point of advantage lies in the fact that it holds the door in the desired position, *i. e.*, open or closed at all times and does not allow it to swing when the car is rounding curves. No lock or catch is required on the door, and it may be opened or closed very easily.

While the apparatus constructed by the Fulton Foundry is familiar, the men who conduct the enterprise are,



W. E. HAYCOX.

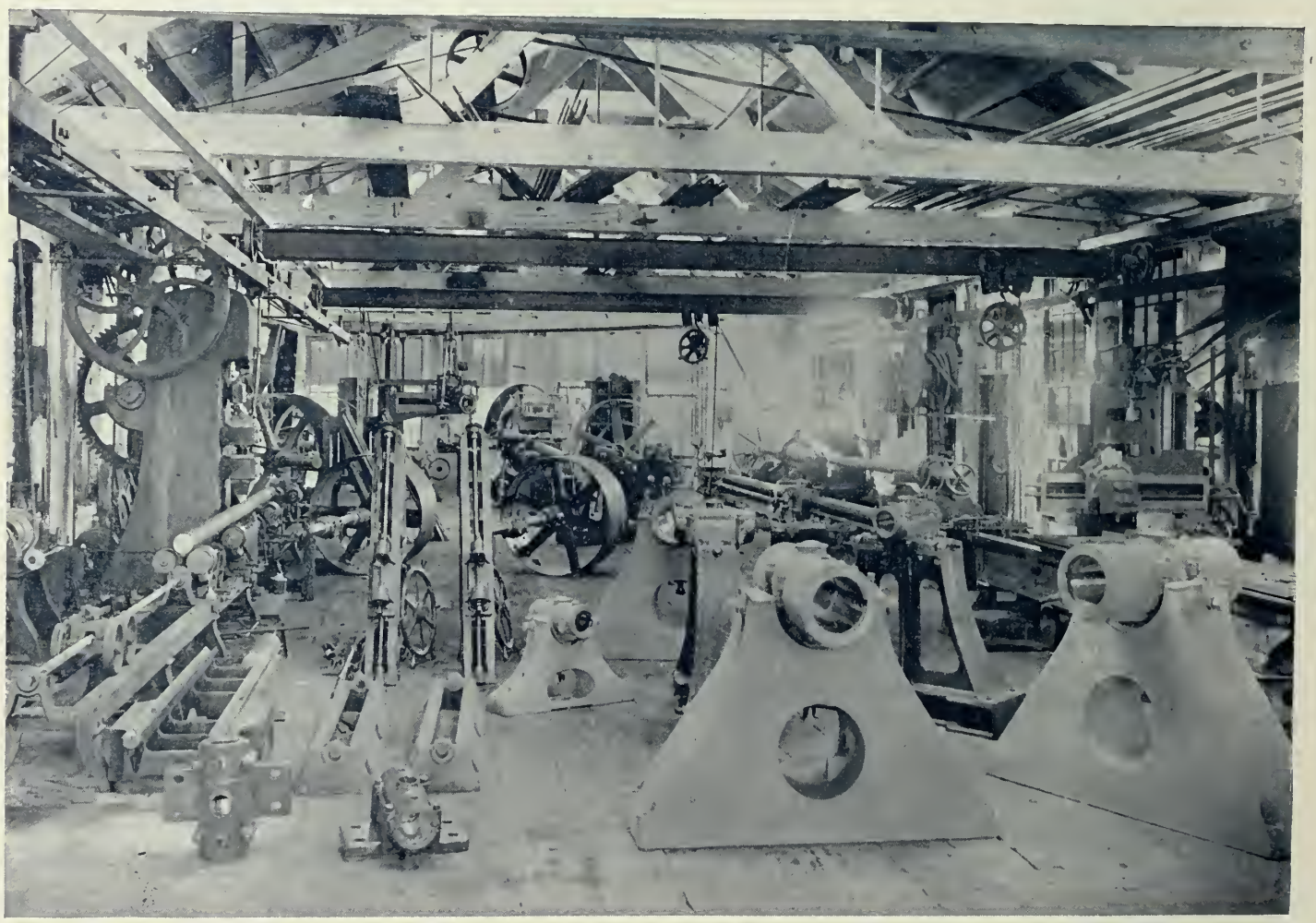
perhaps, not so well known; for this reason short sketches of these gentlemen are herewith appended.

The senior member of the firm is Mr. S. M. Carpenter, a veteran in the business, who has a practical knowledge of it in all its details. He has been engaged in this particular work for an extended period, and to his careful supervision much of the success which has attended the introduction of the apparatus is due.

Mr. Carpenter was born January 8, 1817, in Franklin County, Mass. He started at work in a foundry at the age of seventeen, and he passed several years in Troy and Rochester, N. Y., and thence in 1840 he removed to Erie, Pa., where he resided for twelve years. In 1852 he became interested in the foundry business in Cleveland under the name of Carpenter, Gerry & Co. A small foundry was built and was devoted to the manufacture of railroad work. The plant was enlarged from time to time, but after ten years, on account of the ill health of Mr. Carpenter, the business was sold to Pettengill, Glass & Co. In 1865 the present Fulton Foundry was started by Mr. Car-

penter, on the site of the present plant. After several years he acquired the entire interest in the business and retained the sole ownership until three years ago when Mr. C. J. Langdon was admitted to the partnership, and subsequently Mr. W. E. Haycox became a member of the firm.

Mr. C. J. Langdon, one of the junior partners in the firm, has a wide acquaintance with street railway men. He has charge more especially of the executive business. He was born in 1858, in Cleveland. He attended the public schools of the city from 1864 to 1873, after which he studied telegraphy, securing a position in five



SHAFTING AND ERECTING DEPARTMENT.—HILL CLUTCH WORKS.

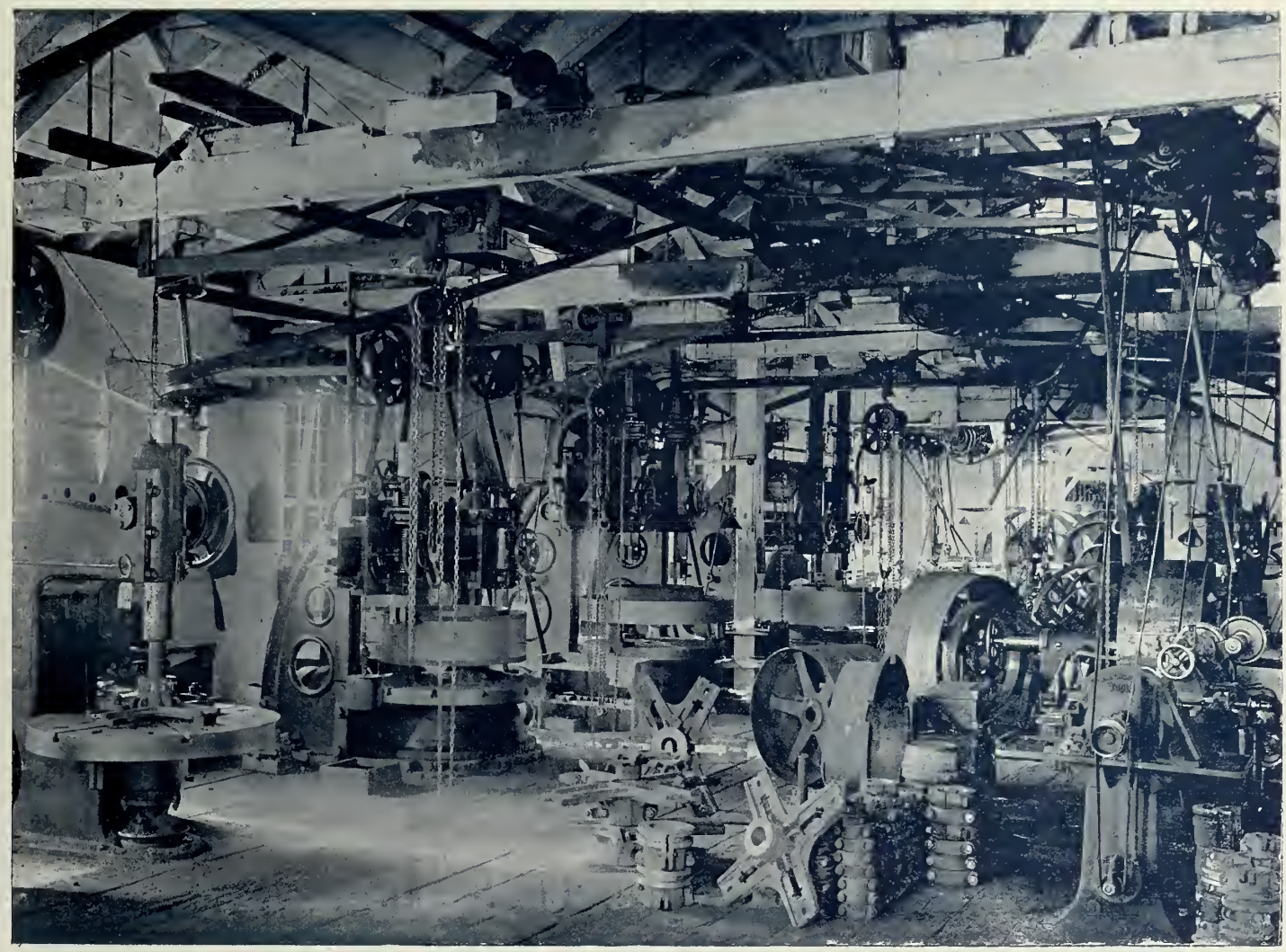
months. His duties as operator occupied him till 1881, when he accepted a position with the Fulton Foundry. and has been connected with the concern since that time.

Mr. W. E. Haycox has had an extended experience in practical street railway business, having worked his way through every grade of the service before his connection with the Fulton Foundry. He was born in Monmouthshire, England, in 1856, and came to this country with his parents in 1874. Three years later he began his street railway work as driver on the East Cleveland railroad. After a year at this work, he became a conductor, which position he held for five years, when he became assistant superintendent of the East Cleveland road. In 1886, he was one of the organizers of the East Cleveland Employes' Mutual Benefit Association, and was elected first president of the organization. In 1888, he accepted the superintendency of the Utica Belt Line, at Utica, N. Y., and upon his leaving the East Cleveland company, he was presented a handsome gold watch and chain by the company and the employes, a gift which he prizes very highly. The Belt Line, at the time, possessed the questionable distinction of being the worst street car railway in the country. Under Mr. Haycox's management a decided change for the better was brought about, and the line became known as one of the best horse roads in the United States. In 1890, the road was electrically equipped, and when Mr. Haycox left in the summer of that year, it was considered one of the best lines in the country, with the exception of the roadbed which was put in the best shape possible with the money allowed for the purpose. In 1891, he accepted the position of traveling agent of the Fulton Foundry, and at the end of a year he was made a partner in the business. As a salesman Mr. Haycox has been unusually successful, and he has made a number of inventions which are well known to street railway men. Among these are his door fastener, patent brake shoe, the double tread wheel and others.

Hill Clutch Works.

The Hill Clutch Works form one of the most prominent manufactories in Cleveland, especially in the estimation of street railway companies, in so many of whose power stations the Hill clutches and specialties are used. The plant is located on Waverly Avenue adjoining the works of the Walker Manufacturing Co., and the buildings contain an equipment of machinery complete in every particular. The accompanying views illustrate two of the departments, and give some idea of the character of the work undertaken.

In the first illustration is presented a view of the shafting and erecting room. In this department the shafting is received from the forges in the rough state. It is first placed in the large machine shown on the left, in which it is carefully straightened, and which is sufficiently powerful to straighten a shaft ten inches in diameter. The shaft is then taken to a lathe where it is turned perfectly true and then polished. The largest lathe will turn a shaft thirty-three feet long and twelve inches in diameter. The shaft is next carried to a machine in which the key seats are cut. This machine is located in the rear of the room. When this operation is completed the shaft is again taken to the straightener so that if it has been sprung in handling, the defect may be remedied.



PART OF MACHINE SHOP—HILL CLUTCH WORKS.

In this department is also located a large open side planer used for planing clutches, floor stands or other large pieces of machinery, and in the rear of the room stands a radial drill of unusual size. In this room all apparatus constructed is assembled and tested so that any small mistakes may be discovered and corrected.

In the second illustration a part of the machine shop is shown. In this department are located the lathes, planers, mills, boring machines, key seat cutters and drills used in finishing the clutches, pulleys, bearings, floor stands, etc. In the back part of this room is a specially designed tool for turning off the wooden shoes used in the jaws of the clutches. When the wood blocks leave the machine they are absolutely true, so that when used the proper contact with the clutch ring is insured, and the wear on the shoes is reduced to a minimum.

The shops and offices are lighted throughout by electricity.

Globe Iron Works Co.

The Globe Iron Works Co., which built the engines for the power plant of the Woodland Avenue & West Side Railroad Co., occupy the first place in ship building, one of the principal industries of Cleveland. The Globe Iron Works were established in 1853 for manufacturing marine boilers, machinery, etc., and in 1884 the Globe Ship Building Co., were organized to build iron and steel hulls for vessels, being the first corporation to engage in the business on the Ohio lake coast. The two companies were combined in 1886, forming the present corporation, with a capital of $500,000. The office and works for the machinery department occupy the square bounded by Centre, Elm, Spruce and Hemlock Streets, while the foundry covers more than half a block on Centre, Elm, Spruce and Main Streets. The equipment of machinery for manufacturing is complete in every respect, and embraces steam cranes and overhead railways for moving ponderous weights. In the foundry are two cupolas, each of ten tons capacity.

The iron ship yard is located on the "Old River Bed" at the foot of Taylor Street where the company have space for constructing four large ships at a time.

The company employ 1,200 hands, their wages aggregating $13,000 weekly. About 15,000 tons of metal are used annually, and 25,000 tons of coke are consumed during the same time.

Since July, 1886, the time of the incorporation, the company have launched forty-five large steel vessels averaging 3,000 tons each. They built the "Virginia", the crack boat of the Goodrich Transportation Co., of Chicago, which plies between Chicago and Milwaukee, and a number of smaller craft. The company have recently taken the contract for two large twin screw steamers, to cost $500,000 each, to ply between Buffalo and Duluth. They will be 360 ft. in length, and each ship will have an engine capacity of 6,600 H. P. The officers of the company are: President, H. M. Hanna; vice-president, J. F. Pankhurst; secretary, Luther Allen.



MEHLING CAR, WITH SIDE ON

The Mehling Car.

The Mehling car, which is in use on the East Cleveland railroad, Cleveland, is intended for summer and winter use. It has been in regular service for several months on the Euclid Avenue line, and while the officers of the operating company were at first inclined to doubt if it would prove successful, time has proved that it is all that the inventor has claimed for it. Two views of the car are shown herewith, one with the side panels removed, fitting it for summer use, the other with the panels in position, adapting it for cold weather. At the present the car is enclosed, and it is noticeable that the panels cause no rattling. The removable panels are a feature of one side only; the windows on the other side are so large and are built so low in the body that when lowered the air has full sweep.

A peculiarity of the car is its construction with a side aisle which is narrower than that ordinarily allowed in a centre aisle car. No inconvenience results from the narrowness of the passageway, as with the arrangement of seats across the car the feet of passengers do not protrude into the aisle and form an obstruction. At the ends of the aisles ready exit is afforded by side doors opening on roomy platforms.

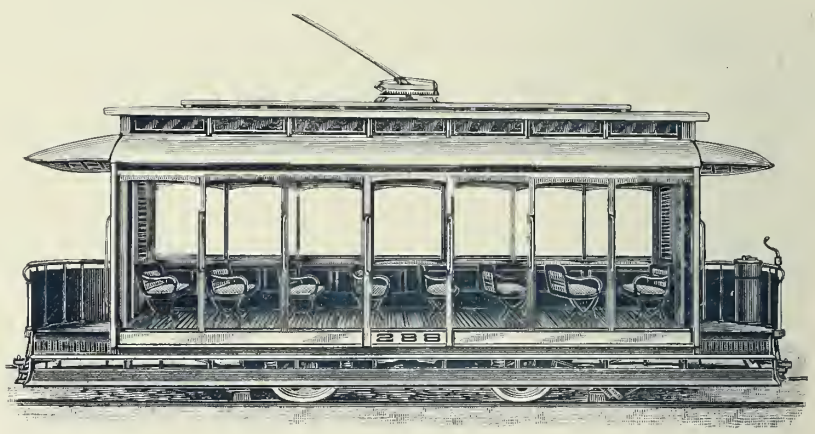
When the car is closed by the panels, a door is arranged at the side, making three doors in all. The car is built with straight sides, and its cost, it is stated, is not high. The inventor is J. A. Mehling who, with S. D. Dodge, of Cleveland, owns the patent.

The annual meeting of the Ohio State Tramway Association will be held at Zanesville, Wednesday, November 9, 1892.

Bodifield Belting Co.

Those who visit the street railway power stations in Cleveland will notice that in many cases belts made by the Bodifield Belting Co. connect engines to generators. They were organized less than four years ago, but they are transacting a large business in belts designed for all classes of work. The offices and manufactory are located at 26½ South Water Street, and the officers are: W. H. Peck, president; George P. Mills, vice-president; C. T. Bodifield, treasurer and general manager, and J. F. Sweeton, secretary. The manufacturing department occupies three floors.

They claim that their belts are especially adapted to street railway work, and certainly they have proved successful in this trying service. They furnished the East Cleveland Railroad Co. all the belts for their new power station, the order including two forty-eight inch belts, and six belts twenty-five inches in width. In the several power stations of the Brooklyn Street Railway Co. twenty-five Bodifield belts, fourteen inches in width, are in use. In the plant of the East Liverpool & Wellsville Street Railway Co., the Short generators are connected to the engines by four twenty-four inch belts of the same make, and Bodifield belts are also employed in the station of the Atlanta & Chattahoochee River Railway Co., at Atlanta, Ga., where Short apparatus has been installed. The Bodifield company call the especial attention of visitors to the street railway convention to the belts in the East Cleveland company's power station near Cedar Avenue, which run the generators with remarkable ease.



MEHLING CAR, WITH SIDE OFF.

Dorner & Dutton.

For many substantial reasons the firm of Dorner & Dutton, of Cleveland, is well known to street railway men. Since the beginning of the present activity in the field, which commenced with the general introduction of electricity as a motive power, the firm have been manufacturing some of the most important essentials of street railway equipment, and have been supplying the demand for apparatus that would meet all requirements under the new and severe conditions of rapid transit service. There has been a marked improvement and development in their trucks and other devices. In their latest form of truck there is now little to be desired in the way of improvement.

The firm of Dorner & Dutton was formed five years ago. Before that time both partners were connected with the street railway department of Bowler & Co. Mr. Dorner had been associated ten years with that firm, and



H. A. DORNER.

he, consequently, has, as a result of his extended and practical experience, an intimate knowledge of the needs of street railway companies, and to his direction much of the success of the firm is to be ascribed.

Mr. Dutton is a street railway man. Until about seven years ago he was secretary and superintendent of



W. A. DUTTON.

the St. Clair Street Railway Co., of Cleveland. Prior to the formation of the partnership of Dorner & Dutton, he was connected with the Bowler Foundry, as has been already stated, and previously he held a position with the Hegley Journal Co.

The firm is, perhaps, best known for its electrical truck which, it is claimed, is giving satisfaction wherever it is in use. It is a solid forged, non-teetering truck, and the latest type is provided with elliptical springs. It is equipped with the Gairing patent brake which is extremely powerful and effective. All the cars of the Brooklyn and South Side street railroad companies, of Cleveland, are mounted on trucks of the firm's make, and it is in use in the following cities: Rochester, N. Y., St. Louis, Louisville, Johnstown, Pa, Fort Wayne, Evansville, Ind., Atlanta, Savannah, New Haven and other places.

The trucks are built at the firm's manufactory, 50–52 Fall Street, and the offices are located at the same place.

The wheel manufactory is located at Newburgh. The firm's wheels, which are cast from a special mixture of ores, have given remarkably good results in use.

Alfred G. Hathaway.

Alfred G. Hathaway, of Cleveland, manufacturer of railway specialties, is a practical street railway man, and



ALFRED G. HATHAWAY.

has a just appreciation of their requirements. For four years he was manager of the St. Clair Street Railroad of Cleveland. He has provided the street railways of Cleveland with many devices that are found of special value in the car houses. His transfer tables form an important part of the equipment of the well arranged car house of the Cleveland City Cable Railway Co. Cars coming into the city enter the car house, and are shifted from the incoming to the outgoing tracks by means of the transfer tables. Thirty of these devices are in use in Cleveland. Mr. Hathaway makes a specialty of wheel presses capable of handling wheels from the smallest to the largest size.

The Crossley Car Brake Co.

The Crossley rope friction brake, which is manufactured by the Crossley Car Brake Co., of 13 South Water Street, Cleveland, is now used on the Jennings Avenue line of the Brooklyn road. It is a device that is well worth examining. The friction of the rope on a

spool on the axle stops a car as quickly as may be desired, but at the same time without a jar. It might be assumed that the ropes would be speedily worn out, but practice proves that such is not the case. Mr. Crossley is authority for the statement that the cost for renewing ropes is by no means as great as that of the oil used for lubricating power brakes. The brake may be adapted for use with any style of motor or truck, and in addition to Cleveland it is used in Columbus, Chicago, Indianapolis and Aurora. D. A. Belden, general manager of the Aurora Street Railway Co., writes of the brake: "It is working to our entire satisfaction. If it proves as durable as it is simple and effective, it is all that could be desired for street railway service."

National Carbon Co.

The National Carbon Co. commenced business in 1886. At that date the entire consumption of electric light, and other forms of carbon, was very small. Goods were largely hand made, and consequently were high in price but poor in quality. At the outset the management of the company recognized that past methods of manufacture must be discarded, that only uniform goods of the best quality must be produced, and that manufacturing costs must be so reduced that the product could be sold at figures far lower than ever before known. In a new industry, where all the conditions were untried, this was a far easier problem to state than to solve. No one yet knew what constituted a good carbon, or realized that the production of perfect goods was an elaborate and many sided process, requiring very exact skill, mechanical, chemical and electrical. During a series of months in 1886 some of the principal obstacles were ascertained and overcome. New methods were introduced, special machinery was invented, and all the new devices that science and engineering skill could suggest were brought to bear. The results of this method were slow and costly, but sure. From the shipment of the first batch of high grade National carbons, the trade of the National Carbon Co. has grown. Each year has been a repetition of the first; a better carbon has been produced, and a larger demand has followed.

From time to time the plant was enlarged till no more contiguous real estate was available. A new factory was required, and the buildings are now in course of construction. The plant will be situated four miles west of the Public Square, at the corner of West Madison and Highland Avenues, on the Lake Shore & Michigan Southern Railroad. The site includes thirty acres, and several of the buildings, of which there will be a dozen in all, are nearing completion. The largest structure, which will be 600 ft. square, is half finished at the present time. The factory will have a capacity of 20,000,000 carbons monthly, sufficient to supply all required in the world.

All kinds of carbons are manufactured by the company. These include moulded carbons of the several sizes adapted to all high tension arc systems; forced carbons of all lengths and diameters adapted to low tension arc systems; hollow treated carbons for ordinary use on arc lamps on incandescent circuits; cored carbons for all places where the finest light attainable is demanded. The last style of carbons, until recently, was made only in Europe; the National Carbon Co now manufactures cored carbons of the highest grade, and is sending them abroad.

Street railway companies will be specially interested in the brushes made by the National Carbon Co. They are manufactured of the purest material, and are made in exact sizes. They are free from grit and do not, therefore, squeak, and are long lived. They are made in all sizes and plated with the desired coat of copper, with an accuracy of a thousandth of an inch.

The company makes carbon plates for batteries, carbon cups, buttons, disks for telephone transmitters, etc.

The officers are: W. H. Lawrence, president; Benj. F. Miles, vice-president; W. C. Hayes, treasurer; H. E. Hackenberg, secretary; J. H. Osborne, superintendent; Clarence M. Barber, engineer.



W. H. LAWRENCE,
PRESIDENT OF THE NATIONAL CARBON CO.

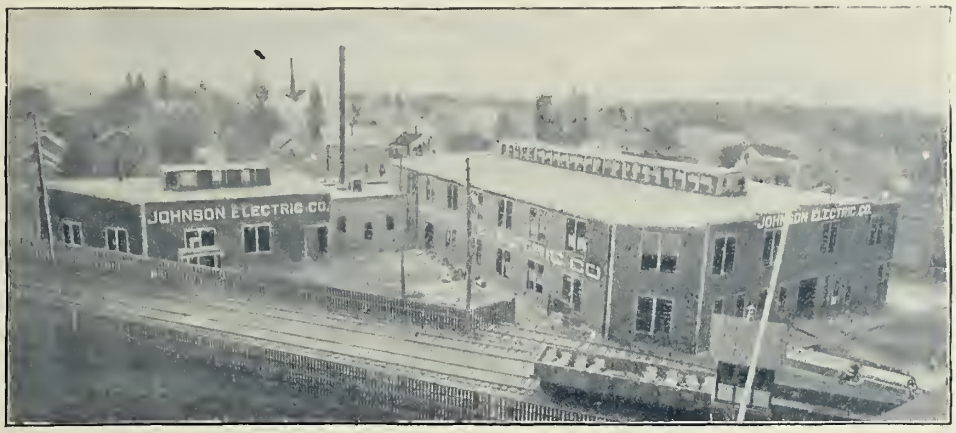
W. H. LAWRENCE.

Mr. W. H. Lawrence, president of the company whose portrait is presented herewith, has never failed in anything he has undertaken. He was one of the founders of the Brush Electric Co., was largely interested in the Domestic Sewing Machine Co., and is a director of the Youngstown (O.) Street Railway Co.

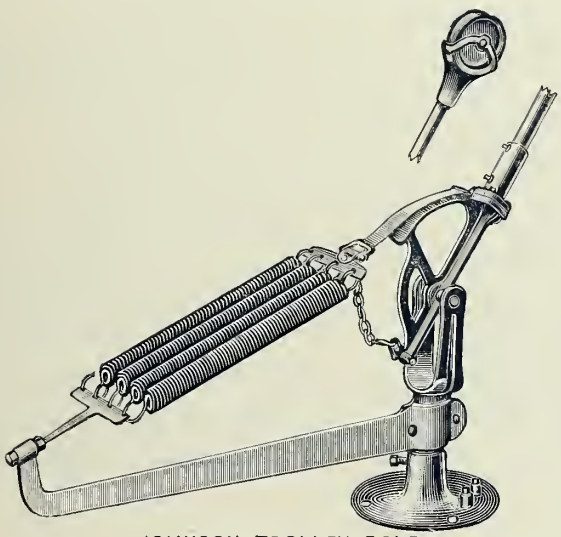
Cleveland Rolling Mill Co.

Perhaps more than any one enterprise, the Cleveland Rolling Mill has contributed to build up the manufacturing interests of Cleveland. The business was started in 1857, by Chisholm, Jones & Co., who six years later incorporated the present company with a capital of $4,000,000men. The works occupy seventy-five acres at Newburgh, about five miles from the city, and give employment to 4,000 men. The plant is one of the most complete in the country, and it possesses a marvelous equipment of improved machinery. An adequate description of the works, which are one of the great sights of the city, is wholly out of the question in the limited space here available, but some idea of the gigantic character of the enterprise may be gained from the following figures: The Bessemer Steel Works, built in 1867 and 1868, have an annual capacity for the production of 150,000 net tons of Bessemer steel ingots, and their open hearth steel plants, built

in 1876 to 1878, have a capacity of 40,000 net tons of open hearth steel ingots. Their rail mills were built in 1857, and have since been enlarged until they now have an annual capacity of 150,000 net tons of rails. The capacity of the three rod mills is 125,000 net tons. The wire mills built in 1868 have an annual output of 60,000 tons of finished wire, and the plate mills equipped with six puddling furnaces, and four trains of rolls including a pug mill, which, with galvanizing works attached, have an annual output of 10,000 tons. They have also extensive foundry, forge and machine shops, a barbed wire factory and blast furnaces of improved construction, the latter having a total capacity of 80,000 net tons of Bessemer pig iron. The various products of the mills include wire, tire and spring steel, wire rods, merchant steel, galvanized and black sheet iron, steel plates, boiler and tank plates, corrugated roofing and siding, Siemens-Martin open hearth steel, Bessemer steel rails, blooms, structural shapes and barbed wire for fencing.



WORKS OF THE JOHNSON ELECTRIC CO.



JOHNSON TROLLEY POLE.

Johnson Electric Co.

The Johnson Electric Co., of Cleveland, is one of the comparatively new concerns in the city, but already it possesses an extensive plant and is turning out a large amount of work. The manufactory is located at Stanton Avenue and the C. & P. tracks, where the best of shipping facilities are available. The company expects eventually to engage in the manufacture of electrical apparatus on an extensive scale and to build heavy electrical machinery. The building was erected with this purpose in view, so that an abundance of space is available for the increase of the manufacturing facilities. It is a two-story structure well arranged and well lighted, and the equipment of the machinery is of the most modern and improved description.

It may be stated generally that the company at present manufactures electric railway supplies of all kinds, and executes repair work on electrical machinery. It is prepared, however, to make contracts for the construction of electrical apparatus and machines of all kinds.

The lower floor is used as a machine shop, and on the upper floor the armature and field winding department is located.

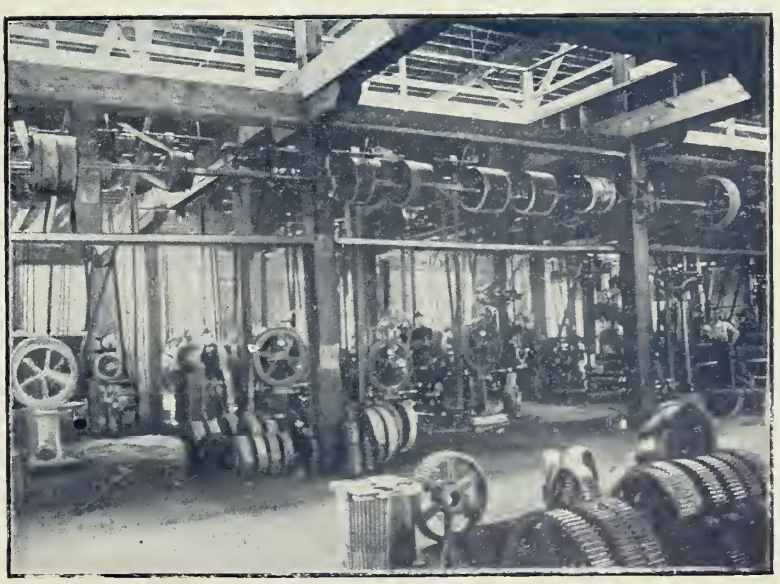
One of the accompanying cuts gives a view of the gear cutting department. The machines used for this work are of a special design which makes it possible to turn out the work in considerably less time than that ordinarily required. There is also in this department a complete equipment of drill presses, lathes and milling machines.

On the opposite side of the rooms are located the lathes in which the armature shafts are turned.

Among the specialties which the company makes is the trolley pole and base shown in the illustration. The features of this device are its strength and light weight. The pole is made of steel, and the adjustment is such that the wheel readily passes all overhead switch pans.

The company makes rawhide pinions, switches of all kinds, in fact all the supplies ordinarily required by an electric railway.

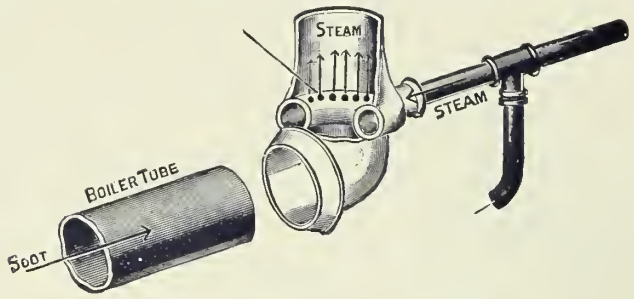
Those interested in the company are A. L. Johnson and Samuel Harris, both of whom are connected with the Brooklyn Street Railroad Co., and F. J. Lewis who is the general manager.



GEAR DEPARTMENT—JOHNSON ELECTRIC CO.

SAMUEL HARRIS.

One of the most experienced street railway men in Cleveland is Samuel Harris, superintendent of the Brooklyn and South Side street railroad companies, Cleveland. Mr. Harris is about 40 years of age.

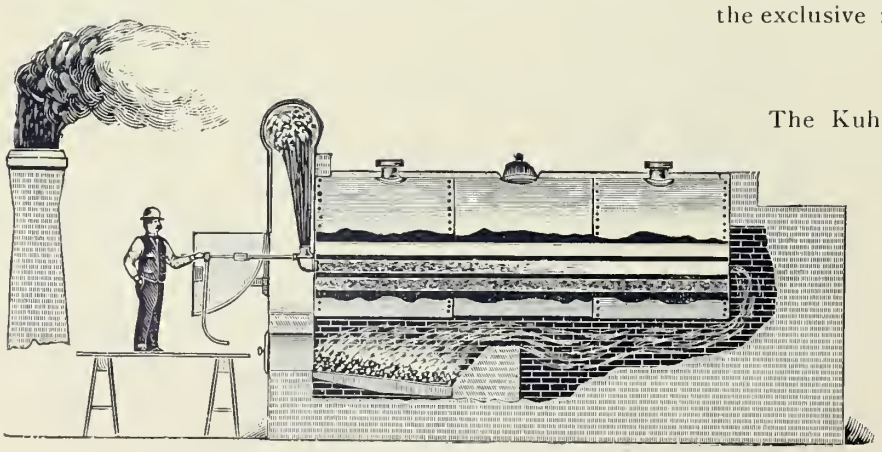


BALDWIN BOILER TUBE CLEANER.

Prior to entering the street railway business he was engaged in manufacturing, and subsequently started a machine shop in Cleveland. About this time Mr. Tom L. Johnson was working on his experimental cable road, and he secured Mr. Harris to assist him in its development. Upon the abandonment of this work, Mr. Harris was sent to Richmond, Va., Boston and other cities to investigate electricity as applied to street railroads. He spent six or eight weeks in the shops of the Thomson-Houston company before that company had motors in operation. He had charge of the practical work of equipping electrically the Johnson lines in Cleveland, and after they were in good working order he went to St. Louis and superintended the work of equipping electrically the Southern Railway there. He spent about a year in St. Louis, when he returned to Cleveland, and was appointed superintendent of the Brooklyn and South Side companies, succeeding Mr. Jilson J. Coleman, who had resigned to become general manager of the Toledo Electric Railway Co. As superintendent, Mr. Harris has the oversight of all the work on the road and in the shops of the Cleveland companies. He is associated with Mr. A. L. Johnson in the Johnson Electric Co. of Cleveland, and is the practical man of the concern.

Oliver P. Clay Co.

The vacuum boiler tube cleaner, illustrated in the engravings, is designed to overcome the constantly recurring difficulty which results from soot filling boiler tubes and gathering in large quantities at the back of the fire bridge wall, and at the back of the boiler. The heating surface of a boiler in this dirty condition is seriously impaired, and many devices are in use for cleaning out the tubes and chambers. The first illustration



APPLICATION OF THE BALDWIN BOILER TUBE CLEANER.

shows a section of boiler, and illustrates the manner of applying the Baldwin cleaner, the soot and dust being drawn out of the tubes into the chimney. From the section of the cleaner the principle of its action will be understood. It is made of a brass composition, and is shaped like an elbow. It has a conical shaped mouth, for insertion in the tube. The steam is admitted into the back of the cleaner, and passes into an annular chamber, surrounding the passage for the gases and soot, with small perforations on the upper side. When the steam is turned on, it rushes upwards through these holes, and creates a vacuum, thereby drawing out all the accumulation of soot in the tube, in the direction of the natural draft, and sending it where it originally should have gone—up in the chimney. By this method no steam is admitted into the tube, and, therefore, no scale is formed, and the inside of the tube is always kept dry. The steam being wire drawn through the small apertures, is first superheated, and becomes thoroughly dry, so that the soot does not stick in the chimney or passages. One of the greatest advantages of this method lies in the fact that, the soot is drawn out in the direction of the draft, and is not blown about the boiler room or into the other tubes. This prevents, in a large measure, the disagreeable work of cleaning out the back connection. By the use of the device the stack and combustion chambers are kept clean, and even the soot and dirt which accumulate back of the fire bridge wall will be drawn out.



KUHLMAN CAR.

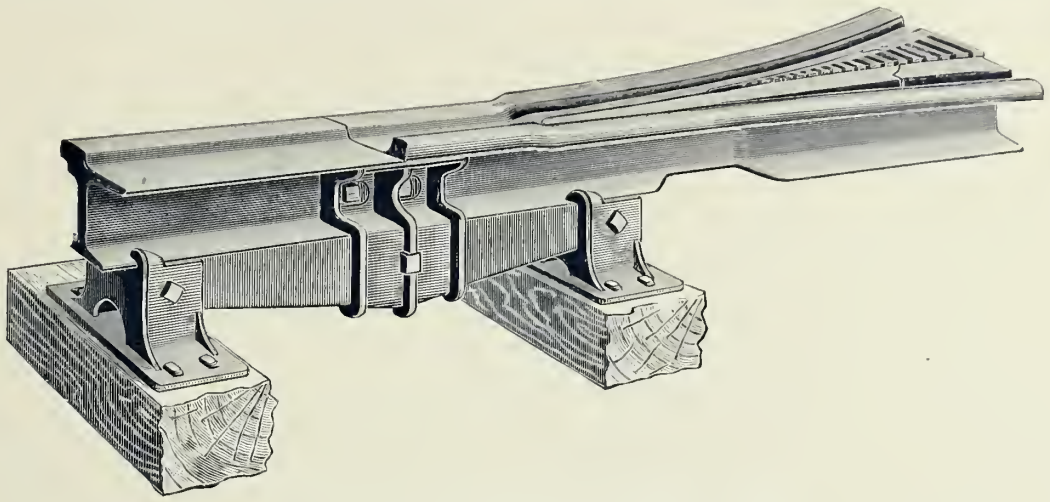
The device is the invention of F. R. Baldwin, of New York City, while the Oliver P. Clay Co., of Cleveland O., is the exclusive manufacturer.

Kuhlman Co.

The Kuhlman Co., of Cleveland, builds car bodies to suit all kinds of trucks, and its work has given great satisfaction wherever it has been tried. The company will in all probability be compelled within a short time to increase the facilities, as a result of new contracts. The company will manufacture the Mehling car, designed for summer and winter use, illustrated in the September number of the STREET RAILWAY JOURNAL.

In the accompanying cut is presented a view of a car constructed by the company for use at Mt. Clemens, Mich. It is extremely handsome in appearance, and is carefully made in every respect. It is twenty-four feet in length, and the body is built sufficiently strong for use as a motor car. It is handsomely finished in mahogany, with birdseye maple ceilings. The seats are covered

with Wilton carpet, and the windows are of plate glass. The Kuhlman Co. is prepared to build cars of all kinds, but keeps nothing in stock. The Mehling cars are to be built for the East Cleveland Railroad Co., to which



STANDARD JOINT APPLIED TO SWITCH POINT.

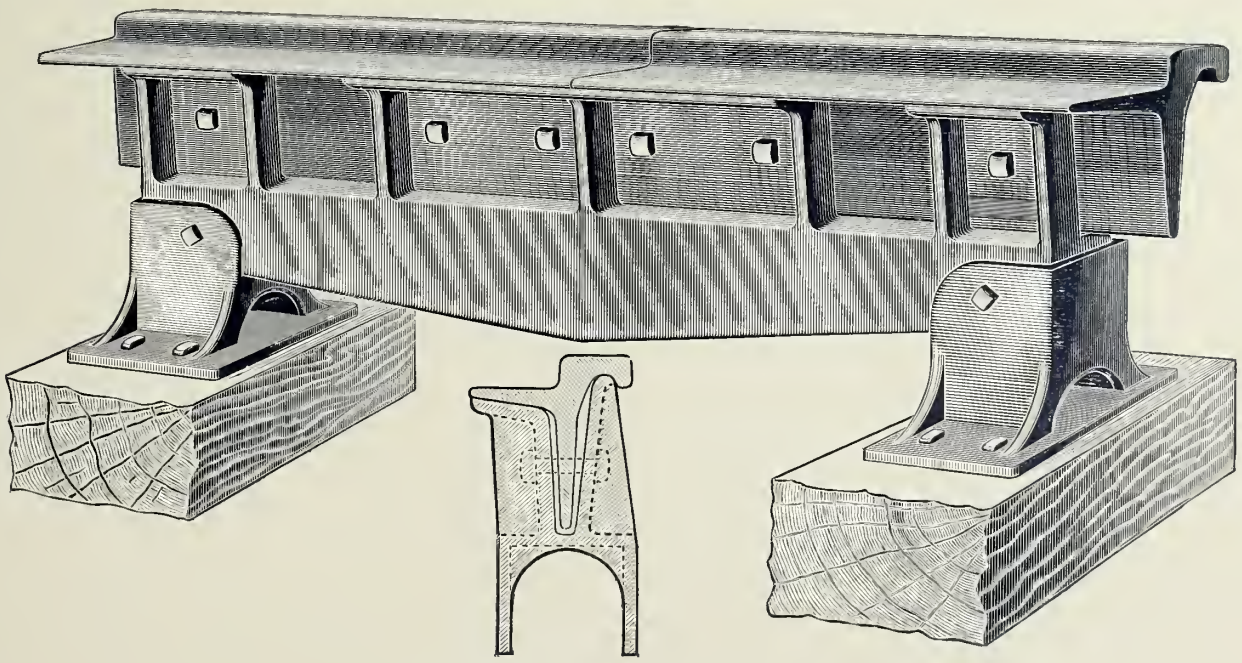
those desiring to learn more of the character of the work are referred.

Mark & Sterling.

It is now generally realized that a good track is essential to the successful operation of an electric road. Among the firms making a specialty of track equipment is Mark & Sterling, whose office is located in the Society for Savings Building Cleveland. Among the specialties which they manufacture, much will be found of interest to street railway companies. In the limited space here available, it is possible to describe and illustrate only a few of these devices. The standard joint is represented in the first illustration, and in this case it is applied to a switch point. It is claimed to possess substantial advantages over fishplates or angle irons. The joint bridge is made of malleable iron supported by chairs of the same material, and the construction is such that the chairs on the ties form a perfectly even base for the rails. The chairs have side clips which engage with the base of the rails, and the lower edge of the joint bridge, binding the former to the latter as firmly as can be desired. The whole is bolted together so firmly that there is no chance for movement except that of expansion and contraction. The joint has been in continuous use for nearly two years, and, it is stated, without any perceptible wear whatever, forming as even a joint as when put in position.

With the joint shown in the second illustration, it is claimed that a three-point rail may be supported as well as a girder rail, and perform equally good service. The joint is supported on chairs, and its construction is such that the rail is upheld from the under side of the tram and head of the rail instead of resting on the lower point. Taper bolts are used, and the rail is drawn firmly down so as to seat on the under side of the tram.

The single brace chair, manufactured by the firm, is designed to take the place of tie rods, and may be used for special work, such as curves, switches or at points where a rail is to be subjected to unusually heavy strain. The brace chairs are made to engage with the web, or to fit under the head and they are made with a solid base, covering a space $5\frac{1}{2} \times 10$ ins. on the tie; the spike holes are staggered so as not to split the wood.



JOINT BRIDGE FOR THREE-POINT RAIL.

All the devices of the firm are made of malleable iron which they deem superior to wrought iron for a variety

of reasons. By using it they are enabled to produce special shapes and designs which it would be impracticable to attempt with wrought iron; besides it withstands the extreme cold better and lasts far longer when underground.

Mr. Mark is the original patentee of the rail chair with diagonal lips, the patent being granted September 18, 1883, and is the inventor of other successful devices for street railway purposes.

Brightman Stoker Co.

The Brightman mechanical stoker for steam boilers is an ingenious contrivance for feeding fuel to the furnace mechanically, and at a continuous and uniform rate. In any furnace all the fuel must be decomposed, or, in other words, converted into its constituent gases by heat before combustion can occur. A match is made of materials that are decomposed at a very low temperature, the slight friction of drawing it lightly over any moderately rough surface being sufficient to evolve inflammable gases that are ignited the instant they come in contact with the oxygen of the atmosphere; the combustion of these gases, trifling in quantity, produces heat sufficient to decompose the wood, and they in time, uniting with oxygen in the atmosphere, produce more heat, and it in turn decomposes any other contiguous fuel evolving other gases, requiring perhaps a higher temperature for their combustion than those evolved from the match. So the process goes on multiplying until the heat becomes sufficient to convert water-saturated coal, and even water itself. into their constituent gases which, coming into contact with the oxygen of the air in the presence of a high temperature, instantly unites with such oxygen. This multiplication goes on indefinitely, and, so far as we know, temperature is infinite. This union of the constituent gases of fuel with oxygen is what is known as "combustion." There is no other method of combustion of fuel in a furnace. Now, the more complete and perfect the union of the gases of the fuel with oxygen, the more perfect the combustion, and the more effective is the furnace in producing heat. The higher the temperature of the furnace, with a sufficient supply of oxygen, the more perfect is this union. If the combustion be imperfect by lack of oxygen or lack of heat, more or less of the combustible gases of the fuel pass unconsumed to the chimney and are wasted. This waste is frequently enormous, sometimes amounting to more than one-half the practically available heat value of the fuel used.

In an ordinary stove or boiler furnace it is necessary to open a door to admit the fuel. This admits a stream of cold air by which the temperature of the furnace is instantly reduced to a point below that essential for the ignition of certain of the gases; combustion of such gases ceases and they go directly to the chimney unconsumed. This waste goes on while the door is open, and continues after the door is closed, until the temperature is again raised to the point necessary to ignite the gases mentioned. Sometimes the air spaces in the grate bars are insufficient to admit the necessary quantity of air to furnish the oxygen required for the ignition of all the combustible gases, or the air spaces, while sufficient in aggregate area, may be so large as to admit the air in too large volumes, so that it cannot be sufficiently heated to unite with the fuel gases, and in such cases the result is in effect the same as in that of the open door—the gases that do not receive their due ratio of oxygen at a high temperature pass to the chimney and are wasted. In estimating the importance of this waste, it should be remembered that all fuel in the furnace must be converted to gas before it can be burned. No fuel is burned otherwise.

The Brightman mechanical stoker furnace is designed to prevent the waste of fuel indicated above. There are no feeding doors to be opened. The fuel is delivered by the shovel or (where a large quantity of fuel is to be handled) by elevator and conveying machinery, to a hopper placed across the front of the furnace at a convenient height above the floor. From this hopper the coal is pushed into the furnace mechanically, the opening through which it passes being kept constantly filled with the entering fuel and sealing the opening against the entrance of air. This avoids the disastrous effect of the open doors used in ordinary furnaces.

The coal entering the furnace is delivered to the top of an inclined grate surface composed of grate bars having a longitudinal reciprocating motion which, together with gravity, causes the coal to move gradually and continuously toward the lower and rear end of the grate. The coal is consumed during its continuous passage from the front to the rear end of this inclined grate.

The grate is composed of longitudinal bars half an inch thick set up edgewise, each bar having on either side horizontally projecting lugs or shelves which interlock with each other in such a way as to form horizontal openings through which air is admitted to the furnace. These openings are small but very numerous, and aggregate more than 50 per cent. of the aggregate grate surface. The motion of the grate bars keeps these air spaces open and free from ashes and cinders, so that a sufficient supply of air is insured. The air openings are small enough to insure a sufficient heating of each air stream to effect combustion. To appreciate the importance of these features, it is well to remember that of all the air that enters a furnace only one-fifth part is oxygen and combustible; four-fifths is nitrogen and absolutely incombustible. The oxygen only is available for combustion; the nitrogen necessarily passes through the fire and out of the chimney, carrying with it more or less of the heat generated by the combustion of the fuel.

Among the constituents of coal, carbon forms a large proportion. Under the influence of heat the carbon is dissociated from the hydrogen, oxygen and other gaseous elements composing the coal, and appears in the form of minute particles. These particles, when heated to a high temperature and brought into contact with oxygen, instantly combine with it, evolving great heat and forming carbonic acid gas. Carbonic acid gas is entirely colorless and transparent, and is the product of perfect combustion.

When a furnace door is opened a stream of cold air is admitted, which cools the gases and the particles of carbon so that the combination ceases. The particles of carbon are densely black, and discolor the carbonic acid, nitrogen and other gases and make smoke.

When a shovelful or more of coal is thrown into a hot fire, some of it is instantly decomposed by the intense heat, and usually a greater quantity of carbon is thrown off than can be supplied with the necessary oxygen for complete combustion, and the result is smoke.

Coal should be fed to a furnace constantly and at a

uniform rate, and the air should be admitted uniformly and in proportion to the rate of coal consumption.

When the coal, entering through the feed opening, reaches the front end of the grate in a Brightman stoker furnace, it is exposed to a high temperature from that moment until it is consumed. The hydro-carbon gases and the carbon particles are given off continuously and regularly, are abundantly and continuously supplied with oxygen at a high temperature, and the process of combustion is made constant and continuous, instead of spasmodic and intermittent. Gradually, the coal is deprived of its hydro-carbons and becomes coke. In this form it gravels from the top to the bottom of the inclined grate gradually, uniting with the oxygen entering through the grate until it is consumed. This movement of the fuel towards the rear is effected by the continuous motion of the grate bars, and is capable of perfect regulation and control.

Experience has demonstrated that in consequence of the uniform temperature maintained in a Brightman stoker furnace, the useful life of the boiler is very much prolonged. The intermittent character of the fire in ordinary furnaces is injurious to the boiler by causing sudden expansions and contractions of the metal, loosening of rivets and tubes, and boiler repairs are constantly required. It is the experience of those who have used these machines that boilers equipped with Brightman's stokers and properly operated do not require repairs.

The capacity of a boiler for yielding steam is usually largely increased by applying a Brightman stoker. The Howard Plate Glass Co., of Pittsburgh, who, having operated four of these stokers for a year, have just purchased and are now erecting sixteen more, state that the boilers from which, when equipped with common grates they, with careful firing took 100 H. P. each, now with the Brightman stokers yield easily 150 H. P. each. The stokers also show over 18 per cent improvement in economy of fuel.

The Brightman stoker is applicable to any form of steam generator, and in many other situations where a high temperature, regularity of heat and a clear, smokeless fire are required, such as acid stills, roasting furnaces, kilns, ovens, etc., etc.

The Brightman stoker will conveniently handle and burn all sorts of refuse, such as tan bark, chips, coal yard dust, coke screenings, manure, garbage, and in short, anything combustible.

It is applicable to old or new boilers. The power required to drive it is trifling, averaging less than one-quarter of one horse power for each stoker.

It is very durable ; there are scores of these machines that have now been in use over five years without any repairs whatever. It is a labor saver. In connection with the mechanical handling of coal and ashes it will save 80 per cent. of the labor required to attend a battery of, say, six or eight boilers. This machine is manufactured and sold solely by the Brightman Stoker Co., of Cleveland, O.

The delegates and attendants at the Convention will visit the works of the Short and Brush companies on the afternoon of the first day of the meeting. The invitation of the Short Co. includes all who are in attendance, and it is expected that there will be a large gathering at the works. Lunch will be served and guests will have an opportunity to examine the several departments of the Brush plant.

EXHIBITION NOTES.

WITH

PARTIAL LIST OF EXHIBITORS

AND

BRIEF MENTION OF SOME OF THE SUPPLIES TO BE SHOWN AT CLEVELAND.

Baltimore Car Wheel Works, Baltimore, Md.
Barnes Brake Co., Cleveland, O.
Billings & Spencer Co., Hartford, Conn.
Bodifield Belting Co., Cleveland, O.
Brightman Stoker Co., Cleveland, O.
Brooklyn Railway Supply Co., Stamford, Conn.
Brownell Car Co.. St. Louis, Mo.
Brill, J. G. Co., Philadelphia, Pa.
Bruce, F. E., Agent Stirling Co., Cleveland, O.
Cleveland Frog & Crossing Co., Cleveland, O.
Crossley Car Brake Co., Cleveland, O.
Davis & Cook, Watertown, N. Y.
Detroit Electrical Works, Detroit, Mich.
Dorner & Dutton, Cleveland, O.
Duplex Street Railway Track Co., New York.
Esmond Street Rail Co., New York.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Ford-Washburn Storelectro Co., Cleveland, O.
Fulton Foundry Co., Cleveland, O.
General Electric Co., Boston Mass., and New York.
Genett Air Brake Co., New York and Chicago.
Gilbert Car Manufacturing Co., Troy, N. Y.
Graham, J. H., & Co., Chicago, Ill.
Griffin Wheel & Foundry Co., Chicago, Ill.
Hathaway, A. G., Cleveland, O.
Hill Clutch Works, Cleveland, O.
International Register Co., Chicago, Ill.
Jewell Belting Co., Hartford, Conn.
Johns, H. W., Manufacturing Co., New York.
Johnson Co., Johnstown, Pa.
Johnson Electric Co., Cleveland, O.
Jones' Sons, J. M., West Troy, N. Y.
Kuhlman Co., Cleveland, O.
Lamokin Car Works, Philadelphia and Chester, Pa.
Lewis & Fowler Girder Rail Co., Brooklyn, N. Y.
Lewis & Fowler Manufacturing Co., Brooklyn, N. Y.
Loomis, H. N., Hightstown, N. J.
Mark & Sterling, Cleveland, O.
McGuire Manufacturing Co., Chicago, Ill.
Meaker Mauufacturing Co., Chicago, Ill.
Mehling Car Co., Cleveland, O.
Mitchell-Brandt Copper Co., Erie, Pa.
Morton Safety Heating Co., Baltimore, Md.
National Carbon Co., Cleveland, O.
New Departure Bell Co., Bristol, Conn.
New Process Raw Hide Co., Syracuse, N. Y.
New York Car Wheel Works, Buffalo, N. Y.
Nuttall, R. D., Co., Allegheny, Pa.
Okonite Co., Limited, New York.
Peckham Motor Truck & Wheel Co., Kingston, N. Y.
Pennsylvania Steel Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Pittsburgh Steel Hollow Ware Co., Pittsburgh, Pa.
Pomeroy & Fischer, New York.
Railway Equipment Co., Chicago, Ill.
Reliable Manufacturing Co., Boston, Mass.
Robinson Electric Truck & Supply Co., Boston, Mass.
Robinson Machine Co., Altoona, Pa.
Rochester Car Wheel Works, Rochester, N. Y.
St. Louis Car Co , St. Louis, Mo.
St. Louis Register Co., St. Louis, Mo.
Schieren, Chas. A., & Co., N. Y.
Scott, Charles, Spring Co., Philadelphia, Pa.
Short Electric Railway Co., Cleveland, O.
Sperry Electric Railway Co., Chicago, Ill.
Stephenson, John, Co., Limited, New York.
Taylor Truck Co., Troy, N. Y.
Walker Manufacturing Co., Cleveland, O
Wall, P., Supply Manufacturing Co., Allegheny, Pa.

Walworth Manufacturing Co., Boston, Mass.
Washburn & Moen Manufacturing Co., Worcester, Mass.
Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

Convention Notes.

The John Stephenson Co., of New York, will be represented, as usual, at the Convention, by D. W. Pugh.

The Stratton separator made by the Stratton Separator Co., of 32 Cortlandt Street, New York, is giving great satisfaction in power stations.

In the plant of the Brooklyn Street Railway Co. are a number of the well known Goubert feed water heaters, and they are used with great success.

The Railway Equipment Co., of Chicago, will be represented at the Convention by W. R. Mason, general manager, W. L. Adams, J. F. Macartney and J. S. Gustin.

A. O. Schoonmaker, of New York, is calling special attention to the superior qualities of East India mica for insulating purposes. It is firm, strong, free from iron and splits easily, qualities that commend it to those engaged in electrical work.

The Haas Distributing Car Heater Co., of Grand Crossing, Ill., has put on the market a new heater for which especial claims are made. The fact that it takes up little room, and that by its use heat is thoroughly distributed, are special features.

Delegates who visit Chicago will be likely to go to Pullman to examine the Patton motor in operation there. One of the last motors recently drew three loaded freight cars over the Pullman tracks at a rate of eighteen miles per hour. The motor will be shipped to Louisville.

A new electric wiring computer has recently been devised by William Cox, by means of which the sectional area and number can be accurately ascertained. It consists of foundation plate with revolving disk, both graduated. The device has been sold to the Okonite Co., of New York.

Many of those who attend the Convention will go via the Pennsylvania road. This line offers such superior facilities that it is popular with travelers. The Pennsylvania company is noted for its elegant passenger coaches, and the excellence of the service in the dining cars, and the beauty of the scenery along the lines is known the world over.

It is expected that many of the street railway men will visit Chicago to attend a part of the exercises incident upon the dedication of the World's Fair buildings. Those who make the trip will probably find it interesting to notice how well adapted the Accelerator cars on the North Side system are for the quick and safe transportation of crowds of people.

Among the cars to be exhibited at the Convention are the following: Prof. Short's private car, made by the Gilbert company, recently redecorated and mounted on an Anger truck; Short gearless car mounted on a Short truck; Short single reduction car mounted on Brill truck; Lamokin car with Robinson radial truck; Brownell car with Brownell truck; St. Louis Car Co.'s car.

The Woodbridge & Turner Engineering Co., of New York, will be, as usual, represented at the Convention. The company has made a fine record, as the roads which they have built have been planned in accordance with the best ideas of engineering practice. The company takes contracts for the complete equipment of electric railways, and has several important roads under construction at the present time.

In power stations, steam pipes are inspected carefully and kept in perfect condition, but the covering is frequently wholly neglected. One of the best coverings in the market is found in the combination of carbonate of magnesia and asbestos. It is exceedingly light, and therefore contains a relatively large amount of entrapped air, which is the best non-conductor of heat. Coverings of this kind, manufactured by Robert A. Keasbey of New York, are giving entire satisfaction.

The Jarvis Engineering Co. of Boston, at the present time is calling attention to a number of specialties. The Sheffield shaking grate has met the requirements of steam users, and is giving satisfaction where it is in use. The Jarvis patent furnace, rocking grate bars, steam pumps, pop safety valves, sectional pipe covering, injectors, etc., have made the company famous. The company has recently installed special heavy engines for railway work at Millbury and Worcester, Mass.

The Railway Equipment Co., of Chicago, will exhibit at the Convention a full line of their latest overhead equipment. This material has never been illustrated or advertised, for the reason that it has been impossible to fill the very large orders received this season. A large number of the best contracts awarded this year have been given with the stipulation that this material shall be used, and owners of railroads are assured of the best class of construction when using the new Type G material of the Railway Equipment Co.

Frank A. Magee, of the E. S. Greeley & Co., of New York City, will represent his company at the Convention. The company has been in the supply business for twenty years, and is eminently fitted by this extended experience to provide the material best adapted for use in all branches of electrical work. The company has of late received many large orders for line material and construction supplies for street railways. Many of the exclusive specialties handled by the company have been found in actual experience to possess great merit.

The Short Electric Railway Co. will make an interesting exhibit of motors and generators. The display will illustrate in a very striking manner the development of the Short Apparatus. The single reduction motors of thirty horse power and twenty horse power will be shown, as well as a standard fifteen horse power motor. The three forms of gearless motor will be exhibited, *i. e.*, the type of 1890, which was shown at Pittsburgh, the 1891 type and the latest machine of twenty-five horse power, which will be seen for the first time at this meeting. A generator of sixty-six horse power will be exhibited, and a 280 H. P. will be run as a motor.

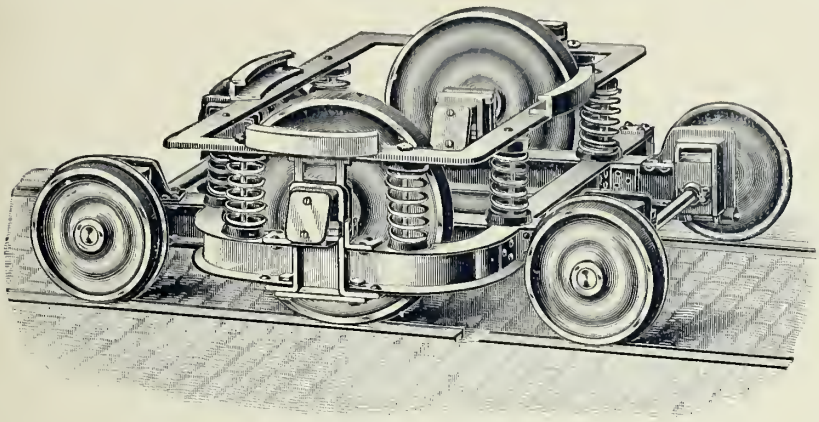
The Railway Equipment Co., of Chicago, have brought prominently before the public the advantages of electric heating. Mr. Mason, the manager of the company, has made this branch of the business somewhat of a hobby, and last season equipped with heaters over 100 electric roads. Believing that a large sale would be the result of putting on the market a successful and economical electric heater, not only for street car use but for residences and domestic purposes generally, he has secured for the company the exclusive right to manufacture and sell throughout the world the patented devices for heating, invented by Mr. T. Ahearn of Ottawa, Can. All of these devices have been in continuous operation during the last year. A large and finely equipped factory has been started by the Railway Equipment Co. for the manufacture of all such devices, and large orders have already been received.

Silicon bronze when used for trolley wires possesses, it is claimed, many substantial advantages. Among these may be noted: First, a tensile strength of 80,000 lbs. per square inch, which is nearly twice that of large diameters of hard drawn copper wire. Second, a ductility of thirty to thirty-five twists in six inches on a No. 4 B. W. G. wire. This far exceeds the standard of any other metal of equal strength and diameter. Third, great resistance to wear, as a six and a third mile road operated since construction equivalent to 800,000 car miles, shows no appreciable wear on straightaway track. Fourth, absolute resistance to corrosion, which insures a perfect contact, even where the wire is used in mines and under other similar trying conditions. Fifth, freedom from breakage by surface abrasion, a frequent source of trouble with hard drawn copper wire. The wire is manufactured only by the Aluminum Brass & Bronze Co., of Bridgeport, Conn. J. L. Pryor represents the company in New York, at 53 Chambers Street, Stewart Building.

The Esmond Rocker-Link Cantilever Truck.

Among the exhibits at the coming Convention will be a model of the above named truck, an illustration of which is given herewith. This is a type of six wheel truck so designed that the principal weight is carried upon the central wheels, while the front and rear wheels, which may be of the same diameter as the central wheels or smaller, perform the ordinary functions of a pony truck; and at the same time, owing to the presence of rocker links upon the axle boxes, take up or destroy the lateral shock that ordinary trucks experience when passing

snaky track or entering curves. They also serve to keep the central wheels, which are ordinarily flangeless, upon the track. The front and rear axles are rigid vertically and longitudinally, but, owing to the rocker links, have a free lateral movement independent of each other or of the middle axle which is rigid to the truck frame in all directions.



ESMOND TRUCK.

The horizontal movement of the front and rear axles does not tend to raise the truck from its true horizontal line, however, as is the case with the ordinary swinging links, but the movement is against the gravity of their load, the same as if against a swinging link, so that the central wheels always remain in contact with the track, and their tractive force is not weakened.

The frame being practically a cantilever balanced upon the central wheels and provided with springs, and having the spiral springs placed in the bottom of the frame and not, as ordinarily, between the axle box and truck beam, does not permit the front or rear wheels to drop into depressions or joints in the rail, and these wheels also in turn carry the central wheels over depressions in the same manner, which prevents pounding at joints. The central wheels can be mounted on the same axle, or preferably, as in the illustration, on independent axles with interior journal boxes, which facilitates their movement upon curves.

The truck is adapted to either steam, cable or electric traction, there being ample space within the frame for mounting the grip or the motors, which may be arranged to work independently on the separate axles or upon a single main driving axle.

The device is the invention of Mr. E. R. Esmond, and is being manufactured by the Esmond Street Rail Co., 106 Broadway, N. Y.

Wilson's Improved Auger-Feed Sand Box.

This sand box (Fig. 1), the makers claim, will operate under any and all conditions, whether the sand is dry or damp, packed or loose, or even slightly frozen, provided it is free from stones and pebbles. The mechanism consists of a spiral conveyor or auger (Fig. 2), which is located in the box and forces the sand out into the spout, but sand is delivered only when the auger is turned.

The conveyor, which is sufficiently large to prevent the sand from arching, is revolved by means of a countershaft having a knuckle joint, to which power is transmitted through bevel gears from a vertical shaft and hand lever, which is located on the dash rail in about the same manner as is the brake lever. The box or hopper, which is larger at the bottom than at the top to prevent the sand from becoming lodged, may be attached to any type of car, and in any position under the seat, on the right or left as is most desirable, and is filled through an aperature having a drop cover in the seat foot board, as shown in Fig. 1.

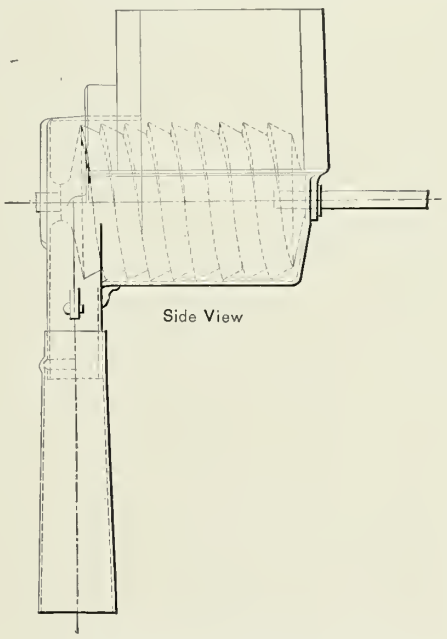
This is known as the Wilson Sand Box, and is manufactured by J. M. Jones' Sons, car builders, of West Troy, N. Y., who will have it on exhibition with other appliances at the Cleveland Convention.

Pennsylvania Iron Works.

By this title we do not refer to the iron industry of the state of Pennsylvania, for this would be a subject of such general import that few would care to read it, but our article relates to the manufacturing plant and business of the Pennsylvania Iron Works Co. in Philadelphia, which, although a comparatively young company, has attained great prominence in the manufacture of cable railway machinery, and as contractors for the designing and installation of extensive cable railway plants.

Although cable railway work is the most important branch of the company's business, it is not by any means confined to this line alone, but includes gas works machinery, engines, refrigerating and ice machinery, foundry, pattern and general machine work.

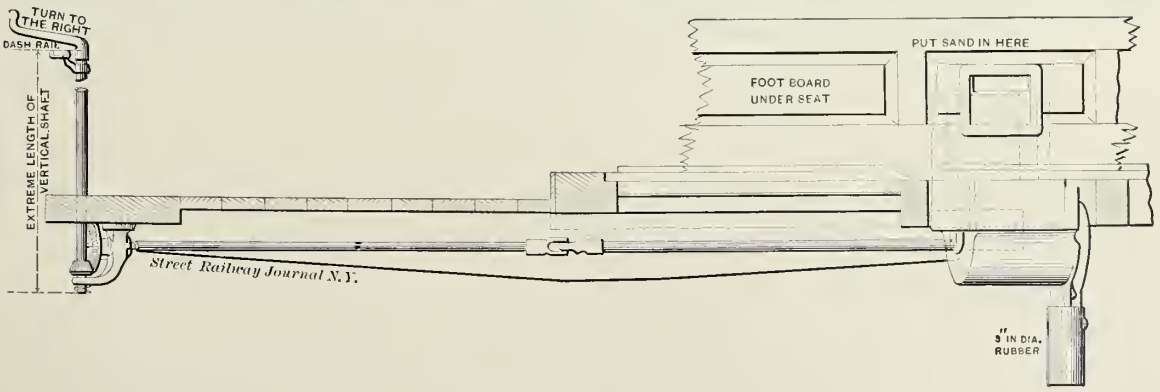
The works and general offices of the company are located at Fiftieth Street and Merion Avenue which, having been recently enlarged, embrace a group of large buildings containing mammoth floor space,



AUGER-FEED SAND BOX—SIDE VIEW.

and on the designing and arrangement of which the best architectural talent of the city was engaged. The different departments and offices are so located on the first and second floors that ready access is had from one to the other, and are known as the machine shops, Nos. 1 and 2, erecting shop, foundry and ice machine department.

Building No. 1. It is 80 × 100 ft. and contains, on the first floor, machine shops Nos. 1 and 2. The former occupies about one-half of



AUGER-FEED SAND BOX.

the ground floor, and divides the second floor with the space allowed for the superintendent's office. Its equipment consists of various sizes of medium planers, drill presses, shapers, lathes, boring mills and special machinery. The third floor of this building is occupied by the draughting room and pattern shop.

Machine shop No. 2 starts in at the lower end of the building, and runs at right angles to machine shop No. 1, out to the railroad tracks, again making a right angle turn towards and to the end of the front of the building; part of this shop is occupied as the tool room, store room, engine and boiler rooms, while the rest contains large lathes, boring mills, etc., to which is brought from the foundry, through the erecting shop, the largest castings for finishing. A traveling crane, of two tons capacity, spans the width of this shop, runs its entire length and is in height forty feet from the floor. The shipping of the heavy work is done at the track end of this shop.

Next in line comes the erecting shop, a building 80 × 200 ft.; in it are located the largest lathes, boring mills, drill presses, etc., as well as pit lathes, etc. A traveling crane of thirty tons handles all the material brought to this building, and here the fitting up, testing, finishing, etc., of all work takes place.

One of the most important buildings is the foundry which occupies a floor space of 100 × 200 ft.; this building also contains a traveling crane of thirty tons, and one of fifteen tons capacity, as well as three of the largest "Colliau" cupolas with a melting capacity of 100 tons per day, besides the latest appliances for core making and moulding machines.

Across the street, the machine, blacksmith and welding shops are located; a space of 75 × 100 ft. is occupied here, and within the building the most adequate machinery has been supplied for the purposes intended. From the foregoing description the reader will learn that the equipment is such as enables the company to handle its products as expeditiously as possible, as well as to insure economical results in this respect.

To the westward of building No 1, there now stands the new erecting shop, 230×65 ft. and 40 feet high between the floor level and the crane track.

This building was finished in August 1892, and contains a lathe pit capable of turning at one time two driving wheels up to forty feet in diameter, ten feet face and weighing 150 tons each. This shop also has an electrical traveling crane of Morgan make, twenty-five tons capacity and a movement of 400 ft. per minute, a Betts fourteen foot boring mill, a Bement 122 in. planer, and a Bement seventy-two foot lathe, besides slotting machines, turret lathes, milling machines, drill presses, etc.

This addition was found absolutely necessary, inasmuch as the company found that the building of the celebrated Boyle compression machines was attaining such proportions that it was absolutely imperative to increase the plant to take care of the rapidly growing business in this direction. These machines are made of from one ton ice making to 200 tons refrigerating capacity, and since the first of the year 1892, ten plants have been contracted for and placed in satisfactory operation, aggregating 1,000 tons capacity.

In the line of engine building, the company makes a specialty of the improved Greene engines, and these are built for severe service and are fully guaranteed, as none but the best materials and workmanship enter into their construction. The same claims apply with equal truth to all the products of the company, and this is the chief reason why the firm has attained its wonderful success.

As above noted, the products which have contributed most to bring the reputation of the company to the attention of street railway men are their extensive cable contracts, this company having been the designers, contractors, builders and erecters of all the machinery contained in the cable power houses of the Broadway & Seventh Avenue Railroad Co. and the Third Avenue Railroad Co., of New York; the Madison and Washington Streets power stations of the West Chicago Street Railway Co., the two new stations now building, of this company, and the three power stations of the Baltimore Traction Co., Baltimore, Md., the details of which have been given in various issues of the STREET RAILWAY JOURNAL.

The rapid and substantial growth of the company during the past six years, prompts our curiosity to learn something of its history, and upon inquiry we find that as early as 1886 the Pennsylvania Iron Works was located at Reading, Pa., and was operated by B. W. Grist & Co., Limited, and embraced a foundry and machine shop, the manufacture of self contained engines being a specialty. During the same year, in order to increase its facilities for the rapidly increasing general business, and in order to cater to the street railway trade, the firm having been incorporated under the laws of the State of Pennsylvania, and being aided by fresh capital, moved to Philadelphia and began the erection of buildings on the site above described, and in 1888 and 1889 the buildings were enlarged and the equipment increased, the last addition having been completed as late as August, 1892.

The prime mover and controlling spirit of the company is Mr. Benjamin W. Grist, now general manager and chief engineer of the company. Mr. Grist was born in Boston, England, in 1842, and learned the engineering trade in his native town, and gained a reputation as an "emergency" man. In 1868 he moved to America, and secured employment with Bement & Sons, in Philadelphia. Subsequently he was in the employ of the Weimer Machine Co., of Lebanon, Pa., the Lebanon Manufacturing Co., as superintendent, and the Mallet Foundry & Machine Co. of the same place, until he engaged in business for himself, as above noted.



COOK PLUMB AND LEVEL.

But it is not to the efforts of the general manager alone that the company has been brought to its present position, but as well to Mr. W. L. Elkins, Jr., who, with others, has furnished the sinews of war, and whose energy has helped to bring the company to its present position of recognized importance. The services of the assistant engineer, Mr. E. A. Moore, have also contributed largely to the success of the firm, while the financial affairs are ably conducted by Mr. Howland Coit, secretary and treasurer.

Cook's Patent Levels.

The levels which are shown in the accompanying illustrations differ in several important particulars from the ordinary form. They are manufactured in accordance with the Cook patent, and are made by Davis & Cook, of Watertown, N. Y. One of the illustrations is of a plumb and level, and the other of a railway level. The tube carrying the bulb is set in a frame which is faced on each side with glass and can be seen from any position and from either side. The bulb tubes are also arranged so as to show their entire length, by which means the bulb can be seen from a distance and from overhead. The inside rings are made so as to revolve on their own centres for adjustment, and cannot get out of adjustment unless the set screws are moved. The levels are made in various sizes.



COOK TRACK LEVEL.

The Connelly Gas Motor.

In view of the recent adoption of the Connelly gas motor as a substitute for horses on the West and North Sides street car systems of Chicago, a brief history of this last successful competitor of the trolley and storage battery may not be out of place, especially when the magnitude of the intended change of power is considered, involving as it does the largest system of street cars in this or any other country, and the prominence which will be given to it by the World's Fair next year. Although the rights have been actually purchased by Mr. Yerkes for his companies, and work is being vigorously pushed upon the first

lot of these motors intended for one of the North Side lines (the first to be equipped) these facts have not been given the prominence which their importance deserves, and this is due not only to the well known conservative policy of Mr. Yerkes, but as well to the commendable spirit of the Connelly Motor Co., who desire to have a line fully equipped with motors, before calling the attention of the world to the merits of their system.

The adoption of a gas engine as impelling power for street cars did not originate with the inventor of this motor, as it had been tried before only to meet with disastrous failure. It remained for Mr. Connelly to supply the "missing link" in the solution of the problem, which was to apply the unvarying speed of a gas engine to the varying speed of a street car, and this he has done with most ingenious mechanism.

The gas engine employed in this motor is of the compound type, and exerts, it is claimed, about one half more power than other gas engines of the same weight. The special mechanism employed to transmit the power from the engine to the axle is positive in action, noiseless and durable. It prevents giving shock to the car in starting, and, above all other advantages, transmits the *maximum power* of the engine when driving the car at the *minimum rate* of speed. This is the distinguishing original feature of the Connelly system, and is what enables a Connelly motor of ten horse power to ascend grades and perform work impossible of accomplishment with other motors of thirty horse power. This was clearly demonstrated in Chicago by a Connelly motor taking a loaded trailer up the Dearborn Street Bridge grade (the heaviest in the city) with comparative ease, while the Belgium steam motor of three times the power was utterly *unable to propel itself* up the same grade.

The average horse car driver is fully competent to operate the motor which is controlled by one lever. The fuel consumed may be either oil gas, ordinary city gas, or naphtha vapor, according to the relative cheapness of each at such locations where the motor is employed. Sufficient gas can be carried for three hours' run, and the reservoir can be recharged in less than one minute. The record of several months' running of a motor in Chicago in regular service showed an average consumption of 1,000 ft. of gas for each seventy-five miles run. The average cost of city gas for power purposes is about $1 per 1,000 ft. In Chicago natural gas is now being introduced, and will be used for operating the motors as long as the supply lasts. With this gas the daily cost of operating motors will be remarkably small.

It is now about seven years since Mr. Connelly first began to put his ideas into metal, and the result, the year following, was a motor which was run experimentally for some time on the Bath Beach road in Brooklyn. Defects of first construction were apparent however, and this was followed by a second and afterwards a third machine, each vastly superior to the one preceding.

About three years ago the attention of Mr. Yerkes was drawn to the Connelly motor, and in consequence two new motors were sent to Chicago and were operated for some months on the Lake Street line of the West Side, hauling passengers daily. Several mechanical defects and the more or less noisy working of the machinery served as obstacles to their adoption. The year following another motor of far better construction was put into service. This made a very fine record against adverse circumstances of track and inclement weather, and proved to the entire satisfaction of Mr. Yerkes and his officials that mechanically the motor was a practical success, but the odor from the exhaust made him hesitate to apply to the city authorities for permission to use it on their lines.

Nothing daunted, the Connelly company then applied themselves to the elimination of this remaining barrier to their success, and last fall another motor was sent to Chicago, this time being put in operation upon the North Side. The record of this last machine is worthy of remark, as showing the severe trial to which its powers were put. Running first upon different horse lines in the outskirts of the city until its reliability was demonstrated, it was then run for a week through the heart of the business section on Dearborn Street, crossing the Dearborn Street Bridge, as already referred to, and which, it may be added, has a double curve upon the grade. It was then put to work upon the Clark Street cable line at night, running on cable time, and regularly hauling passenger cars. Its final trip was over the Wells Street cable line during the daytime, hauling two loaded trailers at cable speed, and between cable trains, demonstrating its ability to do more than it was originally designed to accomplish.

As a result of this long and thorough series of trials which had lifted the motor out of the "experimental" into the "practical", Mr. Yerkes purchased from the Connelly Motor Co. the entire rights for the state of Illinois, and immediately started a factory, which is to-day but the beginning of a large establishment, and it is his intention to build these motors as rapidly as possible, and lose no further time in replacing all the horses at present hauling cars upon his combined systems.

In a recent interview with a reporter of the *Chicago Tribune* the day after his return from Europe, Mr. Yerkes upon being asked if he had discovered anything new concerning motors in his travels abroad replied, "No. You do not have to go abroad to learn about motors. The only practical motor that I have knowledge of is the gas motor which we are using in Chicago. The gas motors we are building and using are not for our cable lines, but we intend to equip the feeding lines with them, and so get rid of all our horses."

It is expected that the Larrabee Street Line upon the North Side will be in operation with Connelly motors some time in October, and will then afford the street railway world an opportunity to judge for themselves, but in view of what has already been accomplished by it, and the fact that Mr. Yerkes has concluded to adopt it for his vast system, after experimenting for years certainly indicates that the long looked for independent motor is at last a practical commercial success.

A Steel City.

The site of the present city of Steelton, Pa., included, a score of years ago, nothing but farm land, and no one realized that the locality possessed splendid facilities for the prosecution of a great manufacturing industry. In the light of present knowledge the admirable situation can be readily appreciated, and its natural advantages afford an abundant explanation of the city's wonderful growth. It is located three miles from Harrisburg, on the banks of the Susquehanna, and its shipping facilities afforded by the main line of the Pennsylvania, a branch of the Philadelphia & Reading and the Pennsylvania Canal, are unsurpassed. To the north and south are found immense quarries of limestone suitable for building purposes, and for flux for iron furnaces. These advantages, together with the very liberal encouragement of the Pennsylvania Steel Co., have been instrumental in building up the place, and to-day it has a population of between 9,000 and 10,000 inhabitants. The town is well laid out with finely graded streets. The dwellings are handsome and substantial. The High School is one of the most complete public school buildings in the country. This structure was presented to the city by the Pennsylvania Steel Co., at the suggestion of the president, Major L. S. Bent.

This company was organized June 26, 1865, with a capital stock of $200,000, which was subsequently increased to $2,000,000. It was decided to adopt the Bessemer process of making steel, and excavations for the building were begun in January, 1866. The Bessemer plant was ready for operation in May, 1867, and on the twenty-fifth day of that month were made the first Bessemer steel ingots ever produced in the state. The total product for the first two years was 5,186 tons, which, while notable at the time, seems now quite inconsiderable; in fact, the average product for one month now exceeds the whole product for the first four years.

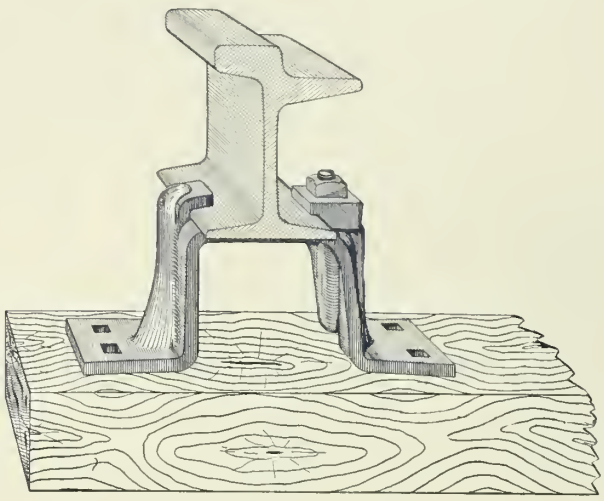
The land originally secured for the works embraced about eighty acres, but this has been increased by subsequent purchases to about 160 acres, all of which lies between the Pennsylvania Railroad and the Pennsylvania Canal. Measured along the line of the Pennsylvania Railroad, the plot extends nearly a mile and a half.

The amount of metal required for the furnaces, monthly, varies from 25,000 to 30,000 tons. The movement of this vast amount of material necessitates extensive facilities, and the company has over twenty locomotives of various sizes running on tracks whose aggregate length is thirty-five miles. The number of freight cars received and dispatched in some weeks exceeds 2,500.

The pay roll of the company embraces over 4,000 names, and the annual disbursement for labor exceeds $1,500,000. It may be safely estimated that over 16,000 persons derive their support from this company's disbursement for labor alone. The works of the Maryland Steel Co. near Baltimore, an outgrowth of the Pennsylvania Steel Co., have been equipped with the most approved machinery and form the most complete plant of the kind in the United States, if not in the world. This company now handles all orders for heavy T rails, leaving the Steelton plant free to take up the manufacture of special shapes, light T rails, girder rails and other street railway appliances.

The supply of pure iron ore indispensable for the production of the requisite quality of iron necessary for the manufacture of street railway rails is obtained principally from the inexhaustible Juraqua

mines in the island of Cuba, which are owned in part by this company. A considerable quantity of ore is also obtained from Spain, Portugal and Africa. The ore is melted in four blast furnaces, and is then cast into pigs. The melted iron being released from the "blast



STEELTON RAIL CHAIR.

pots" runs down the centre trough, and branching out quickly fills the rows of moulds. Water is then played on the iron, and after being sufficiently cooled the pigs are broken loose from the moulds. The iron is next transported to the Bessemer mill.

In the converting department of the Steelton works the pig iron is melted in cupolas to insure the proper commingling of the various quantities of iron, and the metal is tapped from the cupolas into large receiving ladles mounted on scales, by which the contents is weighed. The ladle is elevated by a powerful hydraulic crane to such a sufficient height that the metal is discharged into the troughs or "runners," in which the metal is conveyed into the converting vessel.

The converters are large, heavy, egg-shaped appliances made of steel, lined with refractory material for withstanding heat, and provided with axles or trunnions on which they may be turned by hydraulic apparatus as the process requires. The lower part or bottom of the converter is made of perforated brick, called "tuyeres," through which the air passes into the converter, the air being conveyed by passages extending through the trunnions and connected to pipes leading from the blast engines.

The *fused* metal that flows into the mouth of the Bessemer converter must be transformed, but the process must not be carried too far, but must be arrested at the exact point where the iron becomes steel, as indicated by the color and quantity of the flame. The powerful blast of air required for this work—twenty-five to thirty pounds to the square inch—must always be sufficient to overcome the weight of the metal over each opening of the tuyeres. The metal having become steel is ready to be cast into ingots.

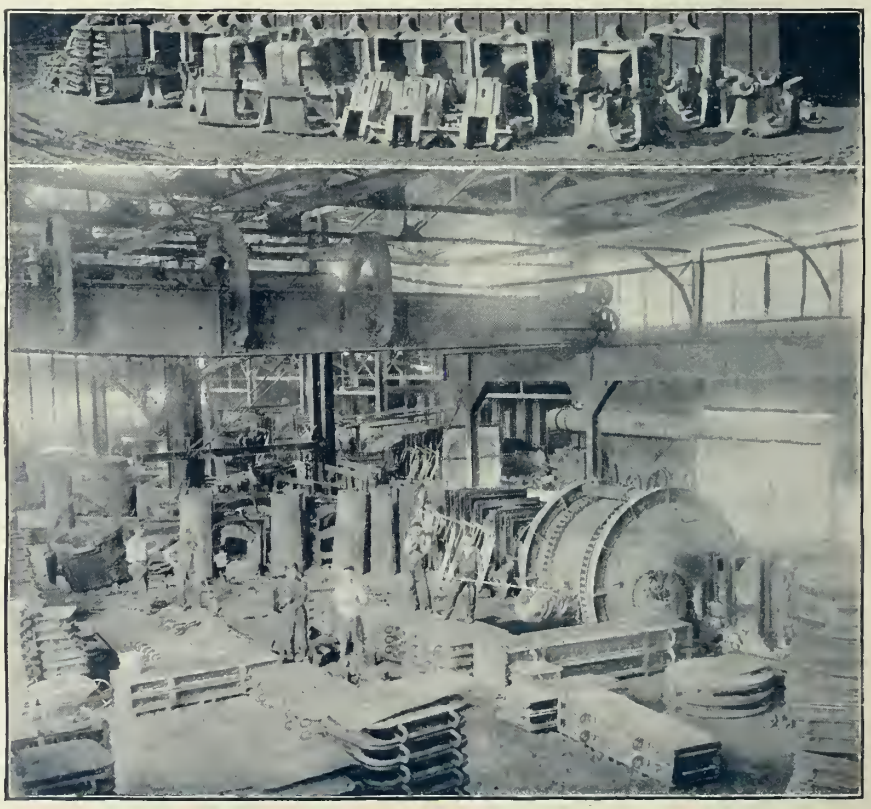
In front of the converters are circular pits into which the iron moulds are placed for the reception of the steel. The ladles into which the steel is poured are swung over the moulds and the steel is discharged into them through an opening in the bottom of the ladle. Each ingot contains sufficient metal to make several rails. After the steel has been in the moulds long enough to become congealed and sufficiently cool for handling, the moulds are stripped off and the ingots are loaded on cars for removal to the mills for rolling.

Each separate lot of steel is called a heat and receives a number. A sample is taken for chemical analysis and the number is finally stamped on the finished rails or other product into which the metal is worked. A careful record is made of the quality of the metal and other material facts relating to each heat. The handling of the ingots, ladles, moulds, etc., is effected by powerful hydraulic cranes.

The ingot now passes to the rolling mills which are located in a very handsome and substantial metal building, 810×200 ft. The ingots are reheated before blooming, the handling in and out of the furnace being effected by hydraulic cranes. The rolls of blooming mill No. 1, where all the ingots for girder rails are made into "blooms," are three-high and thirty-four inches in diameter, and driven by a massive upright engine of 600 H. P. The rolls are provided with the Fritz blooming table, by which two men are able to effect all the necessary handling of the ingots in and out of the rolls and deliver them after rolling to the massive shears, where they are cut into lengths suitable for rolling into rails. The blooms are now taken immediately to the heating furnaces adjacent to the rail rolls while as hot as possible, and are conveyed directly to the heating furnace on iron cars hauled by small locomotives. After being heated to the proper degree, they are placed on the tables or carriers and carried to the rail rolls operated by two powerful engines. After passing through the rolls nine to thirteen times, a bloom of steel, six or seven feet long and about seven inches square is transformed into a thirty foot length of girder rail ready for straightening and drilling.

The operation of rolling being finished, the rail is carried on rollers to a powerful and rapidly driven circular saw which at one sweep cuts and squares both ends of the rail. The rails for thirty foot lengths are cut about six inches longer to allow for shrinkage. From the saws the rails pass to a cambering machine, by which they are slightly curved, after which they are distributed on hot beds and allowed to cool. When cold they become nearly straight, owing to the unequal contraction between the heads and the base.

The next process is that of straightening the rails, which requires more careful manipulation than any of the other steps in the manufacture. The machines used for this work operate in a manner similar to that of die punches, and the rail is moved back and forth by hand under the continually moving arm of the press. Just the right bend is given to the rail by placing a chock of the proper thickness between the rail and the descending head. A few pinches here and here and the "kink" is quickly taken out. Holes are now drilled in



OPEN HEARTH FURNACE AND CASTINGS FOR EDISON MOTORS.

the end of the rail for joint plates, tie rods and bond wires. After being tested and accurately measured, the rails are ready for shipment or storing in the stock yard. Automatic loading machines are provided, by which the rails can be loaded directly on freight cars.

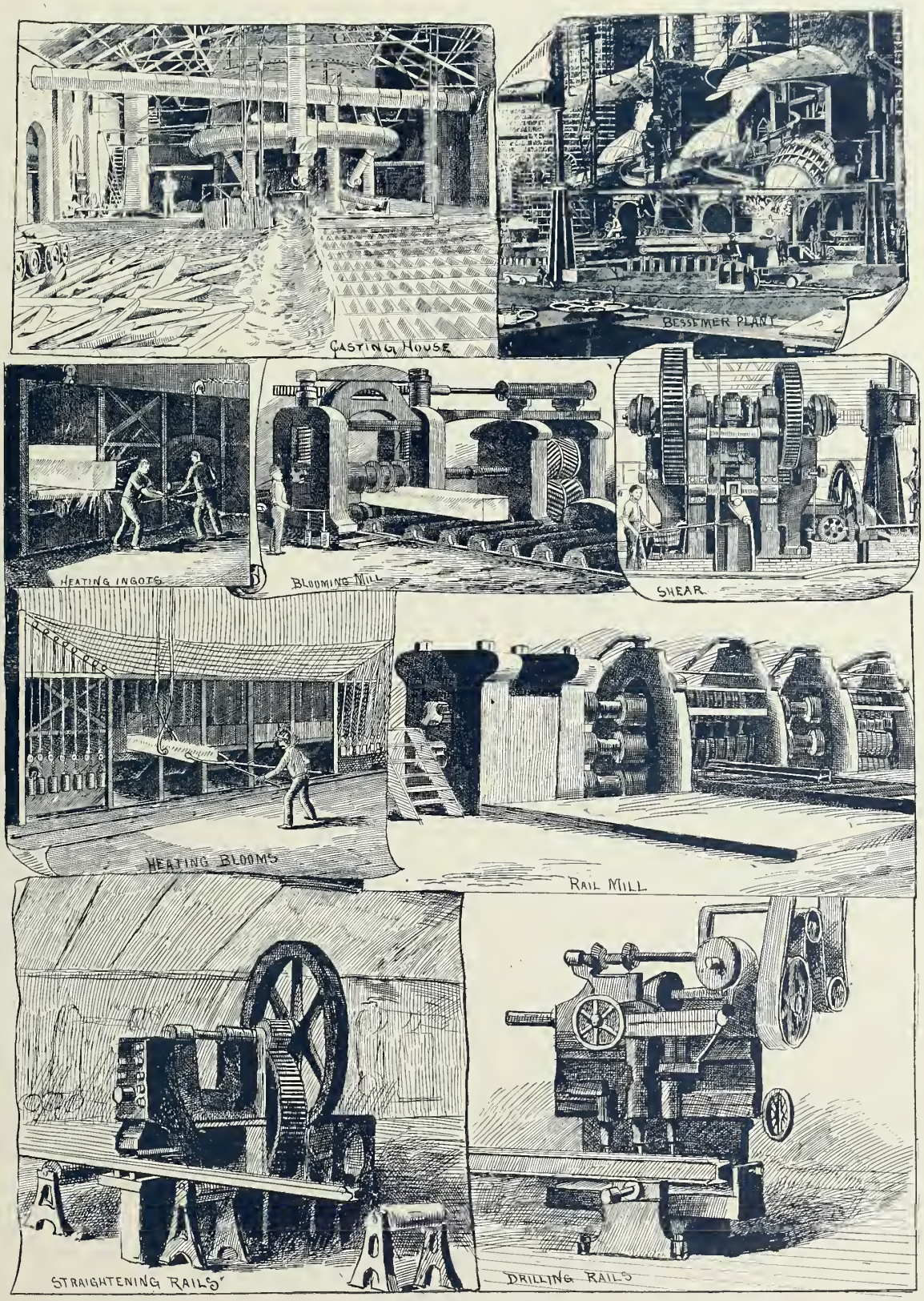
The tests applied by the Pennsylvania Steel Co. are exact, and eliminate almost the possibility of error. Every stage in the manufacture is under the supervision of an inspector, and if a flaw is discovered the work is condemned. The finished rails are subjected to a rigid inspection, and those not strictly up to the standard of "first class" are

rejected and classed as "seconds" which are sorted, and those having good heads are sold at a reduced price, their wearing capacity being ample for sidings and places where light traffic only is required.

Among the most important of the numerous departments of this work are the frog, switch and signal shops. This department is fully equipped with the most approved machinery. The shops are located in a handsome iron and steel building, the ground floors of which give a continuous floor space of 600 ft. in length and from 78 to 145 ft. in width.

One of the specialties manufactured by this company is the Steelton rail chair. This device is drop forged from the best quality of open hearth steel, and its method of fastening, shown in the cut, has proved under severe trials to be perfectly secure, and has shown a capacity to stand a vertical load of 32,000 lbs.

The company has in the course of construction a new open hearth plant and slabbing mill equipped with six of the most approved style of open hearth furnaces. This mill will be capable of producing universal slabs of any size desired.



SKETCHES IN THE PENNSYLVANIA STEEL WORKS.

Devices for Line Construction to be Exhibited by the General Electric Co.

In addition to motors and other apparatus to be exhibited at the Cleveland Convention, the General Electric Co. will show a new line of devices for overhead line construction for electric railways. The railway supply department of the company has been experimenting during the last few months with a new insulator band, and some of the results are embodied in these new construction parts. The characteristic feature of these new devices lies in the fact that the material used for insulation is solid sheet mica. This material is recognized as possessing the highest insulating qualities of all substances used in the manufacture of electrical devices, and, in addition, it will not deteriorate or disintegrate from age or the effects of weather.

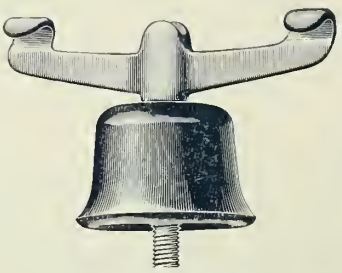


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CAT. NO. 16692.

SINGLE CURVE BELL FOR AUTOMATIC EAR.



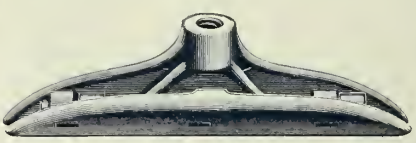
CAT. NO. 16686.

STRAIGHT LINE BELL INSULATOR FOR STANDARD EARS.



CAT. NO. 16698.

BRACKET BELL INSULATOR FOR AUTOMATIC EAR.



CAT. NO. 16723.

AUTOMATIC EAR.



CAT. NO. 16694.

DOUBLE CURVE BELL INSULATOR FOR STANDARD EARS.



CAT. NO. 16704.

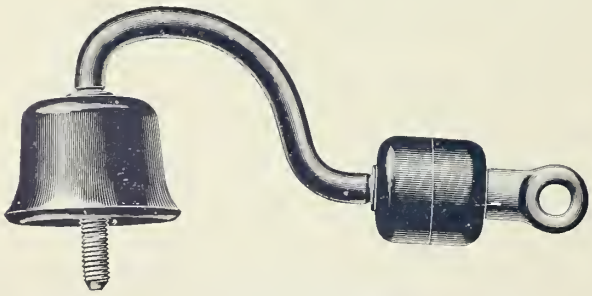
CEILING INSULATED SUSPENSION FOR AUTOMATIC EAR.



SINGLE CURVE INSULATED SUSPENSION FOR AUTOMATIC EAR.

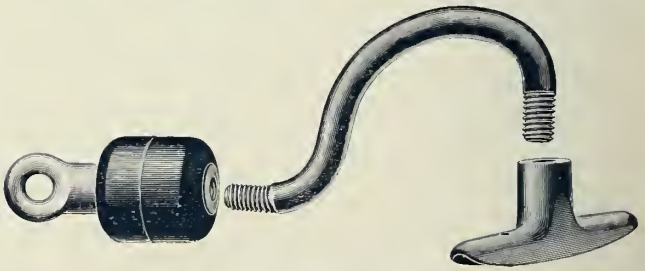


DOUBLE CURVE INSULATED SUSPENSION FOR AUTOMATIC EAR.



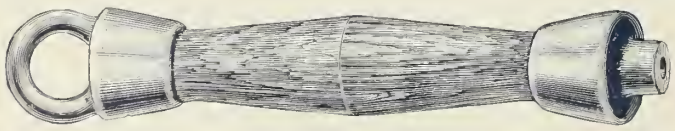
CAT. NO. 16718.

DUPLEX INSULATED SINGLE CURVE SUSPENSION FOR AUTOMATIC EAR.



CAT. NO. 16721.

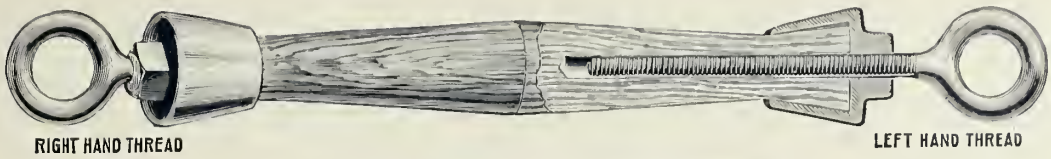
SINGLE INSULATED CURVE SUSPENSION FOR STANDARD EARS.



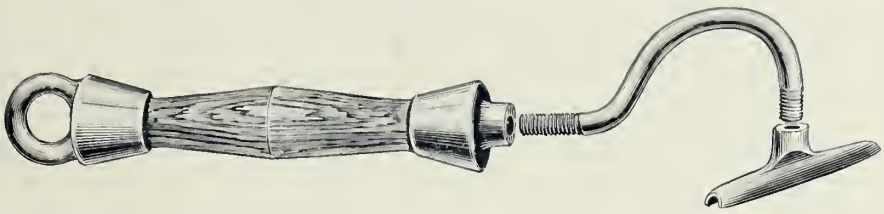
WOODEN INSULATOR FOR SINGLE CURVE SUSPENSION.



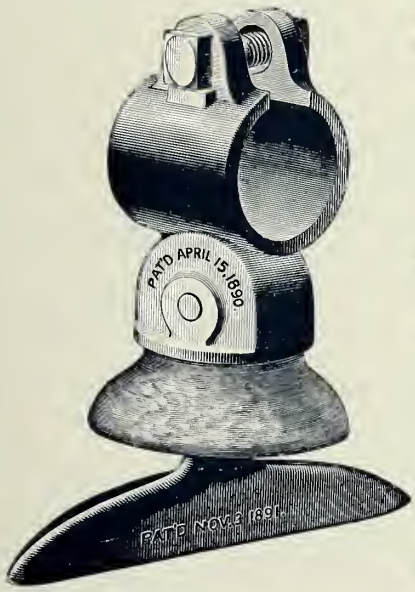
WOODEN STRAIN INSULATOR.



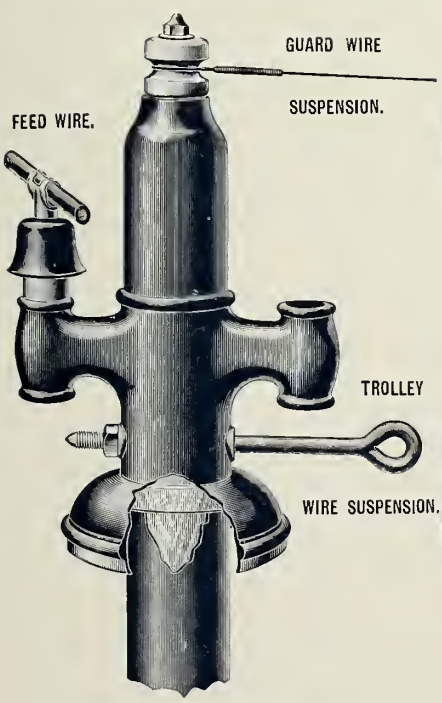
WOODEN INSULATING TURNBUCKLE.



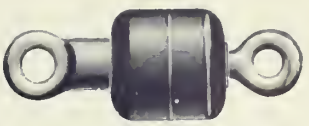
SINGLE CURVE SUSPENSION WITH WOODEN INSULATION.



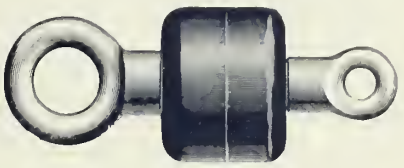
BRACKET INSULATED SUSPENSION FOR AUTOMATIC EAR.



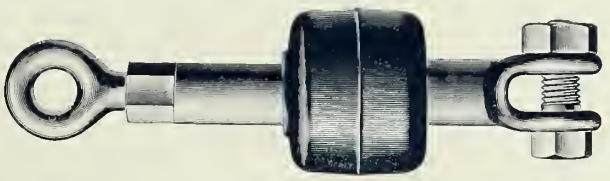
CAT. NO. 16758.
MORRIS COMBINATION POLE TOP.



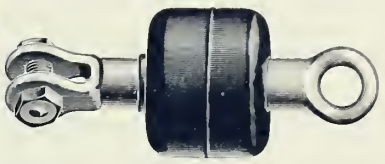
CAT. NO. 16741.
SMALL SHEET MICA STRAIN INSULATOR WITH EYES.



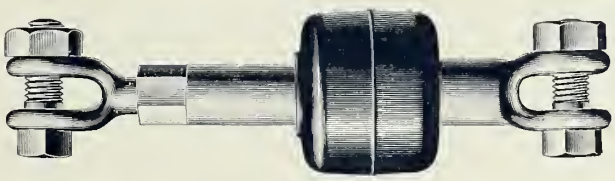
CAT. NO. 16748.
LARGE SHEET MICA STRAIN INSULATOR WITH LARGE SOCKET EYE.



CAT. NO. 16738.
SHEET MICA INSULATING TURNBUCKLE WITH SOCKET CLEVIS AND SCREW EYE.



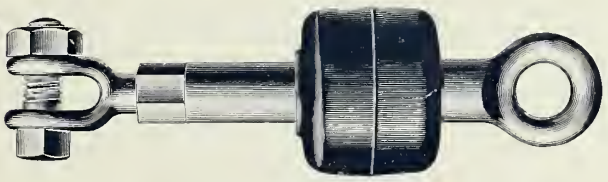
CAT. NO. 16747.
LARGE SHEET MICA STRAIN INSULATOR WITH CLEVIS.



CAT. NO. 16736.
SHEET MICA INSULATING TURNBUCKLE WITH CLEVIS AT EACH END.



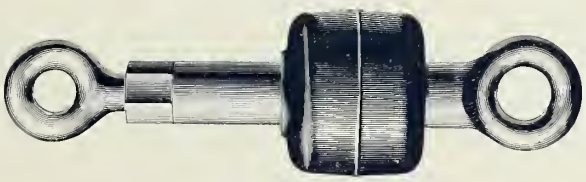
CAT. NO. 16745.
LARGE SHEET MICA STRAIN WITH EYES.



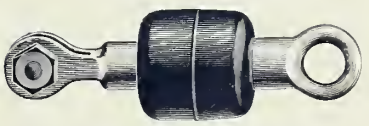
CAT. NO. 16737.
SHEET MICA INSULATING TURNBUCKLE WITH SCREW CLEVIS AND SOCKET EYE.



CAT. NO. 16745.
LARGE SHEET MICA STRAIN INSULATOR WITH EYES.



CAT. NO. 16732.
SHEET MICA INSULATING TURNBUCKLE WITH EYES.



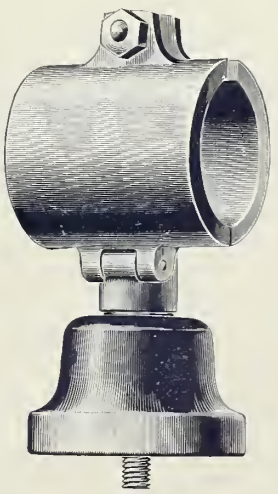
CAT. NO. 16743.
SMALL SHEET MICA STRAIN INSULATOR WITH CLEVIS AND SOCKET EYE.



CAT. NO. 16803.
SINGLE CURVE M. R. BELL INSULATOR FOR AUTOMATIC EAR.



CAT. NO. 16750.
STRAIGHT LINE GUARD WIRE BELL SUSPENSION.

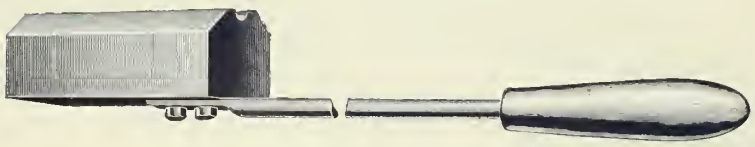


CAT. NO. 16806.
BRACKET M. R. BELL INSULATOR FOR STANDARD EARS.



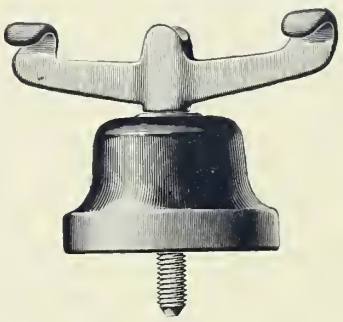
CAT. NO. 16788.
ELECTRICALLY WELDED RAIL BOND.

The new insulator, made in the form of a bell, is constructed as follows: A metal casting, as will be seen in the cut of the cross section, projects around under the head of the screw bolt which holds the trolley wire ear. The sheet mica is first placed in this casting, the screw bolt is then set in, and afterwards mica is put in until the casting is filled nearly to the top; then the metal piece into which is screwed the span wire clip or other suspension device, is set down on the mica, and the edges of the main casting turned over on it by hydraulic pressure. The whole device is folded, covered with an insulating composition which is perfectly impervious to the weather, which forms a secondary insulator and prevents any surface leakage.



CAT. NO. 16762.

SOLDERING COPPER FOR RAILWAY WORK.



CAT. NO. 16801.

STRAIGHT LINE M. R. BELL INSULATOR FOR AUTOMATIC EAR.

There are two styles of this bell, both shown in the accompanying cuts, differing from each other, only that the larger size has a metal rim around its lower edge, which protects the composition covering from being chipped or broken, should the trolley wheel happen to slip from the wire under one of the insulators. Both forms of the bell are made with a square ended screw to hold the ordinary standard ars, and also with a longer pointed screw to fit the automatic ears.

As it is often necessary to put guard wires over the trolley wire, devices have been designed for this purpose, resembling in all respects the bell insulator already described, with the exception that they are smaller in size and are fitted with a small double hook so that they hold the guard wire without the use of the ordinary ears.



CAT. NO. 16804.

DOUBLE CURVE M. R. BELL INSULATOR FOR STANDARD EARS.



CAT. NO. 16811.

M. R. DUPLEX, INSULATED, SINGLE CURVE SUSPENSION FOR AUTOMATIC EAR.

The span and strain wire insulators are constructed on exactly the same principle as the bell itself, and are manufactured in many different designs and combinations of clevis and eye so as to meet all possible conditions of overhead line construction.



THE STREET RAILWAY JOURNAL

Vol. VIII. *NEW YORK & CHICAGO, NOVEMBER.* *No. 11.*

ELEVENTH ANNUAL CONVENTION

OF THE

AMERICAN STREET RAILWAY ASSOCIATION,

HELD AT

CLEVELAND, OHIO.

October 19, 20 and 21, 1892.

PAPERS.

The President's Address.

Gentlemen of the Convention: — This is a patriotic year, and its culminating point is close at hand. Friday of this week has been designated by Congress as a national holiday in commemoration of the discovery of America. Happily for us, since we cannot be in Chicago on that day to take part in the opening of the World's Fair, it is our privilege to meet together as the representatives of one of the foremost American industries in the state, whose capital is Columbus. In this way at least we are permitted to pay our tribute of respect to the memory of the bold and intrepid navigator who 400 years ago turned the prow of his vessel to the Westward and sailed forth into the unknown seas on the most fruitful voyage of discovery in the history of mankind.

It is a felicity to meet in Ohio this year, and it is a pleasure and a privilege to come to Cleveland. We have heard much of the Forest City, with its far famed Euclid Avenue, its viaduct of massive masonry, its splendid Arcade and its beautiful Lake View Cemetery whose crowning feature is the mausoleum which holds all that is mortal of the martyred Garfield.

But of deeper interest than any of the sights of the city, and more closely bound to us by the ties of common interest, are the street railway companies of Cleveland. Their officers have greeted us with such generous hospitality, and have made such excellent arrangements for our comfort and convenience, that we feel like reversing the usual order of business and to extend to them a vote of thanks at the very outset. This city offers a fine opportunity to study practical street railroading. Here we see the most advanced ideas of construction, the highest development of the electric system, and a splendid new cable plant, as near perfect as capital, invention and engineering skill have been able to make it. And by the way of contrast and historical interest, we find a few horse car lines to remind us of the meetings a decade ago, when we used to grow excited over discussions of the relative merits of the horse and the mule as a street railway motor.

The street railway interests of the United States are assuming wonderful proportions. Every day some new company is born, and every morning paper brings us rumors of consolidations, absorptions and syndicate purchases, until the statistician lays aside his pencil and sheet in despair, utterly bewildered by the mass of accumulating and shifting figures. Definite data are out of the question, and I shall not attempt to tell you how great we are even in round numbers. But while the street railways are legion, there is but one American Street Railway Association, and I know you will be glad to learn that Mr. D. F. Longstreet, one of the founders of this body, in compliance with the request of the Executive Committee, has prepared a historical paper, detailing the motives which led to the formation of the Association, and giving due credit to the gentlemen associated with him in the movement. We shall be favored with this paper a little later.

This is pre-eminently an electric age, and most of us believe that as yet we are only standing on the threshold. The horse and his half brother the mule are destined to disappear. The cable system, from its very nature and cost, must be confined to the thickly populated districts of large cities, but there seems to be no limitations to the electric railway. It leaps over the city lines wherever there is a large suburban town calling for rapid transit, it girds the summer lakes, it is forcing its way through the scenic splendors of the Niagara gorge, close beside the water's edge, and when the Convention goes to California, as no doubt it will some day, we may expect to ride around the Yosemite on a train of trolley cars. And how rapidly it has all come about!

It was just ten years ago that the president of this Association, at the Chicago meeting, with a foresight, which must have been born of intuition, ventured to predict that the lightning would some day be harnessed to the horse car. We laughed at his visionary prophecy, and dismissed it from our minds as a piece of optimistic nonsense. But the prophet of a decade ago is with us to-day, and can take revenge by saying "I told you so."

So accustomed have we become to rapid strides and the complete overturning of the existing order of things in our business, that I do not believe that one among you would venture a doubtful smile were I to assert that before the close of the Nineteenth Century, the three successive Convention cities, Buffalo, Pittsburgh and Cleveland will be joined together by a triangular electric belt line, with an immense power house at Niagara Falls, where they are even now just on the point of developing 160,000 H. P.

But this is an assembly of practical men who have come together not to vie each with the other in making extravagant predictions, but rather to contribute each to a common fund the results of his observation and experience. The congestion of traffic in our business centers, the increasing throngs of passengers of the working class nights and morning, as the day of tenement houses gives way to the age of suburban cottages, the safeguards against accidents required by the exigencies of rapid transit, the labor question, the unjust and burdensome taxation of corporations, the ways and means of increasing traffic and reducing the cost of maintenance and operating expenses, give us plenty of things to talk about. The principal subjects for discussion cover a wide range of practical matter having an important bearing upon street railroading as a business conducted for profit rather than for philanthropy, and the reports of the special committees will be worthy of your closest attention and most careful consideration.

While there are many other things which it would be a pleasure to say, I must not now trespass further on the time of the meeting. I thank you once more for the honor conferred and for your kind attention. Very respectfully yours, JNO. G. HOLMES.

Report on a "Model Electric Street Railway Roadbed and Underground Wiring."

BY GEO. W. BAUMHOFF, COMMITTEE.

Gentlemen:—Your committee on track construction and underground wiring respectfully submits the following:

This subject, embracing one of the most important questions connected with the construction and operation of a street railway, is one that should have the most thorough consideration, for, upon the condition of the roadbed more than any other item, depends the success of

your enterprise. The motto should, therefore, be : " The best is none too good."

That we are all striving to obtain the best is evidenced by the fact that reports in relation to this very important branch of street railway construction have been earnestly discussed at former conventions of this Association, and your committee feels inadequate to the task of presenting at this meeting a report that will not be a repetition of what has been so ably introduced by former committees of practical and experienced street railway managers, and the numerous articles published by those interested in street railway publications.

The mistake is sometimes made in designing and equipping a new road, or in changing from animal traction to electricity, of neglecting the track construction by apportioning the amount to be thus expended to such a sum that, in order to make both ends meet, it becomes necessary to weaken that portion of the investment where, above all others, strength and permanency are required.

Now, in no other branch of our business do the ends meet oftener than at rail joints, and when these joints are improperly constructed it results in meeting the bills for repairs to the same with monthly regularity. It is, therefore, essential that in the construction and maintenance of a perfect roadbed the best known type of rail be selected ; consequently, your committee has decided, in submitting this report, to dwell chiefly on the merits of various types of rail known as the girder system, and in order to place the same before you in an intelligent manner, will proceed with an itemized report in the order in which the construction is proceeded with.

First—SURVEY.

Having decided on the style and weight of rail to be used, and the chairs, fastenings and joints for the same, the first step, in order, is to properly survey the route, if a new road, to estimate the quantity of cut and fill where grading is necessary, and the most advantageous manner in which to provide for the same, and to locate all curves, switches and turnouts. In doing so, care should be exercised to provide for all curves the longest possible radius at points of entering and leaving the same, and to provide for the proper elevation of the outer rail of all curves, which should be elevated from one inch to two inches higher than the inner rail, where the conditions of the street will permit ; particularly in any curve of short radius, and more especially when such curve is located on a down grade.

The switches, or crossovers, should be located at such points along the route as will best provide for the following contingencies : Bunching cars for large gatherings, and to insure the constant operation of cars during fires, parades and all other blockades when, from any cause, the terminus of the road cannot be reached. They should never be placed with the switch point against the traffic ; and preferably, on up grades, thus enabling cars to cross to the opposite track by gravity.

" In ordering crossovers, care should be taken to specify that the straight track rail be continuous, for in most work of this kind the reverse is the rule." The aim should be to favor the track most used.

Second.—EXCAVATION.

The depth of excavation must be determined by the thickness of the cross tie, height of rail and height of chair, if chairs are used, plus the space allowed for tamping. The condition of the soil must govern the latter exclusively, but in the reconstruction of the roadbed, where the operation of cars will permit, and in all new work, unless the soil is of a sandy character, the following plan will not only provide a suitable sub-drainage, but insure permanency : Remove all earth to a depth of eight inches below the bottom of the cross tie the full width of the trench, then roll thoroughly with a heavy four horse or steam roller, then spread with a layer of cinders, crushed rock, gravel or furnace slag from six to eight inches in thickness, and again roll until the same is well bedded and leveled. A trench seven feet in width. with a layer of eight inches, will require for one mile in length 24,640 cu. ft. of material, estimated at 3½ cents = $862.40, and will require the removal of 912 yds. of earth, estimated at 25 cents = $228 ; add for rolling, $50 ; total $1,140 per mile of single track.

The fact that the material so placed provides a splendid sub-drainage is the best argument in its favor, and one that will commend its adoption where soil demands it ; for it must be remembered that it is far more expensive to open up and re-tamp poorly constructed track than to properly construct and provide with sub-drainage at the outset.

For surfacing, care should be taken to procure machine crushed rock or gravel, as it insures a more even bed under the tie than coarser material.

Third.—CROSS TIES.

Under this heading we have the metallic tie and various kinds of wood. The committee's remarks will be confined to the latter exclusively, for it will be seen by reference to former reports on track repairs and construction, made to this Convention, that the life of a wood tie when buried to a depth of eight inches or more is the best argument in favor of its adoption, as against the former. The various kinds of wood, and discussion of durability of the same, have also been submitted in former reports, and it is generally conceded that in the selection of the particular kind and quality of timber, the purchaser is influenced by his own knowledge of the timber best adapted for various climates and sections of country, exclusively.

The fact should, however, be borne in mind in the selection of cross ties, not only to keep in view the selection of such timber as is calculated to insure the longest life, but due consideration should be given to the particular kind that will best hold the spike ; and for this reason, the white oak possesses advantages that should merit its consideration.

The size should never be less than 5 × 8 ins. for rail fifty-six pounds and over, and if laid as closely as good tamping will permit—say twenty-seven inches from centers—will materially strengthen the roadbed and assist in holding up the joints.

For joints where wide joint chairs are adopted, one tie of sufficient width is preferable, as it is impossible to insure good tamping where two small ties are used at the joints.

If the above size is decreased, it should be in thickness rather than in width, to insure the tie from splitting, which is often caused by the spike being driven too close to the edge.

Fourth.—RAIL.

In the selection of the rail depends largely the success of perfect construction ; and a road, whether built for speculative purposes or as a permanent investment by the projectors, should not be slighted in this respect.

The requirements of a rail for electric traction are strength, joint connections, durability. In some localities there are municipal requirements specifying what the head of the rail shall be.

For strength we rely chiefly on the weight of the rail, and the thickness and depth of the web.

For joint connections, that rail which affords the best method of keeping both ends of the rail in perfect alignment is the best, and as the girder rail possesses peculiar advantages in this respect, its almost universal adoption is due to that fact.

For durability we depend on the height of the head of the rail at the gauge line over the lower flange, and the quality of the metal. The former is invariably considered by the purchaser, but your committee is not aware of a single instance in which the quality of the metal has been specified, other than the mere mention of whether the same shall be of iron or steel.

In former years, when the old style stringer construction was in vogue, when a good stringer and cross tie would outlast two or more flat rails, iron was chiefly used, owing to its higher market value as scrap. In the construction of an electric railway, where the girder system has superseded the flat rail, steel is more extensively, if not exclusively employed ; therefore, when we have closed our contract, having duly specified steel, we feel assured that the best possible rail has been provided for.

That there is a very great variance in the mixture of the metal before being rolled, is beyond contradiction. That there is also a difference of opinion among the various manufacturers as to the limit of percentage of carbon and other elements, particularly carbon, to be employed in attaining the most satisfactory results as to wearing qualities of the head of the rail, and yet prevent brittleness, is attested by replies to communications on this subject from a number of inquiries ; and whilst the matter is of sufficient importance to warrant its introduction in this report, yet we do not deem it advisable from the data now before us, to assume what constitutes the best composition for a rail. There are other elements to be considered besides carbon, as witnessed in the report of Dr. C. B. Dudley, from the proceedings of the New York meeting of the Iron and Steel Institute, October, 1890, a synopsis of which is herewith given, as follows :

" My own criticism of this work, after the lapse of ten years, and after all the discussion which followed the publication of the papers above mentioned, may, perhaps, be fairly summed up in four conclusions:

" 1. If I had the work to do again, I would certainly determine the sulphur in the rails, since all our studies during the past ten years on the influence of sulphur, point strongly in the direction of indicating that the sulphur has an important influence on steel, especially in its effect on the carbon.

" 2. The influence of silicon, and especially its influence from the metallurgical standpoint, seems to be much better understood now

than at the time when these studies were begun, and if an ideal formula, representing our views as to the best possible composition for steel rails, was to be made at the present time, the silicon limit would be raised somewhat, possibly in the favorite figure of Mr. Standberg, namely, 0.10 per cent.

"3. It is possible that in the first paper published, the influence of the chemical composition on what is commonly known as crushing or disintegration of rails in the track was made more prominent than the facts would warrant. More mature or riper studies would seem to indicate that disintegration or crushing of steel is largely a resultant of lack of soundness in the ingot, and is *more mechanical than chemical*, except in so far as chemistry may be responsible for the soundness of the ingot. However, upon this point of sound ingots, we have seen little reason to modify the views held for some time, that time is more important in securing sound ingots—especially time and certain critical parts of the process—than any other single element. If our views are correct, sound ingots, with consequently sound rails, can be made from steel of varying composition, provided time is allowed at the right points in the process, and the claim that high manganese and high carbon are essential to secure sound ingots is, in our judgment, not well founded, provided that time enough is allowed to make the steel properly.

"4. In all our later studies on the wear of metal, we have, as far as possible, avoided a method of deciding which metal is best which attempts to give what may be called absolute reuslts.

"Especially has it been hoped that some methods of chemical analysis would be devised which would enable us to determine, not only the total amount of carbon, phosphorus, silicon, manganese, sulphur, etc., in these various steels, but also how these substances were combined. For example, does the phosphorus in any given rail exist as phosphide, or partly as phosphate, or both? Is the silicon simply alloyed, or chemically combined with the iron? Does the carbon all appear as strength carbon, or is some of it graphitic, or combined with the iron in such a way as to form a *crystalline body which adds nothing to the strength?*"

One of the largest steam railroad companies in this country, whose extensive testing laboratories enable them to thoroughly test all material purchased in the construction and operation of their railway, require that all steel rails furnished them shall be subject to specifications adopted by said company. Surely, if experience has taught them the wisdom of this precaution, where their rail is entirely above ground, and therefore more cheaply replaced than that of street railways, would it not be advisable for us to pause and reflect on this subject?

A copy of the specifications adopted by the company referred to is as follows:

SPECIFICATIONS FOR STEEL RAILS.

As it is the desire of the _____ Railroad Company to have on the roads under their control none but first class tracks in every respect, and as the rails laid down in these tracks form an important part in the achievement of this result, the _____ Railroad Company have found it necessary to make certain demands in regard to the manufacture of their steel rails, with which the different rolling mills and rail inspectors will be required to comply.

1. The steel used for rails shall be made in accordance with the "pneumatic" or "the open-hearth" process, and contain not less than thirty nor more than fifty one-hundredths of 1 per cent. of carbon.

2. The result of the carbon test of each charge, of which the railroad company is to receive rails, and of which an official record is kept at each mill, is to be exhibited to the rail inspector.

3. A test bar, three-quarters of an inch wide, and about ten inches long, to be taken from the web of a rail made from each charge, is to be furnished to the railroad company's inspector, for use in making analysis and test of the steel whenever required.

4. The number of the charge and place and year of manufacture shall be marked in plain figures and letters on the *side* of the web of each rail.

5. The weight of rails shall be kept as near to standard weights adopted by the railroad as it is practicable to do so.

6. The sections of the rails shall correspond with the respective templates, showing the shape and dimensions of the different rails adopted as standard as near as practicable, after complying with section 5.

7. The space between the web of the rails and *template* representing the splice bar shall not be less than one-quarter of an inch, nor more than three-eighths of an inch.

8. Circular holes one inch in diameter shall be drilled through the web in the center thereof, at equal distances from the upper surface of the flange, and lower surface of the head, and one and one fifteen-sixteenths inches from the end of the rail to the center of the first hole, and of five inches from the center of the first hole to the center of the second hole, and of six inches from the center of the second hole to the center of the third hole.

9. The lengths of rails at sixty degrees Fahrenheit shall be kept within *one-quarter of an inch* of the standard lengths, which are thirty feet, twenty-seven and one-half feet, and twenty-five feet. When specially mentioned in the contract, and not otherwise, 10 per cent. of rails of shorter lengths, and 5 per cent. of *second-class* rails will be accepted.

10. The rough edges produced at the ends of the rails by the saw shall be well trimmed off and filed.

11. All rails are to be straightened, in order to insure a perfectly straight track.

12. THE CAUSES FOR A TEMPORARY REJECTION OF THE RAILS ARE—

1. Crooked rails.
2. Imperfect ends, which, after being cut off, would give a perfect rail of one of the standard short lengths.
3. Missing test reports.
4. A variation of more than one-quarter of an inch from the standard lengths.

13. THE CAUSES FOR A PERMANENT REJECTION OF A RAIL, AS A FIRST-CLASS RAIL ARE—

1. A bad test report, showing a deficiency or excess of carbon.
2. The presence of a flaw of one-quarter of an inch in depth in any part of the rail.
3. A greater variation between the rail and splice-bar than is allowed in paragraph No. 6.
4. The presence of such other imperfections as may involve a possibility of the rail breaking in the track.

By order of the General Manager,

.....Chief Engineer.

The subject relative to the quantity of the various elements entering into the manufacture of steel, which shall produce the rail calculated to give the most wear, and yet avoid brittleness, is one in which there is a great divergence of opinion, and the most expressive method of summing up the numerous replies received, is, that it appears to be a case wherein "doctors disagree."

The rail over which electric motors are operated through thoroughfares in various cities throughout the country is certainly subject to as much, if not more wear, than that of many of the trunk lines; and as we have patterned closely after their method of construction, we may perhaps profit by following their example in other details.

Of the various forms of the head, the center bearing rail is the most desirable, because, with a lower tram on each side, the head is kept free from dirt, and, consequently, offers less resistance to the car wheels.

In many localities the use of this form of head is prohibited. This was at a period, however, when cars were operated by animal traction, when at least 75 per cent. of all vehicle traffic along streets where cars were run were accustomed to use the track. If there ever was any valid objection from this source, the introduction of rapid transit has certainly overcome it; for drivers of vehicles generally shun the tracks of roads operated by rapid transit. The public now demand that the quickest possible time be made in transporting them to and from their homes and places of business, and where once the unruly teamster held sway for blocks at a time, ahead of a slow going horse car and patient passengers, he is now compelled by the change of motive power and a strong public sentiment, to keep to the right as the law directs, and the public demand. Passengers now figure on the exact time required to reach their destination, whereas under the old order of transportation, the street car ride was looked upon as a necessity only for the convenience it afforded. What is, therefore, of most service to the railway company, is likewise beneficial to the public; and your committee would earnestly recommend that in communities where objection is made to the use of the center bearing rail, that the authorities be asked to give the subject careful consideration, at least for a comparative test. We claim that it does not impede vehicle traffic, nor would it be objected to by owners and drivers of vehicles, when properly laid, to the extent of prohibiting its adoption.

Next to the center bearing form of head, the side bearing head is by far the most desirable, from the operator's standpoint; for the only other form made, of the girder type, is that with a groove, instead of a lower flange. The latter form of head is suitable only for curves and crossovers, when rolled with a wide groove, and should never be adopted for straight track, owing to the tendency of the groove to hold dirt, snow and ice.

In the selection of a girder rail of any form of head, and more particularly the style known as side bearing, it would be well to remember that the rail having the widest base offers the greatest resistance to turn over; and care should, therefore, be exercised in the selection of the rail, to secure the widest possible foot. This subject requires no argument to demonstrate its necessity, and your committee, knowing the desire of various manufacturers of rails not only to keep abreast of our wants, but who are constantly employed at large expense in devising new and perfecting existing styles, would urgently advise enlarging the rolls at the base of the rail, in order that the same shall at least equal in width the combined width of the tread and lower flange.

Fifth.—CHAIRS.

The less number of parts about the construction of a roadbed the more economically it is laid and maintained, and the use of a chair, the only purpose of which is to provide for the required height to the top

of the rail for paving purposes, is not recommended. It is much better to secure this height by the adoption of a rail having a higher web, thus enabling the rail to be spiked directly to the cross tie by means of a tie plate, which tie plate should be provided with a brace extending upwards to the bottom of the outer head of the rail to prevent the rail from turning. Where a plain tie plate is adopted, a cast iron brace should be spiked to each tie. No girder rail should be laid without making provision to prevent it from tipping, and the above plan, being more economical than the use of a tie rod, is preferable, as its bearing at the upper portions of the rail is more serviceable in checking the strain than a tie rod secured through the web of the rail.

If chairs are required, care should be exercised in selecting such as will insure the greatest possible bearing on the tie, and such only as will not spring under heavy loads. A chair with a narrow base is apt to cut into the cross tie, and in time work loose or cause the rail to cant. All intermediate chairs should be provided with a brace extending well up under the outer head of rail, which is the best safeguard against the rail turning or canting.

Sixth.—JOINT SUPPORTS.

There are a large number of joint supports now in the market and in use, some of which are offered by the manufacturers of rail, and some devised and manufactured by others, and it would be unfair to dwell on the merits of those of any particular manufacturer; but your committee would very urgently recommend the adoption only of such joint supports as are of sufficient length to cover at least two ties, but we consider such as secure a bearing on three ties preferable. The holes in the web of the rail should not be less than one inch in diameter, to admit the use of a bolt having a large size nut, which should be tightly secured by the use of a hammer and wrench. A six hole fishplate of sufficient height to reach from the foot of the rail to the bottom of the head, twenty-six inches or over in length, securely fastened with large size bolts, is considered by many who have used the same to be superior to all other joint fastenings.

We must bear in mind that cars, as now operated by electricity, are not only heavier than horse cars, but are operated at a much higher rate of speed, and require the most thorough construction. The slightest spring or looseness, will gradually result in a low joint, which if not soon attended to will ruin the end of the rail beyond repair. It would, therefore, be well to relieve the fishplate of much of this strain, by providing a support for the bottom of the rail extending over two or more cross ties.

The rails, when laid in hot weather, may be closely joined, but if laid in low temperature, proper allowance should be made for expansion.

There exists among railway managers a difference of opinion as to the choice between a supported or suspended joint. Your committee, however, earnestly recommends the supported joint, with a support for the bottom of the rail extending to the adjacent ties, and does not deem it advisable to adopt the suspended joint construction, unless the joint support has a firm bearing on the adjacent ties. There are a number of such joint chairs of various manufacture now in use, which, your committee is reliably informed, are giving entire satisfaction.

There is also a diversity of opinion as to the location of rail joints with respect to each other, and on this subject we do not hesitate to take a firm stand in support of the joints being laid directly opposite each other, when constructed for electric traction, as the tendency where laid with broken joints is to cause the car to sway sideways, particularly at a high rate of speed, if the joints are not kept extremely perfect.

The former plan renders it also more economical to repair joints, especially in paved streets.

Seventh.—PAVING.

In the construction of a perfect street railway this item, whilst it comes last, is by no means least, and in many instances solves the problem of economic management in electric traction; for with unpaved and poorly maintained streets it is impossible to build any track that will be entirely non-obstructive, for not only does it impede vehicle traffic and cause untold annoyances to railway managers and passengers alike, but it also offers a very great resistance to the operation of cars by reason of the constant accumulation of dirt and dust on the rail. It is, therefore, essential to the property owner fronting on the street, the railway company and the general public alike, that the street be constructed of the very best known material. Of course, paved streets are preferable, not only because they permit of a uniform level with the track, but add largely in holding the latter to gauge, and in protecting it from being constantly cut alongside by vehicles; and being much more free from dust and dirt, it also effects a large saving in current required for the operation of cars.

Of the various kinds of paving now in use, the following are chiefly adopted, and about in the order which they are named: Granite, telford, asphaltum, wood and brick. The former being by far the most durable, cheapest maintained, and least expensive to remove and replace, for the necessary track repairs, justifies the adoption of the same over that of asphaltum, wood or brick, and warrants the additional first cost, which accounts for its almost general adoption by street railway companies where paving is required, and by municipal authorities on streets where railway tracks exist, or are contemplated. In some localities the asphaltum paving is adopted on streets where railway tracks are laid; but owing to the tendency of vehicular traffic to wear ruts alongside of the rail, and the spring of the rail to loosen the paving material, together with the increased cost of repairing the same, it is not as favorably considered, for track paving, as some of the other systems.

To overcome the first named objection in some localities where this paving is adopted, a double row of granite blocks is laid, adjoining the rail, which also provides for the vibration of the rail, and renders it more accessible to get at the foundation of the roadbed for necessary repairs.

Telford paving is laid by placing stone, known by quarrymen as rip-rap, as close together as the same can be laid, and filling the interstices with macadam, or broken stone, which is laid for a depth of about three inches over the rip-rap, all of which is thoroughly rolled and covered with a thin coating of sand and gravel. This system of paving, if it can be designated by that name, is, however, not suitable for thoroughfares subjected to heavy vehicular traffic, and should only be adopted for street railway tracks on suburban divisions, where, owing to its cheapness, it is quite extensively adopted.

The first cost of paving a street is always the greatest obstacle to overcome, owing to the necessity of providing a suitable sub-foundation. This once done, the street is maintained in good repair by simply renewing the upper roadway, and on account of its cheapness in some localities, as compared to other paving material, wood is quite extensively employed; but on account of its perishableness, caused by wear from heavy vehicular traffic and decay, caused by atmospheric changes, and the further fact that, owing to the expansion of the wood when absorbed with moisture, the blocks bulge upward in places, and in some instances have caused the closing of slots in cable railways, and the breakage of various portions of the running gear of both cable and electric cars, this system is not so generally adopted.

Brick in any form, made of clay or other material, has thus far not stood the test of vehicular traffic to warrant its adoption in any climate, either by railway companies or municipalities, and should, therefore, be given a most thorough trial before it is extensively used.

With girder rail construction, it is advisable to fill in the web of the rail with moist clay just before paving, in order to prevent the paving blocks from working loose, caused by the sand surrounding the same filling up the said space, thus leaving the blocks unprotected, and tending to cause the row of blocks adjacent to the track to settle unevenly. In some localities an iron frame is constructed at each joint for the purpose of providing for repairs to the same without disturbing the paving, but with the late girder rail joint construction, ties well tamped and bolts securely fastened, the necessity for such construction does not exist.

Eighth—UNDERGROUND WIRING.

This subject is one that is usually entrusted to the contractor securing the electrical equipment, and by him sometimes sub-let together with the overhead line work. As all this work is underground, out of sight, and with paved streets made inaccessible without incurring large expense to repair and renew, the most practical method of workmanship and material should be adopted.

The object to be accomplished is to form a perfect connection from each rail along the road to the poles of the generator at the power house, the ground wire being connected to the negative poles, and the overhead wire to the positive poles of the machine; although we have read of the reverse being the rule on some lines, but, as the matter is foreign to the subject now under consideration, we will not further digress therefrom.

A large size insulated copper wire is generally adopted to form the connection between the generators and such points along the track as it is deemed advisable to reach. The return circuit—for by that name it is known—may be completed, either by connecting said wire to the rail, or to a supplementary wire extending the entire distance of the track. The latter is in all cases recommended, and should invari-

ably be of soft copper wire, not smaller in size than No. 0. In either event, however, all rail joints should be bonded with a soft copper wire not less in size than No. 6, and if the supplementary wire is laid, a connection thereto should be made to, at least, every fifth rail; and it will also be of great advantage as a safeguard against any possible break in the circuit, to connect both sides of the track with a No. 6 wire, and if a double track, to cross to the opposite track, and to the supplementary wire in said track, at least every 1,000 ft.

We have heard of instances being cited where copper wire laid underground was more susceptible to electrolysis than that of galvanized iron or steel; but, after a thorough trial of upwards of three years, during which time we have used both, the conclusion reached is, that copper being not only a better conductor, but less liable to corrode and break, is, therefore, the best wire to use for underground work. Galvanized soft steel, or iron wire, used for this purpose, has not proved durable, and we have found the same to be entirely eaten away by electrolysis where it had come in contact with the cross tie, and in perfect condition elsewhere.

The only theory we can advance for this is, that a chemical action takes place between the gases of the earth, precipitated by the sap contained in the timber and salt water, the latter from the use of salt for the purpose of melting snow and ice; although such results have not been noticeable in the use of copper wire. In addition to cross wiring, as above mentioned, as a precautionary matter, to insure a complete circuit, it will he found advantageous to the economical operation of an electrical railway, to excavate or bore in the earth, to a sufficient depth, to secure continual moisture, and whilst iron is usually adopted, owing to its cheapness, yet we believe the use of copper will, in time, prove the most economical metal to adopt for this purpose—for we beg leave to repeat: "*The best is none too good.*"

Where such grounds are located, care should be taken to make the best possible connection to the supplementary wire and the track.

By a careful examination of the ampere meter at the power house, during dry weather, compared with that of rainy weather, it will be noticed that there is a marked decrease in the amount of current used. in favor of the latter; hence it follows that the more connections to the rail and the opposite poles of the generator, with the moist earth, the more economically is the system operated. It must also be remembered that the increased saving in wet weather, over that of dry weather, is not attributable to the increased moisture of the earth alone, but to the fact that the dust and dirt, which readily finds lodgment on the rail, is washed off, and many roads now in operation by electricity have found the use of a car equipped with a tank having one down spout, about five eighths of an inch in diameter, on each side, so arranged as to permit a stream to flow over the head of each rail, most advantageous. These down spouts should be located as near the wheel as possible, in order to insure the same being directly over the rail at all curves, as well as the straight track.

In conclusion, we have only to say, as to the construction of "A Model Electric Street Railway Roadbed and Underground Wiring," its successful accomplishment will involve the comparison and investigation of a wide range of personal experiences, coupled with the patient study of those engaged in the manufacture of rail and track supplies, who are constantly endeavoring at great expense to improve the material and method of construction.

Report on "A Perfect Overhead Electric Construction."

BY CHARLES H. SMITH, COMMITTEE.

Gentlemen:—The president has appointed me a committee on "A Perfect Overhead Electric Construction."

In thus selecting me to prepare a paper on this subject, he evidently intended to pay a passing compliment to my imaginative or inventive powers. He asks me to describe something that does not exist, something that I have never seen, although I have searched diligently for it. I can, therefore, give only my ideas of how an electric overhead line should be constructed, based upon facts and information derived from personal experience and observation.

Iron or steel poles have proved to be the most desirable. I would therefore recommend the following: The poles to be of tubular iron, thirty-two feet in length, and made in three sections, in the usual way. The lower section should be at least seven inches in diameter, and the other two sections six inches and five inches, respectively. The poles should be set in concrete, and at least six feet in the ground, and should not be more than 125 ft. apart. The top of the pole should have about 2 per cent. of rake away from the curb, and should be fitted with a suitable pole clamp, so that the span wire can be easily adjusted to the required height, which should be twenty-two feet above the track. On top of the pole should be a malleable iron cross arm to carry the feeder wires, and guard wire spans. This cross arm should be insulated from the pole by means of a wooden plug inserted in the top of the pole. The insertion of the joints of the pole should be at least eighteen inches, and the joints should be made solid throughout their entire length by means of shims, or other contrivances.

If these joints are not properly made, the poles will not stand the strain. For curves, or extra strain, there should be larger poles of the same make.

Span wires should be of No. 4 "B. W. G." silicon bronze wire, and should be fastened to pole clamps by means of insulated turnbuckles. Great care should be taken in insulating these turnbuckles from the poles.

All well built lines should be sectional, and the trolley wire should not be of too great a size, as it would then call for clumsy supports. As it is not the main current wire, it can be of a smaller size. I would, therefore, recommend No. 4 B. W. G. silicon bronze wire, which affords sufficient carrying capacity, and has great strength and durability.

Sections should not be of a greater length than two miles, and should be separated by trolley breakers, of which there are now a number of good ones in the market. In cities and villages, where there is great liability of fires, it would be advisable to put trolley breakers at shorter intervals. Trolley wire hangers and pull-off brackets should be of the lightest make possible, and still have the required strength and the very best insulation. There is a variety of such hangers and brackets now in the market.

As it is important to have as small a number of joints as possible in the trolley wire, it should be put up in mile lengths, and twisted splice joints should be made, and brass cone-shaped tubes slipped over the wire before the splice is made. After completing the splice, the larger ends of the tubes should be brought together over the splice and a little solder dropped through a small hole made in the tubes for that purpose, in order to keep the joint in place.

Overhead switches, or switch pans, should be avodied if possible, as they become a source of great annoyance. I would strongly recommend a double trolley wire for a single track road.

Great care should be taken in erecting the guard wire spans. They should be properly insulated from the cross arm by means of a strain insulator, or something equally good, and should be of at least No. 6 best galvanized iron wire. There should be two guard wires over each trolley wire, at least three feet apart and four feet above the trolley wire. This guard wire must be well insulated from the guard spans; in case of other wires falling, this would be of great importance.

Pull-off and anchor guy wires, or other wires for the same purpose, must be of the very best material, and of at least No. 8 galvanized iron wire.

Feed-in taps must not be more than five poles apart, and should take the place of the trolley span wire at that point. They should be of at least No. 0 insulated wire.

The trolley wire being sectional, it is necessary to run a feeder wire to each section. I would therefore recommend that the feeder wire be at least 30 per cent. larger than the occasion demands. It will be found that this is money well invested. The insulation on the feeder wire should be the best that can be procured, and I would advise using locust or iron pins with mica insulators or something equally good, for the purpose of fastening the feeder wire to each pole, and great care must be taken to protect it from trees and other obstructions.

A cut-out box should be located on the pole of each trolley breaker, and should not carry a fuse. It should have the same wire running through it as there is on the outside. The fuses should be at the station, with ampere meter and cut-out switch for each section; then, in case of trouble on any section, the location can be easily seen, and that section cut out, if necessary, until repaired.

Lightning arresters are of great importance on the line, and I would strongly recommend using them at least every 1,000 ft. They can easily be attached to the poles, and can be protected by means of a box.

In conclusion, I would say that no matter what expense is incurred for material, or care used in constructing, a good line cannot be insured without a thorough daily inspection.

It is to be hoped that in the near future a perfect overhead electric construction will be realized in some of our large cities, for the example or fact will be of much more value and interest than any paper on the subject.

Report on "Economy of Machine Shops for Electric Street Railways."

By J. H. BICKFORD, COMMITTEE.

Gentlemen:—It is with some hesitation that I present this paper. Everyone here is well aware that it is a subject on which only a very meagre amount of practical information can be gathered. The evolution of the electric motor has been so rapid that no definite methods have yet been established for its care and maintenance. There is great lack of uniformity in the operation of roads, and one can find hardly two which are following the same course as regards repairs and renewals to motor equipment.

Theoretically, it seems but a simple matter to prescribe rules by which this part of the work can be governed, but such will not find favor with the majority of the membership of this Association. *Practical information is what we want.* Street railway men are practical; they have gained their knowledge by long years of experience, and have come to believe that practice is the most reliable guide to follow, and that true theory becomes so only after having been verified by practice. As I have just said, there is a very small amount of practical data from which to deduce rules, therefore it becomes necessary, to a certain extent, to present the subject both ways; first, by looking at what seems to be reasonable, by means of which we will arrive at certain conclusions: second, by presenting such practical knowledge as I have been able to gather.

It would hardly be fair for me to give an account of only what we have done on the roads with which I am connected, and recommend only our methods, as a guide to others; therefore I have taken the means to gather from other roads as much data as possible, and this, together with my own experience, forms the basis of what is to follow.

The one thing to prove is, whether there is economy in maintaining a machine shop when there are so many manufacturing and supply companies which can furnish us with every conceivable thing we want (and many more we don't want) at short notice; and the local machinist stands ready to do our work at a price varying from fifty to seventy-five cents per hour for first class workmen (and double price for apprentices).

"Economy is wealth," so we are taught, but the expounder of this doctrine forgets to point out the particular method of economy which paves the way to fortune. Sometimes extravagance masquerades as economy. This is especially true when one buys cheap goods to place upon a street railway. Economy has two sides, with the transaction between. At first thought one believes that true economy consists in saving all you can at the beginning of the transaction. While this may be, and undoubtedly is, a good rule to pursue, yet in the majority of cases true economy consists in the elimination of all elements of weakness, and the providing of such apparatus as will give the best service with the least amount of repairs. Now, such apparatus cannot always be gotten cheaply, neither can it be well taken care of afterward without the proper means for so doing, which also should be considered as part and parcel of the transaction.

After having bought the best apparatus, we must provide means to take care of and repair it, and the first thing to do is to provide competent help. On this last point hangs the key to success. Heretofore on our horse lines, economy has been practised in its severest sense, and now when we change from animal to mechanical power, it is hard to break away from the old methods and broaden out to the extent which is necessary to properly conduct the affairs of a well equipped electric system.

Outside of conductors, drivers and subordinate officers, the help on a horse line can be of a class which does not command a high rate of wages. Stablemen and trackmen are, as a general thing, employed for their muscle; therefore, I am not far from the truth when I say that previous to the introduction of electricity, our street railroads were conducted with inexpensive help, and we have come to look upon this method as the only truly economical one. I do not present this as a criticism, only as a comparison. It was not necessary to employ high priced men; the class of work did not demand it; therefore, there is no censure due the management, nor can we say that this view of economy was not correct.

Let us look for a moment at the change which has taken place in the last five years, and, if possible, discern whether according to good reasoning it is wise to pursue the long established methods of which I have just spoken. We have equipped our cars with delicate machinery, and have put complicated mechanism in our power stations, and have obstructed (so the public say) our highways with a multiplicity of wires.

What shall we do now? Still employ the same class of help? Is it wise to place this apparatus in the hands of men who do not understand the first law of mechanics? No, emphatically, no; it would be the height of folly, yet I am sorry to say that such was the case with some of our roads in the early days of electrics. The laboring man is all right in his place, and is a necessary adjunct to a railroad, but until he educates himself to the level of the mechanic, he should not be allowed to handle, much less repair, the delicate mechanism of an electric motor. Heretofore, then, we have been dealing with muscle, now we must have brains; hence we must turn our attention to the mechanic and the engineer. Let us take one step more and look at the mechanic, and see if we should discriminate between men of this calling. We have two classes of mechanics; the thoroughly skilled class and the partially skilled class, the latter more commonly called handy men.

You have heard the old adage, "Jack of all trades and good at none," and do you not think that there is a grain of truth in it? However, there are exceptions in this class; some men are born mechanics, and could they have had the proper training, would have become even more skilled than their brethren of the other class. Such men are worth employing for some purposes, but the man who can, in his own estimation, do anything from the building of a motor to the framing of a house, seldom proves to be capable of doing either and the electric road is better off without him. He never gains in knowledge, because he is satisfied in his own mind that he knows it all now. Therefore, I say, we must look still higher for a class of men to care for and repair our electric machinery, and in doing so can only fall back upon the skilled mechanic. By the term "skilled mechanic" I do not necessarily mean a machinist. We have many kinds of mechanics; I mean a man who has learned a trade—has mastered some particular branch of the business, and applied himself to that exclusively. An armature winder is a skilled mechanic; so is a first class lineman; that is his trade, he has mastered it and knows every condition that enters into it; the same with the machinist and the carpenter. Hence, I say again, these are the men we must employ if we want to run our roads properly and economically, and right here we see, as stated a moment ago, that true economy does not consist on what we save at the start; it comes on the other end of the transaction; it is what we save in repairs and breakdowns, which can be very materially lessened by the employment of the right means.

Having thus arrived at the conclusion that skilled help is necessary to success, let us look still further into the subject and ascertain what else is needed to bring about true economy. Just here is where opinion will divide, and is what renders this subject difficult of elucidation. Whether it is economical to maintain an equipment of machinery will still remain a doubt in the minds of many, notwithstanding what I may say or what others, more experienced than myself, may write upon the subject. Nevertheless, we are all here to get information, and as this is brought about by discussion, perhaps what I am about to say will bear fruit later on.

There is no denying the fact that to do a piece of work of any kind properly we must have proper tools; a makeshift in such a case only leads to the abominable temporary hitch. We would be much better off if this word "temporary" and all its modifications were left out of the English language. To do a thing half way results in gross extravagance in the end. There is no denying this; we have examples of it already on the electric railway. If this be true, what conclusion follows, in view of our previous conclusion that we must employ the skilled mechanic. Simply that we must provide him with the requisite tools and machinery to do the work in a skilled manner.

Now that we have arrived at this latter conclusion, there is yet another step, the last, but by no means the least. It is this: How far shall we carry this equipment of the machine shop? Shall we make it a manufacturing establishment? There is surely a point here where we must draw the line. There is a distinction between repairs and renewals, but for all this the question arises whether, if we go so far as to establish a shop for repairs, is it best to go a little further and manufacture supply parts? It will be useless for me to attempt to prove by theoretical reasoning that it is economical to maintain a manufacturing establishment, or even an additional equipment to that required for repairs, therefore I am simply going to present to you a few facts.

In the first place, I wish to call your attention to the methods and practices of the steam railroads. It seems to me that we ought, to a certain extent, to be guided by these people. They have spent over

half a century in probing and sounding this matter of repairs and renewals, and even though we may not wish to follow their example in some things, it will surely be worth our while to consider what they are doing. We find here what we have arrived at through our conclusions, viz., complete repair shops equipped with all the necessary machinery for doing the work in a thorough and economical manner and manned by competent help; furthermore, a thoroughly competent master mechanic at the head of the whole. We find them manufacturing a great many supply parts, even complete cars and locomotives, and everything necessary for the maintenance of the road.

They have learned by experience that it is economical to manufacture in this way. This is shown by their still continuing to do so, and, so far as certain repairs are concerned, they know positively that such can be done in their own shops more satisfactorily than in a local machine shop. Their own men having become familiar with all the requirements of the work, they know every condition under which the apparatus has to work; consequently the successful and economical operation of the road, so far as this department is concerned, is assured. In some instances it may cost a trifle more to make the article than it could be bought for. Suppose it does. If it will give better service and wear longer, it is more economical. As I said at the beginning, economy does not always consist in buying a thing cheap. Happily, however, in the experience of the steam roads, they have found that it costs no more, and in many cases not so much, as to buy of supply companies, which is surely a conclusive proof that it is economical to maintain shops.

After viewing the experience of the steam roads, let us turn our attention to the substantial practical data which I have gathered from the more prominent electric roads. In attempting to write upon this subject, I found that in order to present unbiased information it would be necessary to gather as much practical knowledge as possible from roads other than those with which I am connected, therefore I prepared a list of questions covering the most important points of this branch of the business and sent them to over 250 of the more prominent electric street railways, asking them to co-operate with me in the preparation of this paper by answering as many of the questions as pertained to their respective methods of operation and maintenance of line and car equipment. I am sorry to say that I received answers from but sixty-six roads, notwithstanding I prepared the circular so that it was only necessary to write *yes* or *no* after many of the questions, besides enclosing stamp and envelope for return. It occurred to me that perhaps many thought that this information was for me personally, or else reasoned that if I was to present this subject I ought to know enough about it without their help. However, the sixty-six answers which I did receive gave me valuable data to substantiate my own experience and enable me to write much more intelligently, and I wish to extend my thanks to those who did interest themselves in the matter sufficiently to give me the information asked for.

Among these answers received I have found many things to strengthen my belief that it is economical to maintain a machine shop, not only for repairs but for the manufacture of supply parts. It turns out to be a fact that no less than twenty-four roads are maintaining machine shops, doing all their own repairs and manufacturing many supply parts. They say, unhesitatingly, that there is economy in so doing. They give as their reasons: First, that they can *make* better material than they can *buy*; that they are perfectly familiar with the requirements and conditions of the business; they are operating the roads and are in a position to know just what is needed, and are better able to judge of the strength and durability of the apparatus than those who have never been in a similar position. Is not this a natural consequence?

In presenting this I do not mean to cast a reflection on the earnest efforts of my good friends in the manufacturing business, but I must say from personal experience that there is much material on the market to-day that is not up to the standard. Why? Simply because the makers of it do not understand thoroughly the requirements of the business. Some may be unscrupulous enough to put goods upon the market just for what is in them for awhile, regardless of their stability; but I hope that is not the case, for surely we had much rather believe to the contrary.

A second reason given is, that there is a saving of from 25 to 50 per cent. by manufacturing the majority of parts.

What further, then, *can* we say? Is not this, coupled with the experience of the steam roads, sufficient to enable us to conclude that there must be economy in machine shops for electric street railways?

I have shown you then, first, by reasoning, and second, by actual fact, that this subject must be treated *affirmatively*; therefore, it will be wasting time to dwell longer upon it, except, perhaps, to give a few examples taken from information gathered, and add a few recommendations which naturally arise from a study of the whole.

I have made a sort of classification of the answers received, and the result is as follows:

10 CARS OR LESS.

Received answers from sixteen roads: Fourteen of these buy all supplies and repair parts, and have not a machine of any kind; the other two have a drill press, small lathe and blacksmithing outfit.

10 TO 20 CARS.

Received answers from thirteen roads: Seven of these have partially equipped machine shops, do all ordinary repairs, and manufacture many parts for renewals; the other six have not a machine of any kind.

20 TO 30 CARS.

Received answers from ten roads: Six of these have well equipped machine shops, do all repairs, and manufacture most parts for renewals; the other four have not a machine of any kind.

30 TO 50 CARS.

Received answers from six roads: Of these one has not a machine of any kind; one has only a wheel press; two have a drill press, lathe and blacksmithing outfit; the other two have fully equipped shops and do all repairs and make nearly all supply parts.

50 OR MORE CARS.

Received answers from twelve: Two of these have only a drill press, lathe and blacksmithing outfit; nine have complete shops equipped with machines of all kinds, and manufacture about everything necessary to maintain the equipment; one has a very extensive manufacturing establishment, outside of a complete repair shop, and also maintains a brass foundry.

The remaining roads from which I received answers had no definite information to give. One or two said that they were getting ready to establish shops, and others were undecided what they would do.

Out of the sixty-six roads heard from, thirty-six were winding their own motor armatures and field coils, and the cost of armatures varied from $17 the lowest, to $75 the highest; the average was about $35, including all material. Fifteen roads had wood working machinery, consisting principally of saw table, band saw, surface planer and mortising machine. Seven roads are cutting their gears, but some of them find it no cheaper than to buy. They think, however, that the work and material are better, and for that reason it pays them. Others make all gears and think there is a saving in cost. Eight roads are building their cars, while several are rebuilding old cars, but make no new ones.

I will give now a few of the prices for which supply parts are being made in the shops of the different roads. These figures are an average taken from eleven roads which are using Sprague, T-H. and Westinghouse, double reduction motors.

Refilling commutator (copper bars)	$18.50
Two halves armature bearing, T-H., $3.96, single Sprague.	1.85
Two halves axle bearing	3.50
Brush holder	1.35
Rocker arm, T-H., $1.00, Sprague	3.00
Int. shaft (steel), T-H., $10, Sprague	3.00
Int. pinion (steel)	4.20
Int. gear	3.88
Axle gear	5.66
Armature pinion (steel)	3.58
Trolley wheel (brass)	1.06
Line frog	1.90
Clips for line hangers (brass)	.15
To bore and press on thirty inch wheel	.95

The average price for which roads sell scrap car wheels is $13.65 per gross ton; the lowest being $8, and the highest $20.

Some roads have kept no account of cost of making repair parts, and therefore could give no prices. It is unnecessary to say that it would be wise to do so.

Being anxious to know, myself, and thinking it might be of benefit to many others, I asked the roads to give an opinion as to which of the different types of motors gave them the most trouble. With but two exceptions, the single reduction costs less to maintain.

Nineteen roads are employing an electrical engineer, and four have a superintendent and electrical engineer combined.

In regard to my own experience, I will say simply that it fully coincides with the information just presented to you. I have no doubt, whatever, that there is economy in maintaining repair shops, and even

manufacturing supply parts. Of course what will apply to some roads will not to others. Some roads are too small to think of its being profitable, but many others will find it to their advantage if they will look at the matter in all its parts.

I will not attempt to recommend the number and kind of machines a road ought to have, as it will depend largely on the number of cars they operate, but I have made up a list of machines which I find the majority of those having machine shops are using, and should judge that it covers those most necessary for the work.

One 20 in. swing, 10 ft. bed, engine lathe.
One 16 " " 6 " " " "
One 16 " " 6 " " speed lathe.
One 24 in. × 24 in. iron planer.
One No. 3 or No. 4 Universal milling machine.
One 45 in. upright boring mill.
One 24 " " drill press.
One 12 " " " "
One 100 ton hydraulic wheel press.
One open die bolt cutter and nut tapper.
One medium size shaper.
One tool grinder.
Two forges with power blower.
One set of emery grinders.
One grindstone.
Necessary bench tools and fittings for machines.
One 10 H. P. motor to run machinery.

Of course roads with a great number of cars would need to duplicate some of these machines, and add some others not mentioned.

After having considered this subject and shown you what conclusions have been arrived at, both theoretically and practically, I want to add that, in order to make a success of running a machine shop in connection with an electric road, it will be necessary to employ an electrical engineer. By this I do not mean a handy man, or a man who styles himself an electrician, just because he has had a few months' experience in the electrical business, but one who has a theoretical, as well as a practical, knowledge of mechanical and electrical engineering.

In conclusion, I wish to say that I have endeavored to be as impartial as possible in what I have said, and have tried to present the subject in a comprehensive manner. I hope that discussion will follow the reading of this paper, for although some of us are fully persuaded that machine shops are economical, yet, I think, none of us are so prejudiced that we could not be convinced, should it be proven to the contrary. Let us get at the truth, whatever it is.

Report on "Relative Cost of Operation of Horse, Cable and Electric Roads."

By William M. Ramsey, Chairman of Committee.

Gentlemen:—"The comparative cost of operation of Horse, Cable and Electric Railways," is the title of the paper for which your consideration is solicited for the next few minutes.

The subject is, it is needless to say, a fruitful one, and one on which a wordy speaker might discourse by the hour and leave his hearers no wiser. Your committee desires to present to you the result of its efforts, with only such comments as shall be necessary to its clear understanding.

The work which the committee had to perform was to ascertain from leading horse roads, cable roads and electric roads, such information regarding the cost of operation of each, as the existing methods of accounting in each case made possible. They recognized in the early stages of their work that any attempt on their part to shape the accounts of the companies to suit the purpose of the committee would be fruitless, for reasons which must be obvious to all. A series of questions was framed comprehending the information desired, and with such subdivisions of operating expenses as it was thought would meet with most ready reply. Our experience has proved that the subdivisions were well selected, for many of the replies were as full and concise as could be desired.

As to the greatest difficulty encountered—the lack of uniformity in methods of keeping accounts—enough has been said at former conventions. The difficulty, however, still exists; and, it might be observed, another difficulty was brought prominently to the notice of the committee, that is, the woeful lack of acquaintance with facts, and the need of scientific study and research into the economics of one's own road.

Correspondence was opened with every cable road in the United States by Mr. Greene, and by myself with the representative electric and horse roads. It is with regret that the committee announces that the information received from horse roads, for various causes, is meagre and unsatisfactory. It was not the intention of the committee to pass superficially over the horse roads, as our report would seem to indicate.

Many of the replies sent to the committee were given for the personal consideration of the committee alone, and not for publication or public reference in any way. We have, however, chosen a few of the representative roads of each class, and have tabulated the replies in such a way that reference can be made to them by number if desired. Names, location, amount of stock and bonds, and other marks by which a road might be identified, are necessarily omitted.

A comparison of the reports from these roads does not reveal the characteristics which we should expect to find. We see results which are as varied as could be imagined. Why should cable road No. 1, earning only eighteen cents per car mile, have within eight cents per car mile as much to divide among its stockholders as road No. 3, having nearly twelve cents per car mile more receipts. Let us refer to the reports of these two roads and make a few comparisons.

The first noticeable difference in the conditions under which the two roads operate lies in the fact that road No. 1 operates daily an average of 298 trail or tow cars, while road No. 3 operates only grip cars. Road No. 1 operates 1.54 tow cars for every grip car operated, or a daily mileage of 203.2 for every train of one grip car and 1.54 tow cars to every 100 miles made by a train of one grip car only, which road No. 3 operates. Now if the expense of operating increased *directly* as the mileage, whether made by grip or by tow cars, a direct comparison of these two roads would be possible; but such is not the case. Road No. 3 is evidently at a disadvantage. The same difficulty occurs in the comparison of certain electric roads with one another.

A very excellent method of correcting this error has been formulated by Dr. Cary T. Hutchinson, and is here presented by his kind permission. It is evident that what is wanted is a formula which will represent the ratio of cost per car mile, for any item of expense.

Dr. Hutchinson's method is as follows:

Let "t" = No. of miles a train of two cars runs per day.
" "m" = " " motor car alone runs "
" "a" = cost per train mile for any special item, *e. g.*, cost of fuel.
" "b_m" = cost per motor car mile—the same item.
" "N" = 2t + m equals "car miles" as ordinarily counted.
" "r" = a/b equals ratio of cost per train mile to cost per motor car mile for any given item.
" "c" = cost per car mile, counting trailers same as motor cars. This is the figure ordinarily given.
" "C N" = total cost of operating line per day for that item.

Then $a\,t + bm = C\,N$ for any item of expense.
but $a = br$
$\therefore b(tr+m) = C\,N$

$$b = \frac{C\,N}{t\,r + m}$$

$$b = \frac{C\ 1}{r\ \frac{t}{N} + \frac{m}{N}} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$a = r\,b \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Now $\frac{t}{N}$ and $\frac{m}{N}$, the ratios of train and motor to total mileage, are known.

Then r must be determined for each item of expense.

I take for "r" the following values:

First.—Maintenance of roadbed and track, r = 1.5; although there are two cars instead of one, yet the trail car is by no means as hard on the rails as is the motor car.

Second.—Maintenance of line, —r = 1. It is the same whether there is or is not a trail car.

Third.—Maintenance of power plant,— r = 1.4. Because I have found by experience that under average conditions a train requires about 1.4 times the power of a motor car, and maintenance should be assumed proportional to power developed.

TABLE NO. 1.

OPERATING EXPENSES, ETC., OF EIGHT CABLE ROADS.

No.	Average No. of Grip Cars operated daily.	Average No. of Trail Cars operated daily.	Daily Mileage of Grip and Trail Cars.		Receipts per Car Mile including Mileage of Trail Cars.	Fixed Charges per Car Mile.	Interest on Funded Debt.	Taxes, Tolls—State, County and Municipal Taxes, except Water Taxes.	Gross Operating Expenses per Car Mile, exclusive of fixed charges.	Maintenance of Road-bed and Track.	Maintenance of Cable Rope and Underground Machinery.
			Grip.	Trail.							
1	193	298	80	80	18.054	1.624	1.069	.555	8.810	.401	.686
2	30½	....	127	....	18.300	4.700	4.200	.500	13.700	.500	2.300
3	54	....	100	....	29.840	5.440	3.200	2.240	16.000	1.910	1.720
4	5	6	90	90	15.10	.....	.....	.....	41.000	.....	.....
5	7	7	70	70	19.80	.....	.659	1.210	.....	.....	.....
7	29	58	104	104	.....	1.230	.990	.....	6.750	.....	.....
6	8	5	90.40	105.65	.....	1.884	1.532	0.352	10.715	.448	.734
8	70	70	123.54	123.54	.....	6.610	5.700	0.910	20.050	.400	3.000

TABLE NO. 1.—*Continued.*

OPERATING EXPENSES, ETC., OF EIGHT CABLE ROADS.

Maintenance of Power Plant, including repairs to engines, boilers, etc.	Maintenance of Plant in general. Buildings, etc.	Maintenance of Rolling Stock.	Maintenance of Grips, including inspection and shop work.	Cost of Power—Fuel, water, oil, waste, and wages of employes.	Cost of Transportation—Conductors and Motormen, lighting and heating cars, etc.	General Expenses—Salaries, Legal, Accidents, etc.	Net Earnings per Car Mile.	Wages of Conductors and Gripmen per hour.	Kind of Fuel used.	Cost per ton.
.530	.132	.594	.084	.925	4.702	.756	7.620	28c.	Screenings	1.47
.100	.030	.300	.100	1.700	6.400	2.000	4.900	17c.	Slack & Nut	2.02
.190	.580	1.030	.570	1.070	7.450	1.480	8.400	18¾c.	Coal.	1.21½
....	....	....	....	.....	7.000	3.000	.....	17½c.	R. O. M.	2.00
....	....	....	....	.....	.....	.....	.....	.....	.....	....
....	....	....	....	.....	.....	.....	.....	19½ and 20½	.....	....
.055	....	.480	.263	2.530	4.984	1.221	.....	22½c.	Petroleum.	5½c. per gal.
.120	.100	.860	.540	3.240	9.890	1.900	.....	22c.	Soft Coal.	6.20 net ton.

TABLE NO. 2.

OPERATING EXPENSES, ETC., OF SEVEN ELECTRIC ROADS.

No.	Average No. of Motor Cars operated daily.	Average No. of Trail Cars operated daily.	Average Daily Mileage of Motor Cars.	Average Daily Mileage of Trail Cars.	Receipts per Car Mile, including Mileage of Trail Cars.	Fixed Charges per Car Mile.	Interest on Funded Debt.	Taxes, Tolls—State, County and Municipal, except Water Taxes.	Gross Operating Expenses per Car Mile, exclusive of Fixed Charges.	Maintenance of Roadbed and Track.	Maintenance of Line work, including Underground Wiring.
					Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
1...	39⅙	....	127	....	19.360	.....	.....	.....	9.690	.....	....
2...	17	....	89½	....	25.263	7.222	6.861	.361	17.974	.773	.203
3...	280	5	70	56	40.280	3.360	1.000	2.360	25.440	2.520	.720
4...	10	4	120	120	13.500	9.000	.....	.....	9.000	.....	....
5...	10	....	100	....	15.000	6.400	.....	.....	.....	.....	....
6...	5	....	96.6	....	.....	.....	.....	.....	16.000	.110	.070
7...	37	....	100	....	28.880	.....	2.560	.....	18.530	2.500	.520

TABLE NO. 2.—*Continued.*

OPERATING EXPENSES, ETC., OF SEVEN ELECTRIC ROADS.

Maintenance of Power Plant, repairs on engines, boilers, etc.	Maintenance of Plant in general, Buildings, etc.	Maintenance of Rolling Stock, Car Bodies, Trucks, etc.	Maintenance of Motors, inspection and shop work, electrical and Mechanical.	Cost of Power—Fuel, Oil, Waste, etc. Wages of employes.	Cost of Transportation—Wages of Conductors, Motormen, Dispatchers, etc.	General expenses—Salaries, Legal, Accidents, etc.	Net earnings per Car Mile.	Wages of Conductors and Motormen per hour.	Kind of Fuel Used.	Cost per ton.
Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.		
....	....	....	....	....	....	....	9.670	15½	Slack at 1.90;	Lump 3.00,
.411	.040	3.405	3.405	3.301	8.750	1.091	.0067	24	Wood	by the year.
.360	.330	1.590	2.720	3.560	11.420	2.220	14.3400	22½	Lump Coal	3.92
....	....	....	....	....	1.500	....	4.0000	12½	Soft Coal	1.25
.420	....	1.230	2.360	3.200	....	....	3.4200	13	Soft Coal	1.32
....	....	.740	....	3.840	8.740	.620	5.2300	14	R. O. M.	3.00
....	....	2.360	2.380	2.840	6.900	2.210	6.6100	20½	Slack	1.21

Fourth.—Cost of power.

(a) and (b) fuel and supplies, r = 1.4, as above.

(c) and (d) attendants, r = 1. Because for a good sized plant no more men would have to be employed in the power house if all the cars hauled trailers; the force required is not proportional to the output, but is constant within pretty wide limits.

Fifth.—Maintenance of rolling stock.

(a) and (b) repairs to motors, r = 1.

(c) " " cars and trucks, r = 1.25.

Repairs to trail cars are very much less than to motor cars.

Sixth.—Transportation expenses.

(a) carmen, r = 1.5, three men on a train and two on a motor car.

(b), (c), (d), (e) and (f) may all be bunched at r = 1.25.

Seventh.—General Expenses.

r = 1.

Referring again to our table of statistics:

No. 1 road expends .925 cent per car mile for the item of cost of power, and No. 3 road expends for the same item 1.07 cent and this, notwithstanding the fact that road No. 3 only pays $1.21½ per ton for fuel, while road No. 1 pays $1.47 per ton.

TABLE SHOWING STATISTICS OF ONE CABLE AND SEVEN ELECTRIC ROADS.

By permission of DR. CARY HUTCHINSON.

OPERATING EXPENSES.	Mileage 4,750,000 No. 1.		Motor miles No. 2.		704,913. No. 3.		1,345,146 No. 4.		1,500,000		2,744,000 No. 6.		1,098,000 No. 7.		2,725,000 No. 8.	
	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%
1. MAINTENANCE OF ROADBED AND TRACK	.....	.....	.....	.....	1.040	8.45	2.51	12.66	.....	.....	.....	.....	1.516	10.80	.505	4.60
2. MAINTENANCE OF LINE	.....	.....	.....	.....	.100	.81	.53	2.67	.145	.204	.....	.....	.515	3.82	.....	.....
Total	.159	.205	.200	2.10	1.140	9.76	.....	15.33	.....	.....	.300	2.80	.....	14.62	.....	.....
3. MAINTENANCE OF POWER PLANT:																
(a) Repairs of engines and boilers	.....	.....	.....	.....	.050	.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(b) Repairs of dynamos	.....	.....	.....	.....	.007	.10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(c) Miscellaneous repairs	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.057	.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4. COST OF POWER:																
(a) Fuel	.....	.....	.....	.....	.830	6.75	.....	.....	.675	9.40	1.280	11.90	.....	.....	.....	.....
(b) Oil, waste, water and other supplies	.331	4.26	.391	4.12	.200	1.63	.....	.....	.412	5.64	.440	4.10	.....	.....	.....	.....
(c) Wages of engineers and firemen	.162	2.09	.223	2.35	.700	5.70	.....	.....	.168	2.35	.....	.....	.....	.....	.....	.....
(d) Wages of dynamo tenders, etc	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.500	4.65	.....	.....	.....	.....
Total	.493	6.35	.614	6.47	1.730	14.08	2.84	14.80	1.255	17.39	2.220	20.65	1.304	8.72	2.83	25.80
5. MAINTENANCE OF ROLLING STOCK:																
(a) Repairs on motors, except gearing	.....	.....	.....	.....	.905	7.35	.....	.....	.244	3.40	.....	.....	1.402	9.40	.....	.....
(b) Repairs on gearing and trolleys	1.040	13.40	1.430	15.10	.234	1.90	2.38	12.00	.....	.....	.....	.....	.....	.....	.....	.....
(c) Repairs on car bodies and trucks	.435	5.60	.542	5.70	.528	4.30	2.35	12.00	.315	4.40	.....	.....	.....	.....	.....	.....
Total	1.475	19.00	1.972	20.80	1.667	13.55	4.73	24.00	.559	7.80	1.800	16.80	.....	.....	.715	5.50
6. TRANSPORTATION EXPENSES (a) Wages of Conductors and motormen	.....	.....	.....	.....	4.560	37.14	6.98	35.30	4.678	65.50	4.650	43.29	4.815	32.00	4.00	36.40
(b) Wages of starters, switchmen, track sweepers, etc.	4.330	56.00	4.930	52.00	.485	3.95	.....	.....	.103	1.43	.515	4.80	.....	.....	.....	.....
(c) Cleaning and inspecting cars and motors	.....	.....	.....	.....	.290	2.35	.....	.....	.383	5.35	.....	.....	.....	.....	.....	.....
(d) Oil, waste and other supplies	.....	.....	.....	.....	.485	3.95	.....	.....	.036	.50	.....	.....	2.693	18.00	.....	.....
(e) Accidents to persons and property	.....	.....	.....	.....	.007	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(f) Miscellaneous	.172	2.05	.215	2.26	.477	3.90	.....	.....	.....	.....	.100	.93	.....	.....	.....	.....
Total	4.502	58.05	5.145	.....	6.304	51.30	.....	.....	5.200	9.29	5.265	.....	7.508	.....	5.62	51.30
7. GENERAL EXPENSES																
(a) Salaries of officers and clerks	.437	5.65	.600	6.34	.....	.....	.....	.....	.....	.....	.132	1.23	1.051	7.00	.....	.....
(b) Office expenses	.132	1.70	.182	1.92	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(c) Advertising and printing	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.250	2.32	.....	.....	.....	.....
(d) Legal expenses and damages	.174	2.25	.240	2.54	.....	.....	.....	.....	.....	.....	.102	.95	.291	1.95	.....	.....
(e) Insurance and taxes	.384	4.96	.530	5.60	.....	.....	.....	.....	.....	.....	.153	1.43	.184	1.23	.....	.....
(f) Miscellaneous	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.523	4.90	1.090	7.30	.....	.....
Total	1.127	14.55	1.552	16.40	1.402	11.40	2.21	11.2	.....	.....	1.160	19.83	2.616	17.48	1.30	11.80
Grand total	7.756	100	9.483	100	12.30	100	19.60	100	7.159	100	10.75	100	14.915	100	11.00	100

APPENDED TO DR. HUTCHINSON'S TABLE.

Therefore, for

1. b=1.14 c, r=1.5.
2. b=1.36 c, r=1.
3. b=1.18 c, r=1.4.
4. (a) and (b), b=1.18 c, r=1.4.
   (c) and (d), b=1.38 c, r=1.
5. (a) and (b), b=1.38 c, r=1.
   (c) b=1.25 c, r=1.25.
6. (c) b=1.14 c, r=1.5.
   (b) (c) (d) (f) and (e), b=1.25 c, r=1.25.
7. b=1.38 c, r=1.

These are the figures used in computing cost per motor car mile in the case of the No. 2 railway. No other line used trailers.

Using for r the value assigned above for cost of power, 1.4, our equation reduces to b = 1.07 cent, or in other words .925 cent. should be multiplied by 1.07 to bring it on a basis of comparison with No. 3 road. This gives us .99 cent. for No. 1 road as against 1.07 cent for No. 3.

The difference which still exists may be accounted for either by reason of a possible difference in the efficiencies of the two power plants, or by the possibility that one road may operate more cars to do the same amount of business than the other road.

This method of comparison can be used satisfactorily for any roads, cable or electric, providing the necessary data have been obtained as to motor car miles and train miles, and providing experience and careful observation have enabled the investigator to assign approximately correct values for "r," which will differ in different cases. But there are yet many discrepancies to explain, for which we must seek other reasons. Why should the gross operating expenses of No. 3 electric road exceed the gross receipts per car mile of No. 4 electric road by nearly 100 per cent., and yet both roads still have a fair percentage of their receipts left for dividends? No. 4 road is a small road, and No. 3 is a large one, but we cannot argue that small electric roads have a better chance for profits than large ones. It is fair to assert that study of No. 3 report would lead to the conclusion that either there is more in the road than is brought out of it, or that the only thing that justifies the outlay of twenty-five and a half cents per car mile (trail car mileage included), is the receipt of over forty cents per car mile to do it with.

The quality of the management which any of our roads receives is an uncertain quantity, but must be assumed to be good, in our arguments. The management of roads Nos. 1 and 3 in the cable list are known to the writer to be excellent. The other conditions under which the two roads operate are nearly the same. Yet a "figure of merit," obtained by multiplying the total daily mileage by net earnings per car mile, and dividing by the amount of capital stock paid in, shows vastly in favor of No. 3 road, and this, notwithstanding the gross operating expenses of No. 3 road are about 50 per cent. higher than the operating expenses of No. 1 road—both being placed on an equal basis of grip car miles. We see, therefore, that still another method of comparison must be resorted to in order to give an intelligent idea of the comparative earning power of two roads, namely, the comparative earning power per day of each dollar invested in each road. This ratio, when stated, comprehends all of the conditions under which the two roads operate; it is the final result of a compound proportion of which the ingredients are the investment, the outlay and the income—"outlay" comprehending the management and efficiency of the road, and "income" comprehending, among other things, the comparative value of the territories through which the roads pass.

Operating expenses per motor car mile, or per grip car mile, afford a satisfactory basis on which to compare expense of operation, but net earnings per motor or grip car mile tell us nothing of the value of a road as an investment, unless we know also the total investment necessary to earn so much per car mile; and we take occasion to remark here that future committees on this important topic will find it discouraging work to follow the usual lines of investigation into receipts, cost of operation and net earnings of street railways, and may find it necessary to look to some method of comparison by arbitrary "figures of merit," as has been suggested by several of our thinking engineers.

For a comparison of an average cable road with an average electric road, let us take this same No. 3 cable road, and compare it with No. 7 electric road. The cable road has been shown to be something better than the average, and the electric road is known to the writer to be at least up to the average. These two roads afford us a better opportunity than any other two which we might select, for the following reasons:

1st. Both are located in the same city, where climatic and other local conditions are the same.

2d. Both roads are of the same magnitude.

3d. Fuel and labor cost the same in each case.

4th. Neither road operates trail cars.

The cable road has the advantage in route as to grades and curves; otherwise, the roads offer excellent opportunities for comparison. It might be added that the investment in each case is up to the average, that is, is not extravagantly large, and yet is ample for the business transacted. Each road may be regarded as typical of its class. We see, upon examination, that the cable road has the greater fixed charges by 1.7 cent. There is a difference of one cent in the gross receipts in favor of the cable road; one cent of which may be said to be due to the larger gross receipts; but resorting again to the comparison by "figure of merit," we find a ratio of .00015 to .00020, or nearly three to four in favor of the electric road. This simply means that each dollar invested in the cable road will earn .00015 in one day, whereas, each dollar invested in the electric road will earn .00020 in one day. The total investment in the case of the cable road in this case is two and one-eighth times the total investment in the case of the electric road. The capital stock alone, exclusive of bonds of the cable road, is two and four-tenth times the capital stock of the electric road. What is our conclusion from these facts, or can we draw a conclusion on which we can stand? We have not been conservative in our statements thus far, but are, of course, not infallible. "One swallow does not make a summer," nor do the examples we cite determine the whole matter once for all. The cable road has its place firmly established in the transportation business of the Pacific Slope, and we, who are acquainted with the conditions met with there, cannot presume to say that the electric railway would do the same work better and more efficiently. We are tempted to say so, but the interests concerned are too great to be trifled with in so dogmatic a manner. We recognize that the greatest value will be obtained from this report by members taking it home with them and studying the figures analytically. Another year may develop such improvement in methods of accounting that definite conclusions can be formed, but to do more than merely produce figures from typical roads, the committee is not prepared at this early stage of electric railroad practice. The cable roads have their methods pretty well digested, and their figures are, as a rule, reliable. The electric roads are as yet, with few exceptions published in this paper, in the dark as to what they are doing—except that they have enough left to satisfy stockholders—in fact, 89 per cent. of the electric roads heard from report dividends of from 5 to 12 per cent.

We believe that cable road practice has reached the stage where but little room is left for improvement. They have been developed, improved and operated by the best engineering skill which the country affords. Nearly all are on a good dividend paying basis; but whatever the past experience of the two systems has been, or whatever the present status of the two may be, we are only voicing the convictions of well informed engineers, when we say that electric systems will continue to increase in efficiency (by which is meant earning capacity) until all rivals are distanced, and only one method of rapid transit is recognized—the electric car.

Report on "Standards for Electric Street Railways."

By O. T. Crosby, Chairman of Committee.

Gentlemen:—The committee, of which as chairman I now desire to render the report, was named in the president's letter of January 4, 1892, and addressed to the undersigned. The scope of the committee's work as set forth in that letter and in the resolutions bearing on the subject adopted by the Association last October, is to report on the standardizing of rating, nomenclature, dimensions and accounts.

The committee, as first determined, consisted of the following members: O. T. Crosby, chairman; H. I. Bettis, who, as per your letter, was to give special attention to the matter of accounts; E. E. Higgins; Chas. W. Wason, named as mechanical member, and R. W. Rippetoe. The last named gentleman resigned from the committee work shortly after its inception, and Mr. J. E. Rugg, of Pittsburgh, was appointed in his stead.

The first meeting of the committee was called to take place in New York, February 9, 1892. The minutes of that meeting indicate quite clearly how the work was viewed by the members of the committee, and what subdivision of work was determined upon. I extract from these minutes the following statements:

Present: O. T. Crosby, chairman; Charles W. Wason, representing the East Cleveland Railway Co., and H. I. Bettis, representing the Atlanta Consolidated Street Railway Co.

The discussions in committee resulted in the following conclusions:

The things on which definite recommendations were to be made to the Association were as follows:

1.—Accounting methods. Concerning this the object of the committee will be to emphasize the three headings—transportation, maintenance and construction, under which expenditures are to be kept.

It was also concluded to present the car mile as the unit of operating expenses, especially in regard to the item of motive power. For the purpose of comparing motive power expenditures, double truck

cars shall be distinguished from single truck cars, while double truck cars shall be classed with trains of two cars.

It was also intended to urge the necessity of proper monthly returns. The whole matter of accounting methods was referred to Mr. Bettis, as sub-committee.

In regard to specific dimensions to be standardized, it was concluded that recommendation should be made concerning standard diameter of axles, of wheels, of trolley wheels, of trolley poles and trolley pole sockets; also the width of trolley wheels and the depth of their grooves, also key-ways for axle gears, and the distance between hubs of wheels measured along the axle. The report on their standard dimensions was referred to Mr. Wason, as sub-committee. It was concluded that the diameter of the trolley wire should be referred to Mr. Crosby, he to correspond with the various electrical manufacturing companies and other persons as he might deem suitable. The same conclusion was had in regard to the rating of motors for railway use, this being referred to Mr. Crosby.

The standardizing of the nomeclature of the various parts used in railway apparatus was referred to Mr. Higgins as sub-committee, with the suggestion that he correspond with the electrical companies and railway companies.

It was also determined that each member of the committee should report as soon as possible to the chairman of the committee, his views upon what plan should be recommended to the Association as adequate for carrying on in a permanent way the work of standardizing, which work can scarcely be more than begun by the present committee.

METHODS OF ACCOUNTING.

At the date of the preparation of this report, Mr. H. I. Bettis has made no special report on the subject of accounting, and, perhaps, indeed little remains to be said save to insist upon the importance of preserving the three separate headings, namely, transportation, maintenance and construction, while at the same time referring to the particular forms which were largely prepared by Mr. Bettis, and which appeared in the paper read by the undersigned last October, the discussion of which resulted in the appointment of your committee.

While awaiting any further special treatment of the subject from Mr. Bettis, I beg also to call special attention to the recommendation that a car mile be adopted as the unit of operation in regard to the item of motive power. The introduction of the double truck cars into street railway service makes this unit, however, somewhat inaccurate unless the distinction between the various kinds of cars be carried along with the use of this term. We have thought that the distinction should rest rather as between double truck cars and single truck cars than between cars of different specified lengths. Furthermore, and especially relating to the question of motive power, we recommend that it will be reasonably safe to class two standard sixteen foot cars with double truck cars, experience having shown that the consumption of power in the two cases is nearly equal under given conditions as to track, grade, etc.

One of the chief difficulties, heretofore, standing in the way of determining accurately the cost of one mile of service has been the inaccuracy in the determination of the amount of power consumed for such unit service. The perfection of recording wattmeters that has taken place during the past year will go far towards remedying this difficulty. This, like any other mechanical assistance, will, however, be of no avail if the books be not kept accurately with respect to all expenditures going to motive power. For such accuracy there must be paid a reasonable sum for clerical labor. The object of the blanks above referred to is to reduce that labor to a minimum for a given degree of accuracy. It will, of course, be possible to arrive at satisfactory results by means somewhat differing in detail, but it is strongly urged that the general lines indicated in the recommendation of this committee be followed so closely that it will at least be possible to feel sure in discussing reports of opening expenses from any two roads, that the same items of cost have gone into the headings of transportation, maintenance and construction. We do not feel it necessary to enlarge upon the importance of careful bookkeeping looking to the determination of these three headings. We assume that all intelligent railway men appreciate the importance of knowing what they are doing.

STANDARDIZING OF SPECIFIC DIMENSIONS.

In regard to this heading, I take pleasure in inserting herewith the report of Mr. C. W. Wason, sub-committee on this subject.

"In order to better determine the sizes of the several parts given me, as a member of the Standardizing Committee, I sent out circular letters to 200 of the leading electric roads, requesting them to give their opinion as to the sizes of the several dimensions.

"I would state right here that from the small number returned, namely, about 30 out of 200, that the street railroad companies do not realize the benefit to be derived from such a movement, else they would take the trouble of answering such questions of general information, thus enabling the committee to much better arrive at a satisfactory conclusion. I know, myself, as an officer of a street railroad company, my first inclination upon opening a letter containing questions is to throw it into the waste basket, but upon a second consideration, I conclude it best to send what little information I may be able to give to the party making the inquiry, thinking possibly that the general result therefrom obtained will be of benefit to the whole street railway fraternity.

"One of the objects, as I understand it, of the street railway convention is to enable the street railway men from different parts of the country to get together and exchange their views relative to varions matters, with the idea of the mutual benefit to be derived from the discussion, and which would be impossible for the individuals to obtain did they not come together in this manner. Members of a committee like the Standardizing Committee have much work attending the bringing together of the matter desired, and it surely seems to me that each individual company should do all in its power to assist the committee by answering, to the best of its ability, any inquiries put to it by the members of such a committee through the mail.

"In order to obtain the dimension of the car journals, such as this committee may think best to recommend, I corresponded with the several truck manufacturers, who kindly gave me blue prints and drawings of their journal boxes. If the electrical manufacturers continue to increase the weight of their motors, these dimensions should be increased. The data I have present have been gathered from railroads using possibly a lighter equipment than that which is now being put upon the market. It is absolutely impossible to standardize an appropriate size, considering the change of weight, but the following seems to be the best in the opinion of those from whom I had answers to my inquiries:

Diameter of axle, 3½ ins.
Diameter of car axle journal, 3 ins.
Diameter of axle wheel seat, 3⅛ ins.
Length of car axle journal, 8½ ins.
Diameter of car wheel, 33 ins.
Weight of car wheel, 350 lbs.
Diameter of trolley wheel, 4½ ins.
Width of trolley wheel 1½ ins.
Depth of groove in trolley wheel when new, 1½ ins.
Size of key way for axle gear ¾ in. by 6 ins.
Distance between hubs of wheels, measured along the axle, 48 ins.

"It is essential that the groove and depth of the trolley be the same if the cars run over the same style of switches, as it is almost impossible to put up an overhead construction that will carry all sorts of trolley wheels. This remark may at first look a little absurd, but when one has had much experience with several different sized trolley wheels he will at once appreciate the necessity of all being alike."

The dimensions above recommended as standard have been approved by the other members of the committee to whom they have been submitted, except that Mr. Rugg prefers a thirty inch wheel instead of a thirty-three inch to be considered as standard. It will be seen in studying the articles above referred to that those have been chosen which, if of varying dimensions, interfere most with the interchangeability parts in an electric railway equipment. The object held in view was so to standardize dimensions as to produce as little inconvenience as possible when apparatus such as trucks, trolleys, motors, etc., are obtained for use on the same railway from different manufacturers.

We have endeavored not to forget the principle referred to in the papers presented last year, namely, "that the standardization of parts should be so directed as not to interfere with the progress of invention." There must, of course, in the matters interesting to this Association, as in every other evolutionary development, be on the one hand a constant struggle to ossify into fixed forms, and on the other a tendency to restlessly change in the development of new forms. Complete ossification is justifiable only after the obtainment of perfection. Constant change in every detail is, on the other hand, justifiable only on the ground that nothing valuable has yet been reached. The adoption of any standard whatever constitutes a compromise between the two considerations named. We trust you will find those standards recommended by us to be a reasonable compromise.

Without in this report going at length into a discussion of the con-

siderations which have led to an adoption of each of the dimensions above given, it should be noted that besides the large correspondence carried on by Mr. Wason with various persons throughout the country, there has been a very considerable amount of private discussion on each dimension between Mr. Wason and other members of the committee, and various competent persons. The dimensions of wheels and trolleys above given are intended to be applicable alike to single truck and double truck cars.

Concerning another mechanical dimension, consideration of which was referred especially to the writer, I am able to report that a large majority of the numerous persons addressed by me upon the subject, recommended No. o B. & S. gauge as the best size for standard trolley wire. It is further understood that such trolley wire shall be of hard drawn copper; its conductivity to be 98 per cent. of the standard in the usual tables used; its tensile strength close to 55,000 lbs. per square inch.

Perhaps the desirability of standard dimensions can be as readily shown by referring to this trolley wire as well as in any other way, although at first it may seem to be of very small importance that there should be any agreement on such an article. If, however, it were shown throughout the country that No. o trolley wire was always in contemplation unless very plainly expressed to the contrary, there would be fewer mistakes than have occurred in the past in regard to the size of the channel in the overhead device to which the trolley wire is attached.

More than this, manufacturers of these devices could carry stocks more safely, and purchasers could correspondingly obtain more readily those articles which are especially desired to be shipped in a hurry.

NOMENCLATURE.

The list of names suggested by the writer in the paper last year, has been submitted to a number of railway officials, railway contractors and manufacturers of electrical goods. Some corrections of the list as presented last year have been recommended by various persons and are herewith incorporated. The name now recommended appears first, and after it, in parenthesis, is the one heretofore used for some articles.

Concerning this list of names, the following letter was received from the Westinghouse Electric & Manufacturing Co. :

PITTSBURGH, PA., September 17, 1892.

MR. O. T. CROSBY,
130 Summer Street, Boston, Mass.

DEAR SIR: Referring to your favor of the 6th inst., and to the copy of the extract from the last report of the Committee on Standards of the American Street Railway Association, would state that motors or parts as designated on the first sheet of the extract appear to us to be termed properly. We do not, however, with our motors, use standards for supports on bearings or side arms.

The second sheet of the extract pertains entirely to details required in the construction of the overhead work. As we do not make a specialty of this work, we prefer to refrain from expressing an opinion as to what terms should apply in this connection.

Yours truly,
(Signed) W. C. CLARK,
General Agent.

NOMENCLATURE OF ELECTRIC RAILWAY TERMS.

Generator (generator, dynamo) :—Machine in which the electric current is generated.

Motor (motor) :—Machine in which the electric current is transformed into mechanical power.

Frame (frame) :— Iron body of machine, including pole pieces and standards or side arms, if any, but not including base plates and bearings.

Standards (standard bracket) : — Supports of the bearings of generator.

Side arms (side arms, check pieces, armature bracket) : — Supports of bearings of railway motors.

Pole pieces (pole pieces) : — That part of the frame from whose surface lines of force may pass directly to the armature.

Field coil (field coil, spool) : — Coils of wires wound on frame in such a way that a current passing through these coils makes magnets of the frame and pole pieces.

Brush holder .—Device for holding the brushes in contact with the commutator, including the insulation used in its support.

Rocker arm (yoke, rocker arm) : — Device for holding brush holders in position on commutator while attaching it directly or indirectly to the frame.

Fuse (fuse, fusible plug) : — A metal device for opening circuit when the current becomes abnormally large, the soft metal being melted by a current of fixed quantity.

Switch : — A device for closing or opening a circuit at one or more points.

Rheostat (resistance box, rheostat) : — Wire or other material suitably protected and conveniently arranged to be introduced in more or less proportion into a circuit.

Trolley (trolley contact bar) : — A device used to transmit the electric current from the overhead wire to the cars, consisting usually of a

Trolley wheel : —A small metal wheel making rolling contact with the overhead wire.

Trolley fork :—Mechanically connecting trolley wheel to

Trolley pole :—Supporting the trolley fork and wheel and resting in a socket which is part of the

Trolley base frame.

Trolley wire :—Wire from which the trolley wheel directly receives current.

Standard trolley switch (trolley frog, frog overhead switch)—A device used to fasten or hold together the trolley wires at a point where the trolley wire branches, and to guide, ordinarily automatically, the trolley wheel along the wire over the track taken by the car.

Trolley switch :—A switch designed for use at a point where two branch lines make equal convergent angles with the main line.

Right hand trolley switch :—A trolley switch designed for use at a point where a branch trolley wire leaves the main line to the right in the going direction.

Left hand trolley switch :—A trolley switch designed for use at a point where a branch trolley wire leaves the main to the left in the going direction.

Three-way trolley switch :—A trolley switch for use at a point where the line branches in three directions.

Drawbridge crossover :—A device permitting the easy passage of a trolley wheel from one to the other of two adjacent wires in a continuous direction.

Trolley frog (trolley crossing, crossing frog, crossover) :—A device placed at the crossing of two trolley wires, by which the trolley wheel running on one wire may cross the other, the device also holding the two trolley wires together.

Insulated trolley frog (insulated trolley crossing) :—A device placed at the crossing of two trolley wires, by which the two wires are insulated from each other, and by which the trolley wheel running on one line may cross the other.

Hanger (line insulator, line suspension, trolley insulator) :—A device for supporting and insulating the trolley wire.

Straight line hanger :—The hanger used on a straight line and supported from a span wire, the strain on the same being essentially vertical.

Single curve pull off (single curve hanger) :—The hanger supported by a lateral strain in one direction and, ordinarily, on single track curves, except at ends and the inside curve of double track.

Double curve pull off (double curve hanger) :—The hanger supported by a lateral strain in opposite directions, used ordinarily at ends of both single and double curves, and at intermediate points and on double track curves.

Feeder clip (feeder clamp) :—Clamp with a device by which a feed wire may be connected to the trolley wire.

Feeder :—A wire usually insulated, used for transmitting current from the power station to the mains or the trolley wire direct.

Mains :—Wire usually insulated, serving for the distributing of current from the feeders to the trolley wire through tap wires.

Tap wires :—Wires to convey current from feeders or mains at the pole to a near point of the trolley wire.

Trolley wire section (trolley section) :—A length of one trolley wire with or without branches, but continuous electrically.

Line section :— A part of the overhead conducting system, so insulated from other parts as to permit the supply of power to be separately controlled.

Section box :—A box containing section switches and fuses used for control of a trolley section or line section.

This subject, which was referred at the first meeting to Mr. E. E. Higgins, has latterly been taken up by the chairman, Mr. Higgins having been for some months abroad.

RATING OF MOTORS.

This subject is one affording a wide range of discussion and opinion. In all the correspondence and conversation which the undersigned

has had concerning the matter, none have been found who did not agree that the present loosely used rating by horse power is objectionable, but it has been much more difficult to find agreement or any substitute. All feel the difficulty of putting into the mouths of the many who must refer to the capacity of motors any unfamiliar expression, yet no advance can be made without meeting that difficulty. At the risk of unduly lengthening this report, I desire to repeat in considerable part the considerations presented by me last year. I quote from the paper referred to as follows :

"It must be borne in mind that an electric motor, like any other machine, a man, for instance, is capable of performing work at widely varying rates and widely varying efficiencies, and with widely varying factors of safety with respect to indefinite continuance of such a rate of work. It should further be borne in mind that an electric motor in particular is known to do its maximum rate of work when its efficiency is only 50 per cent.; that is, if twenty horse power represents the maximum rate of work, then forty electric horse power will be required to perform this work. A series motor, such is commonly used for railway work, also must vary widely in its speed while varying the quantity of work it performs per second. Now, this maximum quantity of work, and the efficiency at which it is performed, and the speed of the car connected with it, are matters of importance when we endeavor to get a really serviceable idea of what the machine can do ; that is, of how nearly it can meet the conditions required by the particular service to which we wish to put it.

" Will it serve the purpose best if we rate the machine according to its maximum capacity when its efficiency is 50 per cent., or according to some lower capacity at high efficiency, and at some speed as nearly as possible that at which the motor must be run during the greater part of its time of service ? Should we use the maximum rating, we have the advantage of knowing at once very nearly what is the limit of service which the motor can perform ; but, on the other hand, we fail to be told by such rating what the capacity of the machine is when doing the average work of our service.

" There is at present no conventional uniformity controlling either the manufacturer or purchaser of electrical machinery in regard to these matters, which can be determined only by the custom of the trade, as it may grow up through years of uncertainty, or as it may be directed to more rapid maturity by the action of such an association as this."

The first condition, which, in my opinion, should be connected by implication with any rating whatever, is this: that the machine in question shall be able to perform its rated work indefinitely and under any condition of atmospheric temperature. There is, of course, room for honest differences of opinion in regard to this point. It is well known that the maximum demands for power in street railway service are not those which last for a considerable length of time. A certain manufacturer may thus argue to himself : " This machine which I am about to advertise is able to do twenty horse power of work for half an hour, when the atmospheric temperature is ninety degrees. In my opinion this rate and time and temperature will not be exceeded in the conditions of regular service. Why, then, may I not call this a twenty horse power motor? It is true, if I were building it for stationary work, in which generally the load to be carried is much more constant, I shall adopt a different rating."

It would be possible to express their condition thus : That whatever the rate, it should be possible to maintain that rate indefinitely under all conditions of atmospheric temperature, by stating that the windings of the armature shall never show more than a given excess of heat over atmospheric temperature.

There is again room for honest differences of opinion in regard to the efficiency with which a motor can do its rated work. Suppose the manufacturer has produced a machine which can do its maximum work for an indefinite time without undue rise of temperature. There is today no custom of the trade distinctly understood which would prevent him from rating the machine by this maximum capacity. And, again, in stating that the machine is of fifteen horse power capacity, even if there be agreement concerning efficiency and durability, there might be disagreement of much importance in regard to the speed at which work can be performed by the motor. If it has been so constructed that it can do fifteen horse power of work only at some armature speed corresponding to a linear speed of the car, either much above or much below the average speed of the car, then the information and motor may both be of little value for street railway service. Indeed, the use of the term " horse power" then has necessarily this uncertainty in it : The total number of foot pounds per minute, namely, 33,000, may be made up in an indefinite number of ways by an infinite number of combinations of feet of travel and pounds of pull ; but for our service we should have some known relation between these two.

It seems to me that that which the purchaser has in mind to obtain is such horizontal effort exerted at such a speed and at such an efficiency as will do the work in view. Now, the work in view varies very widely, and we cannot, therefore, obtain a convenient rating which will express this relation throughout the range of the total capacity of the motor. We may, however, select some particular condition, say, that approaching as nearly as possible to the average, and tell by a method of rating, which I will propose, what the machine can do for such condition.

Let us first consider the speed at which it is desirable to know the capacity of the motor. I think ten miles per hour is not far from the speed at which cars will be found most frequently running. If, then, we state concerning a motor that it can develop so much horizontal effort at that speed, we at once have a pretty close approximation as to what load of a car and passengers it can handle at that speed, since we know that twenty-five pounds per ton is a fair approximation to the average traction co-efficient. Suppose, then, we are told that a motor can produce a horizontal effort of 500 lbs. at ten miles an hour ; it is, then, a quick inference that a car weighing twenty tons can be carried by such a motor at the rate of ten miles per hour on a level. We may then conscientiously call this motor a " 500×10."

It may, of course, at once be objected that such a method does not distinguish between efficiency of motor proper and the efficiency of its gearing. For a great many reasons this is not very objectionable. We buy the motor with its gearing, and I can see no particular reason why the manufacturer should not get the benefit or the blame of the good or bad gearing which he may use with his efficient or inefficient motor. Furthermore, in the single reduction motors, now so widely used for ordinary street railway work, the loss by gearing transmission is very small, and probably not widely variant as between the different manufacturers ; and again, in whatever high speed work which it may be feasible to do by gearless motors, the question of the efficiency or inefficiency of the gear is eliminated.

Again, it may be objected that such a method supposes uniform diameter of wheel which must be known to the manufacturer, in order that he may calculate what his motor is doing for a given car speed. Should there be no considerable variation from the thirty inch wheel now so largely used, such a diameter might be taken for granted as having entered the calculation ; and if a different wheel, say thirty-three inch, becomes general, then that diameter may be assumed in the rating.

It would, of course, in any such rating be assumed that the machine is working under a pressure of 450 volts, which is not far from that found on most of the lines throughout this country. In the necessary regulation to which these motors are subjected, a part of this pressure is practically applied to some resistance, external or internal, with respect to the motor ; but I can see no convenient way of taking this into account in determining upon a rating. Indeed, the action of a series motor in street railway service is very complex, and it is much more difficult than sometimes supposed to determine upon a rating which shall give the greatest amount of available information. The very difficulty, however, is warrant for approaching the subject seriously and industriously.

In spite of the fact that many objections may be urged against any suggested method of rating, that which is preferred by your committee and by many persons consulted in regard to the question is this : That a motor shall be known as to its capacity by the horizontal effort which it can apply to a car at a speed of ten miles per hour, the standard thirty-three inch wheels, above recommended, being used on the car, and whatever gearing may be preferred by the manufacturer. It is plain that the horizontal effort that may thus be produced from a given motor whose armature is running at a given speed, may be made to vary by this change of gearing, but for the reasons above stated it has been thought best to consider the motor and its gearing as one piece of mechanism. While this recommendation would at first involve the use of two terms in the name of a motor, namely, horizontal effort and speed, the term for speed would soon disappear after it had become generally understood to be ten miles per hour. Thus for the present, calling a given motor 600×10 ; this meaning that at a speed of ten miles per hour the motor in question will develop a horizontal effort of 600 lbs. Later, however, the same machine would be satisfactorily designated as a 600 lb. motor, the standard speed being taken for granted. At the same time as street railway men begin to go into suburban enterprises, in which higher speeds than those now familiar must be attempted, it will be easy to revive the expression for the

speed at which a motor is rated, and we may thus expect to see motors described as 600 × 20, 600 × 30, etc. This high speed extension of electrical motor work, and especially its extension in the same hands as those now directing ordinary street traffic, makes it especially important that some rating should be adopted which will take speed into account, as otherwise confusion will inevitably result. It goes without saying that much remains to be told concerning a motor after its horizontal effort at a given speed shall be expressed, and a part of the recommendation of your committee is that an implied part of the rating of a motor lies in this, that it shall be able to perform its rated work continuously without a rise of temperature exceeding seventy-five degrees C. over the atmospheric temperature.

In regard to the efficiency, desirable as it is to be informed on that point, it seems too difficult to be involved in any rating which shall be frequently and properly used.

Another method of rating motors, which is presented as the second choice of your committee, is as follows: That two terms should be used, one giving the horse power of the motor at which it can work continuously at a safe temperature, the other its maximum horse power. As has been explained, it is a feature of all electric motors that their maximum rate of work is done at a 50 per cent. efficiency. Nothing is more essential to be established, therefore, than the maximum work the motor will do. Following this method, which was suggested by Mr. Chas. A. Lieb, a given motor might be known as 15×33 or as 20×40, etc., concerning the first machine named, it being understood that it could do fifteen horse power of work all day long without undue heating, but under stress it could perform work at the rate of thirty-five horse power, the efficiency being at once known to be down to 50 per cent. It would also be understood, and go almost without saying, that the motor would be unable to do thirty-five horse power of work continuously; indeed it would be expected to perform such a rate of work safely for only a very short time, say from two to five minutes.

Uninviting as is the discussion of such a subject in a large assembly like this, your committee urges that serious consideration be given to this matter, and that one or the other of the methods here recommended be adopted.

In conclusion, while urging that all definite action possible shall be taken on the recommendations now made, we further urge most strongly that steps be taken to carry on permanently the work of standardizing, especially the work of standardizing the nomenclature and dimensions, since in regard to these there can never be any cessation of demand. To further this object, we recommend that this Association employ a salaried official to be known as the statistical secretary or clerk; that such employe shall give his whole time to the obtainment of data bearing on the work of the Association, direction to be given him in obtaining and collecting such data by the permanent executive officers of the Association at their discretion, and especially by the Standardizing Committee, which we further recommend shall be made one of the permanent committees of this Association. It is exceedingly difficult, as all who hear this will know, for men engaged laboriously in their private affairs to give such work, as that in question, the detailed attention it deserves. If, however, some competent person were at hand who could be asked to obtain the necessary information, then such men as would properly be chosen as officers of this Association, or as members of important committees, would certainly be able to digest the information and present it in useful form to the Association.

Another important work which could be assisted by such an official, and, by such a permanent committee as that which has been much before us; namely, the furthering of the actual use of whatever standards this Association may adopt. Little has been gained in what we believe all recognize as a useful work, if we stop at a formal adoption of names and dimensions. A constant and well directed presentation of the Association standards by some proper official will do much to increase the value of whatever action you may take. Some presentation should be made, not only to members of the A sociation, but also to manufacturers interested in the standards that may be adopted. As a preliminary step to the extension of this work, we recommend that copies of this report and of your action upon it be sent broadly to manufacturers, contractors and dealers in electric railway supplies. We further suggest that in so far as you may adopt any of the standards herein recommended. that you should urge manufacturers and dealers to make their catalogues conform with your recommendations in the details touched upon; and we further urge that the Association shall urge its members to keep before them the standards that may be thus adopted, and that they shall insist upon the obtainment of the use of these standards by the manufacturers in so far as possible.

As stated in the minutes of the first meeting of this committee, we consider that the work has been only begun by the presentation of this report To be of value it must be continuous. This report will be insufficient and faulty in many particulars, yet we feel that we have given, perhaps, as large a share of time and attention to this matter as it would have received at the hands of any other four or five men that you might have chosen. The cure for the insufficient report is, we feel, perhaps, to be had in the appointment of some official as above suggested, more than by any other means.

Standardizing of Accounts, Accounting Methods and Statistics.

Addendum to Report of Committee on Standards.

By H. I. Bettis, Sub-Committee.

Gentlemen:—The subject of formulating a standard system of accounting and forms for statistical information is of great importance to this Association, and I appreciate the weight and value of the undertaking as much as anyone, and perhaps more than the majority of the members of this Association, having given the subject considerable study.

The prodigious strides which the street railway business has made in the last few years now causes this business to come to the front. The meetings of this Association for the discussion of the knotty problems problems which are continually preplexing our managers, has also impressed upon us the necessity of more reliable statistics for comparative study.

The ultimate object of all accounting is to ascertain with accuracy the amount of net income after all operating expenses and fixed charges have been paid.

With this object in view, and no other, the art would be reduced to a very simple profit and loss account, debited with all expenses and credited with the entire income; but the owners and managers of our street railway properties for many reasons desire some further information than this.

It is not sufficient for them to know that their road has a certain income, or that the expense has reached a certain amount.

They desire to know many things in addition to these; what was the source of income; how many miles of track they have; how many cars; how many trips those cars make; how many passengers they carry; what other sources of income there were; what was the expense of operating the road; what portion was simply for the transportation of the passengers; how much was paid for motive power, for repair of cars, of apparatus, of track, buildings, etc., etc.; what has been expended in construction, improvements or betterment.

Having all this information well in hand, the owners and managers can determine more readily wherein the expenses have been too large, and have hereafter a basis upon which to calculate their future operations.

Moreover—what is of incalculable benefit—they can compare the cost of operating expenses of other lines throughout the country.

Heretofore, the great difference of opinion on the part of street railway officials as to the necessity or value of any reports or statistical information, has rendered it almost impossible to get any reliable information, and above all to make any comparisons, one road with another.

In order to get any beneficial results by comparison, it is necessary that we have statistics compiled from some standard basis.

We cannot compare wheat with potatoes, neither can we compare the cost of operation of one road with the operation of another, unless like expense accounts are included in each case, and the data compiled under the same rules.

In the case of the steam roads of the United States, the Interstate Commerce Commission has caused to be compiled a *Classification of Expenditures* and certain rules for their guidance in making the annual reports to the government.

Most of the railroad commissions of the several states have adopted this classification, and nearly all the railway companies use the same in their accounts.

It is quite probable that in the near future the Interstate Commission may extend its jurisdiction over the street railway companies, and in that case would compel them to adopt a uniform system of accounting as a basis.

Such a system of accounting, to be accepted by all the railroad

companies in this Association, can only be adopted after due consideration and the co-operative endeavors of our accounting officers.

This committee will not attempt to prescribe a set of rules and reports, but only to suggest certain distinctive lines which we believe should be followed in the future, when deciding upon a basis for accounting statistics.

DIVISION OF EXPENSES.

We are all agreed that it is essential for the expenses which add to the present or future value of a property to be separated from those which do not, and that the three great divisions should be

1. Transportation expenses.
2. Maintenance "
3. Construction "

This established, the various subdivisons may be few or carried to infinity, but the final results are necessarily the same.

The differences between these divisions are as follows:

1. *Transportation* expense is simply the expense of transporting the passengers, and includes nothing whatever expended upon the the property. Under this heading we should find wages of conductors, drivers, gripmen, motormen, (engineers and firemen on dummy lines), fuel, provender, lubricants, wrecking, etc., etc.

2. *Maintenance* expense is the expense of keeping the properties in their original condition, and consists of the amounts expended upon repairs of track, buildings, cars, power plant, engines, etc., etc.

3. *Construction* expense is such as adds to the value of the original plant, such as additional buildings and machinery, new tracks laid, less the value of old ones taken up, etc.. etc.

Improvements and betterments should also be included under the head of construction, that is, for such portion as the property is improved over the first cost.

One question deserving your consideration is that of taxes, and whether it should be included in the opening expenses or not. I have noticed that the majority of the roads do now include it, while a few deduct it from the net income after operating expenses.

In comparative statements this is an important item, and it would be well to decide this question. Our road deducts taxes after the operating expenses as one of the fixed charges, which I think is correct.

MATERIAL.

Another point we would suggest is to recommend the accounting for material as closely as possible. It is the practice upon many roads to keep no account of material purchased and kept in stock for future use, but to charge all material purchased to expense, whether used at once or not.

It must be perfectly clear to this Convention, that when material is purchased, there is no decrease in the assets of the company, and consequently no expense. There has been simply an exchange of cash for material. The expense does not occur until the material is used.

When we can impress upon our accounting officers the necessity of accounting for material as closely as for the paltry nickel, we shall have advanced one important step in the right direction; and until this is accomplished, our monthly returns will not show us what they are intended to show, *i. e.*, the business done and the expenses incurred during the month.

It is absurd to charge to the expenses of one month all the bills paid in that month, or the bills contracted in that month, when the material covered by the same may have been used long ago, or may be in stock for future use.

Material used represents from 30 to 40 per cent. of the expenses of operation, and yet on the majority of our roads it receives no attention whatever.

I would like to say something concerning the care of material, the method of handling supplies, method of keeping stock accounts, of the care of tools and old material, but fear to take too much of your valuable time upon subjects of minor importance.

UNIT FOR COMPARISON.

It has been suggested that we adopt as a unit for comparison *the car mile*, especially in regard to motive power, and consider the single truck with double motor car as the standard, double truck cars to be equal to two trains of two cars each.

It is difficult to say what should be the unit, whether it should be the car mile, the passenger or neither.

When we consider the vastly different conditions to be contended with on the various roads, in the shape of grades, distances from power house, amount of traffic, etc., we can hardly settle upon any factor for a unit.

It may be decided that the best results for comparison will be found by comparing the percentage which operation bears to gross income.

FUTURE WORK.

I would advise for the continuance of this work that a committee, selected from the accounting officers of roads in this Association, be appointed to prepare a Standard Classification of Expenditures, with blanks for Statistical Reports to be referred to the next annual Convention; the same to be previously circulated among the members of the Association, in order to obtain the fullest possible criticism and examination at the Convention.

Special Paper on "Experiments on the Expansion of Continuous Rails."

BY A. J. MOXHAM.

Gentlemen:—In the matter of track construction to-day, the question of paramount importance is that of the joint. For many years the question has been the rail. As this has received time and attention, one weak spot after another has been eliminated, and so great has been the pruning process that the one weak spot left, "the joint," is only the more glaring from the absence of many of its brothers in misfortune.

Known to be the weakest point in the structure, the question of the joint has had its full share of attention. It is not, perhaps, generally known, but is nevertheless a fact, that the joint of the formerly despised street railway has already distanced its heretofore leader, the steam railroad; certainly in its practical application, if not in its scientific development.

The question of the best joint is not entirely a scientific question. It is also a commercial question, and it ceases to be scientific when it ceases to be commercial; it then becomes "*non est*." All evil is comparative:

> "The little girl who had a little curl
> Right in the middle of her forehead,
> Who, when she was good, was very, very good.
> And when she was bad was horrid,"

might have been either a little angel or a little devil according to whether the conditions were favorable to her easy control or not. So with the joint. The joint of the steam road can be controlled—it is exposed and therefore accessible; that of the street road cannot; it is practically inaccessible. It has been proposed to overcome this by making it accessible by means of boxes with removable covers. Apart from the objection that this adds to the amount of street taken up by the track, the cost, if properly done, is almost prohibitive. I have been informed by the manager of one of our largest and most progressive street railway systems that, after a careful trial, it was found to be cheaper to take up the paving and tighten the joints once every few months than to pay the interest on the investment of the boxes.

The question of a good joint is embodied in very few words, to wit, "absence of motion;" and it must be absence of motion of the cars as well as of the rails, particularly in the case of electric roads. If two rails be placed in perfect surface and alignment and closely abutted, and so held, the problem is solved. Not only must they be true to surface and line, but they must be abutted. It will not do to leave the usual expansion space. This can be quickly demonstrated by cutting a groove one-quarter of an inch wide in the head of the middle portion of a rail. The surface and alignment are here true, but not abutted. A slight jar can be felt from the first; in a short time it becomes worse, and after continued use, bad and rapid wear, accompanied by a low spot, results. In this case there is no motion of the rails; the evil is resultant from the motion of the cars. This, however, goes without saying, as, of course, the cars are the destructive agency, and it is only emphasized because it is a very prevalent opinion that if the rails as laid to-day could only be held rigidly level, the problem would be solved.

A few words as to the evolution of the joint: Ignoring the old stringer construction, the first leaf was taken from the steam road, at that time far in advance of street railway construction, at least in this country. The girder rail of to-day was in general use abroad some time before it was adopted here; but when adopted here, its advent at once permitted the use of the ordinary splice bars, in which the bevel of the plates fitting between similarly beveled portions of the rail and drawn into place by bolts, provided the joint. So amply strong was this joint considered, that at first it was deemed capable of economy;

the bars and bolts were made light and the bearing surface small. With the horse car it appeared satisfactory. The development of cable roads, however, at once indicated the weakness of the early practice, and the size of the bars and bolts was increased, and much larger bearing surfaces provided, in the shape of channel splice bars. Electricity now appearing showed even this improvement inadequate. It was found that the wear was concentrated at the rail juncture, and a bar that had become useless because of actual wear at this point, showed no wear at the extreme ends. In other words, the wear was indicated by motion at the rail ends, and did not extend to the whole bar. The problem was then attacked on the theory of stopping all motion. In this two points were essential:

First—To hold the rail against motion by means of the fastening bars; to which end it was necessary to

Second—Hold the fastening bars against motion by means of the bolts.

As to the first: Not only were the bars made of great rigidity both vertically and laterally (for both are essential), but they were made to *fit* the rail. If one of our hearers will carefully examine an ordinary splice bar after it is tightened up, he will be somewhat surprised at the result. Taking a thin piece of paper and trying to work it into the fit, he will probably come to the conclusion that he has not more than 50 per cent. of real bearing or fit, as compared with the apparent bearing. No matter whether the track comes from a careful or careless manufacturer, nor how rigid the inspection, the evil will be found; it is only a question of more or less. It is due to the absolute impossibility of making a fit of rolled surfaces when the structure is rigid. A good machinist will tell you that even with the lathe or planer this is a difficult achievement, let alone without. To avoid this, a spring or yield was introduced, and this under conditions demanding rigidity as a sequence. In other words, the springing or yielding portion was in itself of great rigidity, and only made to yield by excessive tightening power. Hence the bearings, while strong and rigid in themselves, were made to spring or yield to a fit when tightened home by bolts large in diameter and many in number; and to secure this, very deep bars of great structural stiffness, which permit of two rows of bolts of large diameter, were devoloped. It must be remembered that this must all be embodied in the joint itself; to make a poor joint and then merely support it, has been proved a total failure.

As to the second point, properly holding the bars: A large number of bolts was the first development, and increased size or diameter followed. A nutlock to prevent slackness has been experimented with. If without spring to take up, not only the slack of the nut, but also the stretch of the bolt, it is useless, and few, if any, exist with these desiderata. A bolt so large in diameter that it will not stretch, and threads well cut and tight fitting, so that the nut is not liable to turn, are to-day the best safeguards. Not only the size, but the location of the bolts, is an important factor. It is the jolt or impact of the car that loosens the nuts. The vibration passes along well defined lines. If the bolts are located in the line of greatest vibration, the nuts will tend to turn more quickly than if located elsewhere. A double row of bolts with the lower row staggered gives excellent results. A single row does not suffice.

Such is the joint of to-day, structurally stiff, heavy enough to take up the jar of the blow without transmitting it all to the nuts, a yielding fit that tends to counteract all motion, and large bolts, carefully located with a view to vibration; in itself good, and as it now stands, to a certain extent, capable of economical use, and far ahead of its brother on the steam road, even of the heaviest construction. But even so *it will not do.* If not, query, "What then?" There is but one answer. *No joint at all.* While apparently a bold suggestion, it is at least worthy of thought and discussion. That the rail can be made continuous by mechanical means we know, but what of expansion and contraction? *We will do without it*; and that we can do so, the sequel, I think, will show.

To the credit of Mr. Philip Noonan, I think, belongs the first practical idea of a continuous rail. His theory, in a nutshell, may be described as gripping the rail at one end and permitting the wave motion or flow induced by passing trains to be, so to speak, rolled out before the train wheels, into a tension device that within certain limits holds what it gets. He provides against danger of rupture by a spring device which limits the strain. He put his ideas to a test, built a considerable stretch of track (some three miles) on the Lynchburg & Durham railroad, at or near Gladys Station, Va., and it to-day is in successful use. Expert investigation and report indorse it in all essential particulars, though it is, perhaps, questionable whether the fastenings he used to make his rail continuous are strong and rigid enough to prohibit all yield. For details, those who care to investigate may be referred to a pamphlet on the subject, that can be obtained by addressing the inventor, at the above named place.

At a glance, the problem of a street railway differs from the steam road in that the former is surrounded by the roadbed, while the latter is, at least to a great extent, exposed. The effect of the surrounding roadbed is twofold:

First—By its great surface friction, it tends to hold the rail against change, stops all wave motion, and

Second—It to some extent modifies the temperature.

The problem was to find a measure of value for both. To this end the following experiment was made:

One rail in a section of track was so connected that it was in reality a continuous rail. One side of the track was taken instead of both, because it was thought the parallelism of the adjacent rail would at once indicate changes that were expected to occur, which, perhaps, other

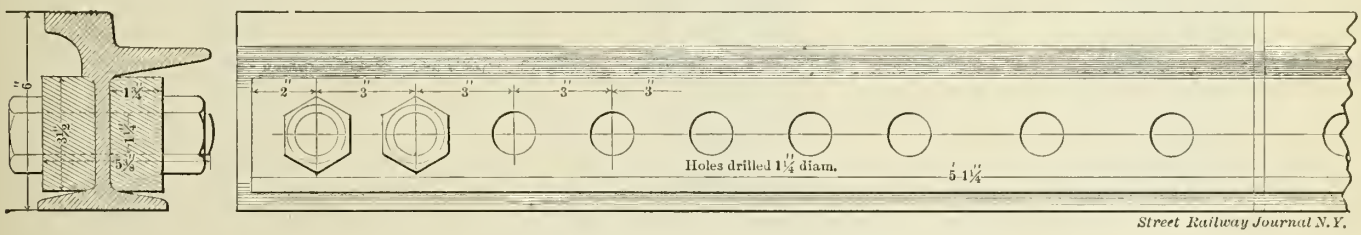


FIG. 1.—SECTION AND HALF SIDE ELEVATION OF JOINT.

measurements might fail to disclose. The length was 1,160 ft., and the profile one that embodied level track, up grade and down grade. As the track was laid and in use, it was determined that it was best to make the rail continuous by a joint rigid and stronger than the rail, so as not to have to remove the whole roadbed. This because the roadbed, which was macadam, had become solidly packed, and represented normal conditions hard to obtain if once disturbed. Remember that when the experiment was made it was thought questionable whether the rail, when prevented from expansion and contraction, could be at all restrained by the roadbed; hence all the restraining power offered was to be retained. At the end of each separate rail the usual one-fourth of an inch had been left for expansion. This was filled by a carefully measured dog, made of the same section as the rail, cut to fill the space tightly, and then driven into place.

Now for the joints: These were to be stronger than the rail itself, and for connection body-bound, machine-turned bolts were decided upon. The two side bars were of steel, 4 × 1¾ ins. thick and 5 ft 4½ ins. long. The body-bound bolts were eighteen in number and 1¼ ins. in diameter. (See Fig. 1.)

As is well known, one of the most difficult things in metal working is to secure a real fit between two surfaces. The usual work of a machine tool—be it lathe, planer or what not—is very far from accurate, as the introduction of template work into a shop soon shows. Out of an ordinary selection of average machinists, it is rare to find one in ten capable of making a real fit, sometimes less. To insure an absolute fit was deemed a necessity. It was done as follows: A number of jigs were made having a hardened steel guide for the drill. With this the bars were drilled in pairs, and as drilled each bar carefully tested by the standard. The holes were drilled one thirty-second of an inch smaller in diameter than ultimately needed. The roadbed surrounding a joint being removed, one bar was clamped to the rail, and the holes (also one thirty-second of an inch small) were drilled through the web, using the bar as a guide. After the temperature of the parts was equalized, the adjoining bar was then adjusted and a rose bit reamer carefully worked through the three holes. As quickly as one hole was completed the gauge was taken, and one of a series of machine bolts (previously turned to a standard slightly large) was accurately turned for

this special hole; and so to completion. The accuracy of the work may be shown by the fact that after reaming if anything interfered with the equalized temperature (as for instance one bar being removed and laid in the shade) during the work, the bolts could be put home. Each bolt was a driving fit. It took twenty-four hours to properly adjust each joint. The track was thus made continuous.

At five points along the line heavy stakes were firmly fixed in the ground, one on each side of the road, in the top of which were set small wire nails. A thin but small cord was tightly stretched from stake to stake, the tops of which were several inches above the top of the rail. Directly underneath this line a mark was made on the head of the rail with a cold chisel. Measurements were taken from the stake to the chisel mark, and from the top of the rail to the tightly stretched cord. Observations were taken at these five points, in the manner indicated, throughout the whole summer.

The work was started on March 19, and finished April 25, 1892. The average temperature during the work was 43.04 degs., the maximum eighty-one degrees and the minimum ten degrees.

The section of rail used in the track is of the girder type, six inches deep, weighing seventy-eight pounds to the yard, and shown in Fig. 1. The rail is fastened to the ties by means of tie plates, and the gauge is preserved by tie rods spaced ten feet apart. The ties are spaced eleven to each thirty feet, and the roadway is excellent macadam.

Anticipating the unknown, provision was made for a possible sudden stoppage of the line by means of portable connecting tracks kept in readiness. In order to further explain whatever might occur, careful preparations were made to read the temperature of the rail at different parts above and below ground during the experiment. As the rail was in use, this was done by a special rail in the adjoining roadbed, and in order that the scope of investigation should be fully complete, the temperature was continuously taken at the head of the rail, at the lower flange of a six inch rail, of a seven inch rail and of a ten inch rail, or its practical equivalent, a ten inch I beam. Simultaneously readings of the temperature were taken as follows:

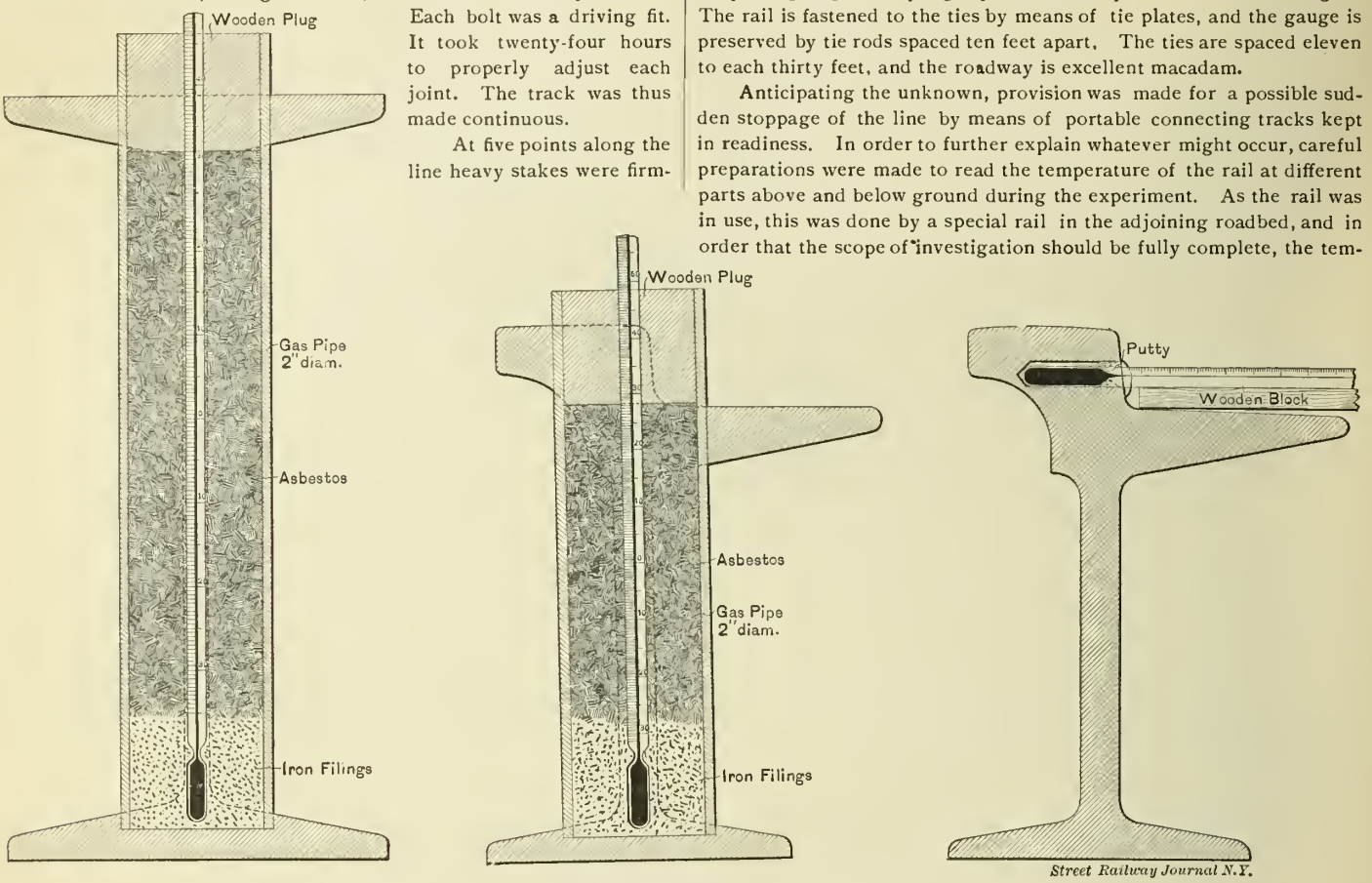


FIG. 2.—METHOD OF DETERMINING TEMPERATURE OF I BEAM AND RAILS.

Air in the shade.
" " " sun.
Roadbed at a depth of seven inches.
" " " " ten "

The apparatus used for the purpose of these readings is fully illustrated in Figs. 2 and 3. Before using the thermometers they were tested for comparative readings by immersing them all in the same bath, which was raised gradually from freezing point to the maximum limit of thermometers; simultaneous readings being taken at intervals of five degrees. It was not found necessary to make any comparative corrections, no difference greater than one-half degree being found. The correction for the stem exposed in the thermometers was in all cases so small, not amounting to more than one quarter degree, that it was neglected. The thermometers were obtained from Queen & Co., and are graduated to one-quarter degree. Fig. 2 shows the arrangement of thermometers for procuring temperature of top and bottom of rails, and explains itself. The rails were imbedded in macadam, and in such a manner as to most closely resemble the conditions found in an actual roadbed. The thermometers were enclosed by a box with sides of wire netting admitting the air freely, and intended only to protect the thermometers from accidental breakage.

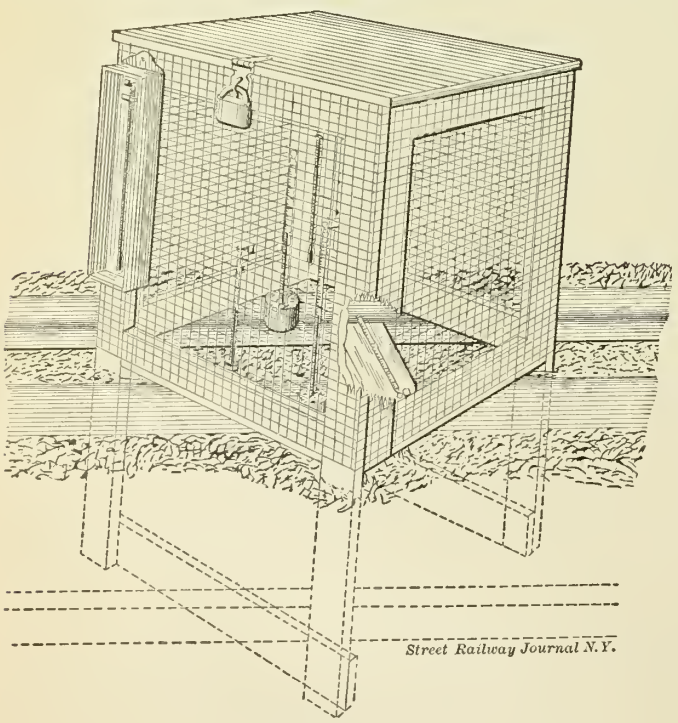


FIG. 3.—BOX FOR PROTECTING THERMOMETERS IN TEMPERATURE TESTS.

During the experiment many thousand readings were taken. Without wearying you with the dry, technical details of their repetition, the writer merely calls attention to the fact that a recapitulation of these readings, in the form of averages, is attached to this paper, and in such shape, that the engineering student to whom they will perhaps appeal, will find food for study. There are eight different comparisons. Speaking very briefly, it may be stated as the result of an analysis of some of these averages:

First—That the roadbed at ten inches depth averaged,

A.—During day readings

At 8 A. M. 1.25° less than air in the shade.
" 12 M. 5.52° " " " " " "
" 6 P. M. 1.88° " " " " " " and

B.—During night readings

At 6 P. M. 1.93° less than air in the shade.
" 12 P. M. 8.30° more " " " " "
" 6 A. M. 8.09° " " " " " " "

as was to be expected, the earth being colder than the air temperature during the day, and warmer during the night.

Second.—That the flange and head of rail, as laid in the roadbed, differed from the air temperature as follows:

A.—During day readings (see table No. 1).

At 8 A. M. Flange 2.36° less than air. Head 3.13° less than air.
" 12 M. " 3.63° " " " " 4.40° " " "
" 6 P. M. " 2.19° more " " " 5.61° more " "

B.—During night readings (see table No. 2).

At 12 P. M. Flange 5.93° more than air. Head 4.00° more than air.
" 6 P. M. " 3.94° " " " " 2.67° " " "

Comparison is always made with air in the shade, because the irregularity of the sun's rays introduces disturbing elements so great as to hide the law. As a factor of correction, if desired, the percentage of difference can be deducted from table No. 3.

This slight analysis of the tables will suffice to prove to the practical railroad man that for all ordinary purposes, the rail may be assumed to be subject to nearly full air temperature, and that the roadbed will not suffice, as has been believed, to keep the rail temperature virtually regular. Steel is a far better heat conductor than earth, and, as the tables show, the whole rail (flange as well as head) closely follows the air temperatures. Readings taken over a long period, night as well as day, every fifteen minutes. With this fact before us one element of doubt has been removed; but it also proves that the heating of the sun in the day, and the cooling of its absence at night, leaves the expansion and contraction most certainly there.

Now for its effects. The experiment has proved absolutely and beyond cavil, that it is restrained and held by the surface friction of the surrounding roadbed. From first to last, from a temperature of twenty-two degrees below freezing point (or ten degrees), to a temperature of eighty-nine degrees above freezing point (or 121 degs.), extending from March to August, there was *absolutely no movement of the track out of place.* Even at the ends was this true; proving that not only will the roadbed hold the track as a complete structure, but that it will do it consecutively. Once bedded, it will hold a rail ten feet or thirty feet, as well as one 1,100 ft. On this point there is no room for error. The expansion in 1,100 ft., if not neutralized, would equal five and one-fourth inches, under the conditions here stated, and five and one-fourth inches would throw the rail out of line fourteen feet, if it were held at the ends and permitted to bow in the center. An expansion of one rail would mean about six inches in thirty feet out of line. The query arises, "What has become of it?" It is existent, and, like all force, it would flow to the point of least resistance. In the case of a street rail, buried in the roadbed, it is reasonable to believe this point is in a minute enlargement and reduction of the sectional area of the rail.

As to its effect upon the steel: Experts teach us that a variation of seven degrees in temperature, if held, would subject the rail to a stress of 1,000 lbs. per square inch. Taking a track laid at the low

TABLE NO. 1.

DAY READINGS.

Variation between Flange, Head of Rail and Air (Thermometer shaded) for 8 A. M., 12 M. and 6 P. M.

Month.	No. of Readings.	Flange of Rail.	Head of Rail.	Air (Shade).
General Average:				
April	57	48.°40	49.°18	49.°97
May	70	62.°76	63.°98	65.°17
June	46	78.°00	78.°95	79.°43
July	72	77.°57	77.°91	79.°54
August	78	75.°17	75.°07	77.°68
September	36	65.°88	65.°38	67.°11
	359	69.°13	70.°09	71.°79
Average at 8 A. M.:				
April	19	42.°07	46.°50	41.°05
May	23	56,°97	52.°78	61.°91
June	17	71.°44	72.°26	74.°17
July	24	68.°07	65.°31	71.°50
August	26	68.°80	69.°38	71.°19
September	12	63.°25	59.°70	53.°33
	121	61.°21	60.°44	63.°57
Average at 12 M.:				
April	20	50.°00	50.°90	54.°20
May	23	64.°78	66.°71	69.°21
June	16	80.°59	82.°03	85.°53
July	24	79.°10	81.°27	83.°89
August	16	79.°44	76.°00	84.°71
September	12	71.°50	72.°25	73.°29
	121	71.°91	71.°14	75.°54
Average at 6 P. M.:				
April	20	52.°70	52.°28	53.°85
May	24	65.°85	65.°81	61.°10
June	14	84.°73	83.°88	78.°84
July	24	81.°79	81.°70	76.°68
August	26	78.°40	79.°57	73.°83
September	12	71.°75	70.°04	68.°04
	120	72.°26	73.°84	69.°45

TABLE NO. 2.

NIGHT READINGS.

Variation between Flange, Head of Rail and Air, for 6 P. M., 12 P. M. and 6 A. M.

Month.	No. of Readings.	Flange of Rail.	Head of Rail.	Air (Shade).
General Average:				
May	37	59.°88	58.°75	56.°07
June	48	73.°76	72.°37	68.°32
July	71	74.°40	72.°93	68.°54
August	75	74.°25	71.°70	68.°41
September	33	65.°76	63.°48	59.°63
	264	70.°74	68.°96	65.°60
Average at 6 A. M.:				
May	12	54.°25	53.°58	49.°79
June	17	67.°41	66.°66	63.°00
July	24	67.°22	66.°08	60.°66
August	25	67.°12	65.°99	62.°54
September	11	59.°27	58.°54	53.°13
	89	64.°50	63.°54	59.°23
Average at 12 P. M.:				
May	13	58.°11	56.°77	54.°88
June	17	71.°97	69.°50	65.°38
July	23	72.°96	71.°30	66.°17
August	25	71.°46	69.°90	66.°14
September	11	63.°86	62.°22	56.°90
	89	69.°15	67.°22	63.°22
Average at 6 P. M.:				
May	12	67.°12	66.°08	63.°62
June	14	83.°64	82.°53	78.°21
July	24	82.°96	81.°35	78.°68
August	25	80.°18	79.°26	76.°18
September	11	72.°31	70.°59	68.°86
	86	78.°69	77.°42	74.°75

TABLE NO. 3.

SIMULTANEOUS RECORDS

of Air Temperature Exposed to the Sun and in the shade.

Month.	No. of Readings.	Air (Shade).	Air (Sun).
General Average:			
August	60	77.°96	82.°00
September	30	65.°40	73.°38
	90	77.°11	79,°15
Average at 9 A. M.:			
August	20	69.°25	105.°45
September	10	59.°50	60.°55
	30	66.°00	90.°48
Average at 12 M.:			
August	20	82.°79	98.°87
September	10	73.°75	93.°85
	30	81.°10	97.°20
Average at 6 P. M.:			
August	20	80.°47	75.°70
September	10	69.°05	66.°30
	30	76.°66	72 °56

temperature of forty degrees and subject to a maximum of 120 degs., or a variation of eighty degrees, the stress is equal to less than 12,000 lbs. per square inch. Much less than the elastic limit, and less than the strain put upon an ordinary bridge, or similar structure. It would therefore appear that the effect on the steel would be harmless.

On the face of it, therefore, there is nothing to prevent us abutting our rails, and this is but the prelude to an absolutely continuous track —*one without joints*—the rails welded by electricity, or otherwise connected one to the other, up to such lengths as may be deemed best.

As to its practical application, many precautions suggest themselves. It must be remembered that a track so laid will be like a huge spring under tension, absolutely safe and harmless when restrained by the roadbed, but ready to spring like a shot from a cannon if, while in this condition, the roadbed be removed. The part of common sense would appear to be to limit the length of a continuous rail to, say, 500 or 1,000 ft., with specially devised expansion joints at these intervals; or, if desirable to take up the paving for repairs on a very short piece, the following would be effective: First remove only a foot of paving, then with a hack saw cut out, say, six inches of rail, thus removing the tension or compression, as may be. This done, the rest of the roadbed could be removed, starting from the cut part of the track, without danger. Be this as it may, it should be borne in mind that chained lightning is not a nice plaything, and therefore a lightning conductor is sometimes handy.

One important saving that would be effected by a "track without joints" would be in the weight of the rail. A rail of 100 lbs. per yard is to-day in use, and next year will be extensively used. Perhaps, without their knowledge, the cause of this has been the street railroad men's dearly bought and sad experience with joints. The joint being defective, the effort has been made to secure such stability of track as to relieve the joints by means of a heavy rail. In a 100 lb. rail there are but thirty pounds of wearing surface, of which not more than eighteen pounds can be used before the rail will have to be thrown out; therefore there will be eighty-two pounds unused. For mere stiffness and rigidity, a sixty-six pound rail, if supported by the proper number of cross ties, will answer every engineering demand, even of electric cars at high speed. Anything over this goes to the debt of "bad joints."

TABLE No. 4.

DAY RECORDS

Of Earth at 7 inches, Air (in shade), and Flange of Rail.

Month.	No. of Readings.	Earth 7′	Flange of Rail.	Air (Shade).
General Average:				
May	10	59.°80	62.°40	65.°40
June	74	73.°74	76.°71	78.°10
July	72	73.°95	77.°57	79.°55
August	18	73.°28	76.°05	76.°72
	174	76.°52	80 °88	82.°57
Average at 8 A. M.:				
May	3	55.°50	56.°50	63.°70
June	26	69.°35	69.°30	71.°67
July	24	69.°14	69.°29	70.°29
August	6	69.°50	67.°66	69.°50
	59	66.°75	68.°45	70.°49
Average at 12 M.:				
May	3	60.°33	65.°00	72.°66
June	25	73.°38	78.°90	84.°78
July	24	72.°79	80.°35	96.°35
August	6	71.°91	76.°83	82.°03
	58	70.°58	76.°84	92.°20
Average at 6 P. M.:				
May	4	62.°62	65.°00	61.°25
June	23	79.°13	83.°30	78.°21
July	24	82.°91	83.°49	79.°06
August	6	76.°66	84.°00	77.°83
	57	86.°50	82.°14	75.°57

TABLE No. 5.

DAY RECORDS

Of Earth at 10 inches, Air (in shade), and Flange of 10 inch I Beam.

Month.	No. of Readings.	Earth 10″	Air (Shade).	Flange of 10″ I Beam.
General Average:				
July	72	72.°59	79.°27	74.°90
August	78	71.°91	76.°42	72.°94
September	33	65.°12	66.°88	65.°12
	183	70.°94	75.°82	72.°84
Average at 9 A. M.:				
July	24	69.°80	76.°93	69.°37
August	26	65.°05	68.°64	69.°88
September	11	63.°18	58.°18	60.°25
	61	66.°57	67.°73	67.°73
Average at 12 M,:				
July	24	72.°04	88.°08	77.°50
August	26	70.°57	72.°74	73.°81
September	11	64.°04	72.°40	65.°37
	61	69.°95	78.°73	73.°92
Average at 6 P. M.:				
July	24	75.°91	78.°77	78.°20
August	26	74.°15	77.°36	80.°76
September	11	68.°13	69.°04	68.°91
	61	74.°08	76.°37	77.°62

Paper on "Is a Standard Rail Head Possible?"

BY JOHN F. OSTROM.

Gentlemen:—Perhaps an apology should be made for not submitting the contents of this paper to your committee on "Standards for Electric Street Railways." That this was not done is due to two causes. First, my attention was not called to the fact that such a committee was at work until within the past six weeks. Second, the last of the statistics to which I shall refer reached me less than a week ago, when I judged that the commitee's work was probably completed and its report made up.

For several years I have been deeply interested in the development of the modern American street railway track. I have seen rail weighfrom thirty to ninety-eight pounds per yard, and varying in height from three inches to nine inches, used for the same kind of traction, without, so far as I could see, any effort being made to standardize either weight or shape. On the same road I have seen eight different sections of girder rail in use, besides a stringer rail and four different sections of guard rail. Surely, I thought, if such statistics as are obtainable were presented to the American Street Railway Association the matter can be taken up and a standard rail, at least for electric traction, adopted. With such statistics it might be possible to submit to the Association a sketch of such a rail; and so, believing that "In a multitude of counsellors there is wisdom," I began by taking the car builders and truck and wheel manufacturers into my confidence. Twenty-two of them answered my letters. Eleven of them said, "Make your standard rail to carry the wheels we make the most of, two and a quarter inches tread and three-quarters inch flange." Six substitued two inches for two and a quarter inches, and said, "The majority of our wheels are made two inches tread and three-quarters inch flange." One truck manufacturer wrote last May; "The street railways generally in the large cities are using a wheel having a two inch tread and a flange not exceeding three-quarters of an inch. This width in tread I regard as altogether too narrow for electric purposes, and consider that it is used by the railway companies in deference to the fact that their horse car rails are not adapted, usually, to a wider tread. If you will permit a suggestion, the tendency of electric railroading, as you are doubtless aware, is to higher speeds than heretofore; and, also, there is a decided tendency to connect towns miles apart by the electric railways. This means, I think, that in the near future long distances will be traveled, largely in the country, and very high speeds will be attained. Consequently, the tendency will be to use broader treads and deeper flanges. I should recommend that your standard rails be adapted to a wheel having a minimum tread of from two and a quarter inches to two and three-eighths inches for city use, and an allowance should be made by which, at least, a seven-eighths inch flange must be used on the rails. We should prefer to put out a wheel having a tread full two and a quarter inches in width, and we put out two inches only because the two and a quarter inches are not suitable in all cases for the old rails which are sometimes used." After receipt of these letters I extended my inquiries and wrote to every street railway company in the United States and Canada, whose address I could learn, asking for particulars as to the kind of road operated, width of tread and depth of flange used, kind of paving in use or in contemplation, legislative or corporation enactment governing

type of rail to be used, and suggestions as to what would constitute a rail that could be used by the majority of the street railroads. When the answers to these letters began to come in both conditions and theories confronted me. Wheel treads vary from one and a half to five inches; flanges from seven-sixteenths to one and a half inches; rail from sixteen pound T to ninety-eight pound girder. One council unanimously requested the road to take up all girder rail and lay T rail instead. Another specified both form of rail and weight (groove girder, seventy-seven pounds), while others specify a rail of a particular manufacturer, a rail with a stated width of wagon tram, etc.

Suggestions as to standard vary as much as conditions. On one point only all seem to agree, and Ohio voices the general sentiment: "Tram rails no account for anything or anywhere."

One road writes: "There should no rail but a T rail be used where the city authorities will allow it." Another: "Plain T every time, under all circumstances of paving and traffic." Another: "There seems to be a popular projudice against T rail for street work, which is exercised wholly without reason; and, so far as the T rail for the very best service goes, there is no chance for argument."

Against these are suggestions for side bearing rail, with various widths of wagon flange and for center bearing and groove girder rails; eighty eight companies, operating 1,083 miles of track, suggest T rail; sixty companies, operating 1,101 miles of track, suggest girder rail; forty-five companies, operating 1,243 miles of track, suggest a section of girder rail deep enough to be spiked direct to tie in paved streets.

One correspondent sums up the subject of a standard rail as follows: "To my mind this would be utterly impossible. There are too many people who think they know more of such matters than any one else."

There was the last straw. I gave up the "search after the unattainable," but would call your attention to a most excellent article on "Rail Sections and Special Construction," by Geo. W. Mansfield, read before the Massachusetts Street Railway Association, and published in the October number of the Street Railway Journal. It is by all means the best paper I have read on the subject, and except that I would make my lightest section of rail seven inches high, instead of six inches, I cordially endorse all he says as far as it relates to a solid rail. But if a standard rail is unattainable, it is not impossible to adopt such standards of measurements for the head of the rail as will make the six sections suggested by Mr. Mansfield possible.

There are at present, besides the various sections of the rail, over ninety sections of girder rail now on the market, with fifteen different widths of head between one and a half inches and two and a quarter inches. These rails have ten variations in flange room or dip, from seven-eighths to one and three sixteenths of an inch. Should each of these widths of head and depths of flange room be required in each of the four sections of girder rail, Mr. Mansfield suggests we would have 600, and with two widths of wagon flange, 900 girder rail sections to select from.

The adoption of one width for rail head and one depth for flange room would, in my judgment, be the nearest approach that can be made to a standard rail. With these measurements, specifications should be given as to the distance of gauge line from center of web of rail and radius of curve at gauge line. With these points decided, it would be comparatively easy for the railway companies to settle the question of a standard wheel tread and flange. Rails bought from one manufacturer would connect at gauge lines with those of another. The side bearing, groove and T rails suggested in Mr. Mansfield's paper, could be carried in stock by the various manufacturers, and many of the expensive delays incident to new construction during the past years could be thereby avoided.

The necessity for a standard recognized, is it possible to devise one that can be accepted as such? In response to inquiries already referred to, I received replies from 306 roads, operating cars on 4,347.8 miles of track.

Twenty of these roads operate with steam motors over 155 miles of track; twenty-nine with cable motors, over 328 miles; ninety-nine with horses, over 1,117 miles; 198 with electricity, over 2,748 miles; fifty-nine have 625 miles of stringer rail track; 197 have 1,532 miles of T rail track; 146 have 2,190 miles of girder track.

I think you will agree with me that this mileage will justify us in assuming that the above reports may be reasonably taken to represent the condition of the street railway situation of the country to-day.

Two hundred and sixty-four roads reported width of wheel tread on 3,937 miles of track. These varied from one and a half inches to five inches, in fourteen different widths, two inches, two and a quarter inches and two and a half inches being used in the majority of cases; 170 roads, operating 2,942 miles, use two and a quarter inch wheel tread or less; 56 roads, operating 568 miles, use two and a half inches tread.

If these could be combined, and a two and a quarter inch tread wheel substituted, we would have 226 roads, operating 3,510 miles, using one tread wheel, or about 84 per cent. of the reported trackage; 279 roads, operating 4,118 miles, reported twelve different depths of wheel flanges, varying from seven-sixteenths of an inch to one and a half inches, five eighths and three-quarters of an inch being most largely used; 223 roads use three-quarters inch flange or less on 3,581 miles of road; 26 roads use a seven-eighths inch flange on 298 miles of road.

If these could be combined, and a three quarters inch wheel flange adopted, we would have 249 roads using this wheel flange on 3,879 miles of track, or 94 per cent. of the reported trackage.

The adoption of such a wheel flange will be perfectly safe wherever the radius of curve at gauge line of rail is not over a quarter of an inch.

Leaving the general results, let us look for a moment at the statistics of the 198 electric roads, with their sometimes dangerously high speeds, and their 2,748 miles of track; 181 of them reported thirty one different wheels, varying from one and three-quarters inch tread and five-eighths inch flange to three and a half inch tread and one and a quarter inch flange on 2,640 miles of track; 109 of these use a wheel tread two and a quarter inches, or narrower, on 1,870 miles of track; 51 companies use a two and a half inch tread on 512 miles of track. If it were possible, as I believe it is, to combine these, we would have 160 companies using a two and a quarter inch tread on 2,382 miles, or 90 per cent. of the electric mileage reported.

One hundred and forty-six of the electric roads use a three-quarters inch wheel flange and under, on 2,244 miles of road, and 24 roads use a seven-eighths inch flange on 256 miles of track.

By combining these roads, increasing the depth of wheel flanges below three-quarters of an inch to that point, and cutting down the seven-eighths inch flange to three-quarters of an inch, we would have 2,500 miles of track using our standard, or 95 per cent. of reported electric track.

We find, then, that the wheel tread that most nearly approaches the necessities of the street railway world of to-day is a two and a quarter inch tread, and the wheel flange three-quarters of an inch deep. Recognize this fact, and the apparent need is for a rail designed to carry such a wheel. Such a rail should have, in my opinion, a head flat, or nearly so, two and five-sixteenths inches wide, with a curve not over a quarter of an inch on the gauge line corner, with a dip of one inch to the wagon flange in side bearing rails, and one and an eighth inches to the bottom of the groove in groove rails. The width of head and the gauge line curve can be made alike in both T and girder rails. Distance of center line of web to gauge line in the girder rail is five-sixteenths of an inch. My reason for making the groove deeper than the dip in the side bearing rail, is that in the latter both head and flange are subject to wear, while in the groove rail the wear is confined to the head of the rail until the wheel flange strikes the bottom of the groove.

Such a standard rail head I believe to be perfectly feasible. Its adoption by this Association would materially simplify both the track and wheel questions. It would give to manufacturers a clear idea of what street railway requirements are likely to be, and enable them to have such rails as may be desired, ready for next spring's business; and it would be of incalculable benefit in connection with such suggestions as those of Mr. Mansfield, already referred to, in enabling the many new companies to avoid the mistakes of inexperience, and to work with us toward a higher standard of excellence in street railway work.

Events Which Led Up to the Formation of the American Street Railway Association.

By D. F. Longstreet.

Gentlemen:—Complying with a request from your Executive Committee, I have the honor to submit herewith a paper narrating the events which led up to the formation of this Association.

The October number (1891) of the Street Railway Journal, a copy of which reached me in due course in Denver, contained an editorial under the heading "History of the American Street Railway Association," which contained these words: "Probably the credit of having first conceived the idea of an organization of street railway men belongs to Mr. D. F. Longstreet, while to H. H. Littell, Henry N. Watson, Walter A. Jones, Thomas Lowry and J. E. Rugg great credit is also due for the part they played in its organization."

It was because of reference to this article, in the office of your secretary, the following month, and of the conversation that followed, that I agreed to write up the inside history of the events which led up to, and the methods employed in forming, the Association. It was my intention to have written this for the secretary's files only, and simply that the future historian of the Association might be in possession of the facts, but your Executive Committee having requested me to prepare it in this form, I feel in duty bound to reply.

In order to give a clear idea of the matter, I shall have to go back to my first connection with street railroads, which was in July, 1865. I had then been back from the war about six weeks. I found on my return to Providence, R. I., (I had enlisted there in 1862) that street cars had been started on one route February 22, 1865, and other tracks were being laid by the Union Railroad Co. One of the routes then building was into the section of the city where my home was. I had become accustomed to long hours and exposure. It seemed to me that the life of a conductor would be an agreeable one, and I made the necessary application. On my nineteenth birthday I received notice of my appointment, and three days later commenced work. The pay was $2 per day, and the hours sixteen. I did not mind the hours, and the pay was ample for all my necessities.

I was impressed at once with the utter lack of system and accountability in the conduct of the business. The route was single track and turnouts. There was no system by which we knew when or where to meet cars, and no instructions which would give the right of way, or govern the movement of a car under unusual conditions, which latter it was demonstrated, were quite usual. The result was, that cars were frequently off time, would meet on single track, and after a season of wrangling as to who was right and who was wrong, one or the other would pull back or jump the track. The route upon which I was running was a double fare route; passengers riding beyond a single fare point were requested to pay more. There was no method of telling which had paid through. There was no system of accounting for money received. It was the custom to keep tally with pennies, and at the end of the day to turn in as many fares as you could find tallies. It was said that some of the boys would spend the "tallies" (by mistake) for beer, sandwiches or cigars, and in that way unconsciously reduce their living expenses. Whether this was true or not, they certainly had the credit of being dishonest. I had just passed three years under circumstances which demanded the strictest sort of discipline and accountability, and these things were very annoying to me. I figured out a time table for the boys on the route upon which I was running, in which the passing points were given, and established an understanding as to what each should do under certain circumstances. During that summer we carried, at times, large crowds to a resort which was located beyond the half fare line. As there had been no system provided by which those who had paid through could be distinguished from those who had not, the results were disastrous. It was the custom to use two-penny pieces in tallying for such passengers.

When a car would arrive at the line with seventy-five passengers, for instance, you might find only twenty-five two-penny pieces, and it would puzzle you to pick out those who had not paid.

To remedy this, I cut some little strips of writing paper, and bought me a punch of peculiar design. I punched two clippings out of these strips, and, as fares were collected, would hand one of my crude checks to passengers paying through, and when the line was reached such passengers as did not have these evidences were required to pay again. One thing annoyed me so much that I decided to leave the business as soon as an opportunity should present. It was a common occurrence for a passenger to remark: "How much do you give the company out of this trip?" It was no use "getting mad," it would only make matters worse; there was no way of proving your honesty.

I fully recognized that a young man like myself, with ambition and no capital, was out of place. I would willingly have worked for my board in any business which held out inducements in return for honest and earnest efforts. I did not think this did, and after six months' service made up my mind to leave the business, and had made application for a clerkship in a large establishment in the city. Just at this time I learned that the superintendent was about to appoint a clerk in his office, and I at once made application. I had the advantage of being familiar with the details of the business, and my record at the receiving office and elsewhere was good, and I got the place. This was in February, 1866, and I had been on the road seven months. I had to work long hours in my new position. The road had been in operation a full year, and nothing had been done towards systematizing the office work. It was the construction period, and the superintendent was of necessity on the street much of the time, and false economy had prevented giving him any clerical assistance. I found everything in a state of chaos. It was slow work to go back a year and pick up all the ends and establish a system of reports and accounts which would be useful, but it was suited to my tastes. Things were reduced to a system. Gradually, as the business grew, I got the hours down to twelve for a day's work without reduction of wages, believing we would get more efficient service and better results. The one matter which bothered me most, was how to get a check on the fares collected, not only for financial but for moral reasons. I resorted to such means as changing the runs every week. The conductor who had turned in the most money during the week was put upon the run of the conductor who had turned in the least, and so on. By careful observation of conditions and comparison of results, I would some time determine if a man was dishonest or incompetent, and let him go.

While this and other methods resorted to, was a check which undouhtedly benefited the company, in a degree, yet it did not touch the vital thing, which was, to my mind, a system which would enable the conductor to maintain his honesty before the public.

I believed that, until we got such a system, we should not be able to get honest and competent men, to remain long in our service. I gave a great deal of thought to this matter, and talked to inventors and mechanics whom I happened to know, and, as early as 1869, I presented to the board of directors, with a great deal of pride and satisfaction, a machine which had been designed by a Providence mechanic, by the use of which a record of fares collected could be kept. It was a small, light affair, carried in the hand, and the pressing of a button by the passenger recorded the fare. It was crude, of course, as are all new inventions, but it was on the right track. To my great surprise and astonishment, it met with violent opposition in our board, one member remarking that he would as soon order a placard, "This is a thief," to be placed on a conductor, as to require him to "carry such a thing as that." My reasons and explanations were scouted and frowned upon, and I was not quite certain when I finally got out from the meeting, that I had not fully lost caste with the board for having made such a heinous proposal. However, before leaving I fired this parting shot, "I don't think any member of this board would care to place himself in a position where he could appropriate thousand dollar bills as easily as a conductor can six cents." I was disgusted and dishearted in a degree, but I knew I was right, and in the end it would be shown to be so.

It will be necessary for me to refer to the fact that the Union Railroad Co. was a Sprague corporation (so called), the house of A. & W. Sprague owing a control of the stock. Col. Amasa Sprague was president, and his brother, the Governor, was also a director. Colonel Sprague was largely interested in the breeding and training of trotting stock, and (in 1867) had constructed the finest trotting track in the country. It was located in Cranston, R. I., just outside of the corporate limits of Providence. Something like seventy acres of ground were enclosed, and the grand stand and stables, probably cost to exceed $100,000. Large purses were offered, and it was Colonel Sprague's intention to have all contests over that track conducted "on the square."

Col. Geo. H. Smith of Providence, who was superintendent of the railroad, and whose clerk I was, was appointed by Colonel Sprague as secretary and treasurer of the "Narragansett Park Association." Colonel Smith had been a conductor on a steam railroad all his life, and derived his military title from his connection with the state troops. Neither he nor I knew much of anything about trotting contests. The matter of providing suitable record books, and of reducing the business to a system, was entrusted to me. I collected all the rules to be found, and made a study of the matter, in order that I might know the requirements. For the first year everything moved along very nicely, but at the October meeting (1868) a fraud was perpetrated in the painting and otherwise disguising of a horse, and entering him in a class in which he did not belong. The case was followed up, the guilty parties ascertained, and punished by being ruled off our grounds for all time.

We reasoned, however, that as the country was large, these people could wear out their natural lives in similar frauds before they had exhausted the opportunities which the multitude of courses provided.

A copy of the evidence in the case, and the finding of our association, was forwarded to the turf papers, and to a few of the principal associations in the east. The latter took the matter up and expelled the guilty parties from their grounds.

This suggested unity of action, and I began to talk about an association, national in its scope, in which all members should be governed

by the same rules, and with a governing board which should hear all appeals and render final judgment.

* * * * *

In due time, February 3, 1870, at New York, an association was formed under the name of "The National Association for the Promotion of the Interests of the American Trotting Turf." By-laws, rules and regulations were adopted. Colonel Sprague was elected president, and Colonel Smith, secretary and treasurer, and the work of organization and systematizing this new business fell to me.

Three months later (May, 1870) I was elected secretary and treasurer of the Union Railroad Co., and treasurer of the Narragansett Association, and when Colonel Smith went to London, Eng., in 1872, as general manager of the Metropolitan Railroad system there, I was elected to all the positions he had filled, in addition to those I already held.

From the formation of these associations up to July, 1874, at which time I resigned from the Narragansett and National Associations, I was remarkably busy. My office in the National Association had taken me frequently to other cities, but I had little or no opportunity to observe matters connected with railroading.

Early in the year 1872, a friend returning from Buffalo, told me of a registering punch he had seen in use by conductors on the street cars there. I had some correspondence, and then went on to Buffalo to inspect its working, and to arrange the terms of a contract. Our board of directors had somewhat changed since the time when the device I had presented to their attention three years before had been so summarily rejected. Upon my return I advised a contract for the punch, and at the same time an increase in the pay of the men, and putting them in full uniform.

All this was agreed to. If I am not mistaken, the Atlantic Avenue, East New York & Greenwood Railroad, now a part of the Richardson system of the roads of Brooklyn, was the first to contract for the punches, and the contract which I signed was the second one, The punches were put on in a small way both at Syracuse and at Albany before they were in Brooklyn, but that was because we agreed it should be so. I was in Albany a few days, and was also in Brooklyn when the punches were first put on, for the purpose of watching results. It was at that time I first met the elder Mr. Richardson who was in charge as lessee, and I have very pleasant recollections of his courteous treatment of me while I was closely watching the developments in Brooklyn.

In October, 1872, just twenty years ago, I got it into my head that "horses had got to go," This was because of experiments I had witnessed with an engine running on naphtha gas and air. A contract was made in January, 1873, with Mr. Geo. B. Brayton, the inventor, in which he agreed to build, and we agreed to pay for, an engine of suitable size and shape for the propelling of a car. An amendment to our charter was obtained by the terms of which, towns and cities were enabled to grant us permission to use any motive power. We had previously been confined to the use of horse power. By numerous experiments, Mr. Brayton convinced me that naphtha was not dangerous if handled under proper conditions; that settled, it seemed to me the rest was easy. We talked of the size and shape of the engine, and finally decided upon an upright four horse power machine. It occupied precisely the same location and space that are commonly taken up for stoves in street cars. There was a water jacket around the cylinder which was cased with hard wood. A condensing coil was put out on the roof, a five gallon can of naphtha was under the seat with an air pump near it which pumped into a tank under the floor of the car. The power was transmitted by gears, and controlled by a lever at each dasher rail, so graduated that a speed from a crawl to fifteen miles an hour was possible. We were very confident, Mr. Brayton and I, that the problem had been solved, and I had already in my mind disposed of all our horses upon favorable terms. When everything was ready we found to our dismay, that four horse power was not sufficient. It would hardly "take up the slack," so to speak. Mr. Brayton thought, after this experiment, that six horse power would do, but I said "if six will do, make it twelve or fifteen and that will surely be enough." The new machine was twelve horse power because we found that was as big a machine as we could get into the space. Again I was confident, and I must say that the early experiments gave very gratifying results. To make a long story short (for the experiments extended over a period of eighteen months), we concluded that in order to get traction for ordinary grades, and to meet the usual and unusual conditions of the track, that the car would have to be very much increased in weight, and that nothing less than forty horse power to a car would give assurance of success. That settled the matter, to my mind if not to my satisfaction. It was not feasible from a commercial standpoint.

There were things which five cents would buy, but this was not one of them. Ten years later, when this same question of self propelled street cars came up, and it was proclaimed that a five horse power electric motor was going to revolutionize the street car business (Bentley-Knight system, Cleveland), I ridiculed the idea.

It is well known that I opposed all electrical schemes. It was not because I knew less, but because I knew more about the practical requirements than those who were promoting these schemes. We all know how the motors have been increased from five horse power to fifty horse power, and it is generally admitted to-day that forty horse power to a car is none too much; and then all these machines can be pushed to nearly double their rated power for a short period. The early teachings about electricity were that, if it took twenty horse power to run one car it would take more than forty horse power to run two cars, and so on in increasing ratio; but that has been shown to be false. The manner in which the power is made and distributed makes the system feasible. As soon as this was demonstrated, I became an enthusiastic believer in electrical propulsion, and two years ago built a road in Denver, and equipped it with cars thirty-eight feet long, which climb along grades of 5 per cent., carrying loads of 40,000 lbs.

But I am getting away ahead of time; I must go back to 1874.

The Sprague failure was in 1873 and the control of the Union Railroad stock fell to the trustee. A radical change in the *personnel* of the board was made, and it was proposed to use the scalping knife in every direction. At one of the first meetings of the new board, it was voted unanimously to reduce the pay of employes to the old standard of $2.00 per day, and it was seriously proposed to abandon the punches.

There had been no discussion of this resolution; it seemed to have been talked by the members before they came to the meeting and I was taken by surprise. It seemed to me to be undoing in a minute what we had been years in accomplishing. I was not then a member of the board, but was its secretary. I hastily drew up a resolution, and asked that it be substituted for the one just passed, and after some discussion it was so voted. The resolution was as follows:

"*Resolved:* In order that we may intelligently consider the expediency of reducing the daily compensation of conductors and drivers, the treasurer be, and he is hereby directed to furnish this board, at its next meeting, a statement of all the facts which should properly enter into the consideration of the matter, together with such notes and remarks as are necessary to an understanding of the subject in all in bearings."

At the next meeting I presented the report called for by the above resolution, and will quote from the concluding portion:

"In connection with this subject, I deem it proper to call your attention to a few facts in connection with the operation of the road, that you may readily discover how important it is to secure faithful and efficient service from conductors, and from that you will also be able to estimate the amount you can afford to pay, to make the position so desirable, and the means of detection so ready and complete, as to stop both the inducement and the opportunity for peculation.

"It is undoubtedly essential to remove both, for, if the inducement exists, the opportunity will offer in a greater or less degree under any system, and if the opportunities are large, the inducements will exist in a majority of cases. Each car transports on an average 130,000 passengers per year and is driven in that time about 19,500 miles. The safe conduct of these passengers, and their good will as well as valuable property of the company, is entrusted to these men. It is therefore of vital importance that the driver should be careful and considerate, and that the conductor should, in addition, be intelligent, gentlemanly, active and attentive. That we do not always secure men possessing these qualifications in the highest degree, is true; but it is also true that we can make a much better selection where the pay is adequate to the service required. The number of passages made over our road last year was 285,000, and, to illustrate the vital importance of honesty, it is only necessary to say that one fare appropriated by each conductor on each passage would amount to the sum of $17,100. The registering punch, which establishes a system of accountability, the need of which was long felt in the business. is of almost incalculable benefit not only to the company, but to the men who use it. Its cost to us does not exceed one and a half cents per passage, and is an insurance, in my judgment, of many times that amount. It furthermore secures to the conductor the means of preserving his character for honesty before the public, without which he might be falsely accused and unduly influenced."

This was written nearly twenty years ago. Figured on the lines of to-day's methods of railroading the results would be much more favorable to the company than are here shown. A full discussion of the matter followed the reading of this report, and it was voted unanimously that it was inexpedient to reduce the compensation. This was a decided victory for the right. These directors were all able business men. Their first impression was that the pay was too much, but when a full statement of the facts was placed before them they saw in a different light. The great obstacle I had to contend with, always, was

that other roads did not pay as much wages, or did not keep up their roadbed and equipment as we did. My argument was that we got the equivalent in a better service which was bringing to us a relatively better business.

I remember that during this and other struggles for good service, even at the expense of dividends for the time being, I many times wished there was a way to get at the whole railway interest of the country, just as I could get at our own board of directors, believing that the entire service of the county could be built up, greatly to the credit and advantage of the companies if they would pursue a liberal policy with employes and the public.

My early experiments were not confined to any branch of the business, but included everything that came along. I could tell of many amusing experiments with car starters, sand boxes, snow scrapers, brakes, boxes, loose wheels, roller bearings and dozens of things. They all cost money. I would gladly have told all my experience to any one interested in the business, and would have been glad to learn the experiences of others.

It may seem strange to you that under all these circumstances I did not make an effort earlier to form this Association. I did make a start for it once. Let me tell you about it. Just at this time when my mind was full of the idea of a national organization, a man by the name of Sayles, representing the Tanner patent brake, made a claim against our company for $30,000, for past use and also an extravagant demand for the right to continue its use. Inasmuch as his claim covered the brake which was in use practically, upon all street cars, it was something which interested every one in the business. Mr. Sayles named over to me many roads which he said settled his claim. I took his papers and promised to look into the matter. Soon after this I heard of an injunction suit which Sayles had brought against a small road in Brooklyn, the "Grand Street & Newtown Railroad Co." I remember that "Tracy, Catlin and Van Cott" were attorneys for the road. General Tracy was counsel. As soon as I heard of this suit, I went to Brooklyn and had an interview with General Tracy. In substance he said he did not think the claim was valid. They had made a good *prima facie* case, but he believed it could be successfully contested. It was a question of expense. It would cost any small company much more to fight than to settle. It seemed to me that here was the golden opportunity for a union of interests, and I undertook to see what could be done to that end. I ascertained that Mr. White, president of the Dry Dock road in New York City, knew much about this case, and I first called upon him. I found out that he had settled the claim so far as his road was concerned, but upon terms which made it cheaper to settle than fight. Mr. White gave me all the information he could, and evinced a spirit of cordiality and fraternity exactly harmonizing with my own feelings. I wish I could say as much of any other New York City railroad man I met, but I can't. I did not call on them all, however; I got very tired. I went to Boston and called upon the president of one of the roads there to see what he thought of forming a combination to pay the expense of making a test case of the Brooklyn injunction suit; suggesting at the same time that it might lead to a permanent organization which would be of great advantage in many ways. This president was a "very busy man." I had never seen him before, but the moment I put my eye on him I could see he was "very busy." He settled my business at the "drop of the hat," and this was about the way he did it:

"Young man, go back to your country hamlet; but first learn that this company will take care of its own affairs, and attend to its own business, and if it shall have any lawsuits on hand it will not call upon you for contributions." The matter was dropped.

This experience taught me that the fraternal spirit was not strong in either New York City or Boston, and I had other experiences which were quite discouraging.

I was personally acquainted (brought about and continued by other than railroad interests) with two gentlemen who were presidents of street railway companies in their respective cities. "Philadelphia," said one of the gentlemen, "is a peculiar city. We operate under different conditions, perhaps, from any other city; our business is governed largely by our 'Board of Presidents.' That is carrying out your idea of association, but is local, and it seems to me it must be so, and that no real good can come from a national organization, as there is not much in common."

The Baltimore gentleman held quite similar views. Even when the convention was called, ten years later, you will notice that not a single company in New York City or Philadelphia was represented, and only two companies out of a possible three dozen or so took any notice whatever of the call, and had the convention been held anywhere else, I know of at least one other city where the apathy would have been nearly as great.

But all this is now over. Everybody now sees the advantages of this organization, and it has been supplemented, strengthened and supported by numerous state organizations all formed on the same lines. The incidents I have mentioned are interesting as a matter of history, and show what little encouragement there was, and why a little diplomacy was finally necessary to bring about the desired result.

In the fall of 1878 I had a very severe sickness, from the effects of which I did not readily rally, and the following summer (1879) by the advice of physicians and friends, dropped all business thoughts and cares, and started for the Northwest, my first and only vacation in fourteen years. My objective point was Duluth, and we went straight there without delay. A month later, leaving the ladies in Duluth, I took a trip to St. Paul and Minneapolis, and then out to the wheat fields of Dakota, the Dalrymple Farms. The only street railways I saw on that trip were at St. Paul and Minneapolis, and I confess I did not seek to become acquainted with the people who were responsible for such an outfit. The cars were bobtails, the drivers went on duty with pants tucked in boots, minus coats, hats ranging from the derby to the sombrero. I thought them, taken as a whole, to be about the toughest lot of humanity I had ever seen bunched together. I learned that they were boarded at the company's expense, and paid about $40 per month. There was an evident lack of any sort of discipline or system. The horses, mules and cars, matched the men. I don't know now when it was that our friend Thomas Lowry took possession of these properties, but I do know that to-day they are among the best equipped and best managed systems in the country.

I first met Mr. Lowry at the Boston convention. I was impressed by his personality more. perhaps, than by any other one man. His energy was inexhaustible, and I could see that, on general principles, which should govern the conduct of the business, there was no difference of opinion between us. On my way back East I stopped in Chicago to see the city and its system of roads. Remembering some of my experiences in cities nearer home, I wondered what my fate would be if I should call upon one of the superintendents. However, as there is something of the spirit of adventure in my makeup, I concluded to try it. The city directory told me where I could find the office of the Superintendent of the West Division road, and, boarding a car, I was soon there. I advanced timidly, and asked if the superintendent was in. Being answered not unkindly in the affirmative, I had the courage to send in my card, upon which was engraved my name and address and a modest reference to my official position. I was received with open arms, as it were, and soon made to "feel at home." I found Mr. Lake to be quite willing to impart any knowledge he had, and ready and quick to pick up and digest anything which was good in the experience of others. I spent the day with him very pleasantly, and to our mutual advantage, so we both agreed. The next day I received the same sort of treatment from Mr. Holmes, of the South Side road.

The fraternal spirit shown by these men was in such strong contrast with the narrow-minded views of Eastern railroad men that I determined to revive the idea of a national organization. I was satisfied that it must apparently originate in the West, where the fraternal spirit was strong. The question was how to draw the East into the scheme, and I did not see at once any feasible way of doing it. "Western ideas" were not at the time popular in the East. It was evident to my mind that the convention must be held in the East. I turned plan after plan over in my mind, certain that I would eventually hit upon the proper one. While this Western trip did me a lot of good, my health was not completely restored, and in the spring of 1881 I went away again, this time to the South. The street railroad business in that section of the country was not then developed, and I saw nothing to indicate that the "South" could be drawn into any organization.

One day during the Summer of 1881 a very pleasant and affable gentleman walked into my office in Providence and introduced himself as H. H. Littell, of Louisville, Ky. He had been spending a season on the Rhode Island shore, as I recollect it, and was on his way home. He could not stop to look about, as he was in a hurry to get away, but said he liked to make the acquaintance of street railway men, and so had run in. The idea of a national association was then firmly fixed in my mind, and I talked with Mr. Littell about it in a general way. He agreed with me that it would be a good thing for every one connected with the business, and I promised to let him know more about it.

Mr. Walter A. Jones, than whom there was no more genial,

earnest and active member of the fraternity, was a close friend of Mr. Rugg, of Boston, and of myself. My affiliations with Boston railroad men at that time were confined to the "Highland" outfit, including Merrill, Rugg, Littell, etc. I mentioned the matter to Jones and Rugg, and they were both enthusiastic over it, especially Mr. Jones, who was quick to see the advantage from the view of a supply man, as well as a railroad man. He urged me to carry the plan out that fall (1882). I was inclined to wait until the Spring of '83. His persistence carried the day. The plan was this: The convention was to be held in Boston. Mr. H. H. Littell was to issue the call from his home in Louisville. The reasons for this were: 1st. Because the location was right, it being about the geographical centre of the region I supposed would send delegates. 2d. I felt we could depend upon Western enthusiasm and support. 3d. Because in my interview with him in Providence Mr. Littell had agreed to co-operate in any plan I would get up.

The whole thing was to be done quickly. No time was to be given to discuss the matter until the convention was reached. It would have been very awkward, and I am afraid very disastrous, to have explained that out of the many roads in Boston, only one could be relied upon to take any part in any plan for such a convention. I agreed to prepare a draft of by-laws and constitution, as a basis for the convention to act upon, and this I did. In order to carry the plan out successfully, some missionary work was necessary, and I suggested that we three, (Jones, Rugg and myself) take a trip West, and talk the matter up. This was done. I wrote the letter calling the convention, before I left Providence on this trip (Mr. Littell has the original now, so he told me six months ago) so that I could show and explain it as we went along. The following is the text of the letter, and a copy was mailed to all street railroad companies throughout the United States and Canada.

LOUISVILLE CITY RAILWAY COMPANY,

Louisville, Ky., November 8, 1882,

Dear Sir:—Permit me to call your attention to a matter which has for some time been considered by a number of street railroad men, viz.: The formation of an association based upon well established principles governing similar organizations, the object of which shall be the promotion and advancement of knowledge, scientific and practibal, in all matters relating to the construction, equipment and management of street railways; the establishment and maintenance of a spirit of fraternity among the members of the association, by social intercourse and fricndly interchange of information and ideas, to the end that the best service may be obtained at the least possible cost.

With this object in view, I have been requested by a number of street railway officials, both in the East and West, to issue this circular, and urge that your company send a representative to a convention to be held in the city of Bostion, on the twelfth day of December, 1882, for the purpose of organizing and adopting a constitution for the government of such an association.

It is expected that most of the prominent street railroad companies in the United States will be represented. Will you be kind enough to notify Mr. J. E. Rugg, supterintendent Highland Street Railway Co., Boston, Mass., at once whether your company will send delegates, in order that adequate accommodations for the convention may be made in advance? As soon as replies are received arrangements will be made, and you will be notified of the location and the hour the convention will meet.

Very respectfully, H. H. Littell,
Supt. Louisville City Railway Co.

The whole plan was an innocent conspiracy, as it were, to get a lot of railroad men together with only a crude idea of what they were coming for, relying upon the combined wisdom of delegates to bring good out of it.

It must not be understood that I wanted to control the convention. My advance work was simply to furnish a form to be afterwards moulded to suit the ideas of the majority. The Boston roads were not at the time a unit. There had been a free fight among the different companies, long continued. The hatchet had been buried, but with the handle up. President Merrill of the Highlands road, agreed to the plan, and to stand behind the invitation to meet in Boston, even if no other Boston road came in. I knew they would be obliged to come in when we tumbled in upon them delegates from all over the country. Mr. Merrill urged Mr. Richards, of the Metropolitan road, to preside at the convention and welcome the delegates, but this he declined to do as late as the Saturday prior to the meeting which was on Tuesday. Mr. Merrill then prepared the statistics for his speech at the opening of the convention.

The plan being fully decided upon, we (Jones, Rugg and myself) started West. Our first stop was at Buffalo, where Messrs. H. M. Watson Spaulding, and Edwards were met. They all heartily approved of the plan.

Next stop was at Cleveland, where Dr. Everett, Robison, Hathaway and others were seen. Then to Chicago, where Lake, Holmes and Wright were posted. From there we went to Louisville and pounced in upon Mr. Littell one fine morning. He was informed of the plan, and presented with the letter he was to sign and issue. He modestly objected to taking the responsibility of issuing such a call, but we assured him it was the only way, that the whole subject had been explained and was understood, and that any delay or consultation would open up the whole subject to talk and explanations which would not be profitable and would consume valuable time, as the season was already far advanced. Every one we saw agreed to do as much missionary work as possible. Mr. Jones agreed to look after New York City, Brooklyn, Albany, Troy, etc., and we came East.

Mr. Littell's letter was issued November 8. Twenty days later Mr. Rugg sent out his letter, and the convention assembled on the 12th of December. In just five weeks from the time the first gun was fired, the national organization had been perfected. I doubt if this speed will be equaled by any similar organization.

One word more and I am done. No one, who was prominent in forming the Association desired anything personal out of it. Mr. Merrill was chairman of the convention simply because Mr. Richards could not be coaxed to become interested in the matter. Mr. Littell was naturally the nominee for president, his name having been attached to the call, but as he was not primarily responsible for that, he cannot be said to have benefited from his own efforts. Personally, I did my full share of work on the organization committee, and would then gladly have let go the helm I had practically held up to this time, feeling sure that a crew would be put on board which would steer the Association away from all shoals and breakers. I reluctantly consented to take a position on the executive committee at the urgent request of many friends who thought I ought to be on board the ship on its first voyage. Not that I was not proud to be associated with such men as comprised the official list, but because I was willing others should reap the honors and credit so long as the Association I had looked forward to for so many years, and which I could see would elevate and benefit the business so much, was now an accomplished fact.

Among the names which should be recorded in this connection, in addition to those hereinbefore referred to, are those of Mr. Cleminshaw, chairman of the Committee on Constitution and By Laws, Mr. Richardson, secretary, and Messrs. Walsh, Goodell, Johnson and Robillard, who together with Messrs. Littell, Lowry, Jones, Merrill, Watson and myself, formed the original Committee on Constitution and By Laws.

Who can compute the value of this organization for the past ten years?

How much money has it saved to individual members?

How much has it contributed in advancing the material interests of the communities which are served by its members?

How much has it benefited the supply companies?

How much the employes?

What an educator it has been!

The street railroad business of to-day is conducted upon lines thought out by intelligent and progressive men, and not, as ten years ago, in the main, by narrow minded, selfish men, who guarded with zealous care as so much individual capital stock anything for good or evil which they had met with in their experience. The question now is, how can the Association be made more useful and beneficial to its members?

PROCEEDINGS

OF THE

ELEVENTH ANNUAL CONVENTION.

Wednesday Morning Session.

The Eleventh Annual Meeting of the American Street Railway Association was convened in the Hall of the Young Men's Christian Association, Cleveland, O., October 19, 1892.

President John G. Holmes, of Pittsburgh, Pa., called for order at 11 o'clock, and introduced Hon. William C. Rose, Mayor of Cleveland.

The Mayor made an interesting address of welcome, which was as follows:

Address of Welcome.

BY MAYOR WM. G. ROSE.

This is one of the most important conventions that ever assembled in this or any other city. You represent all kinds of surface street railways, steam dummies, horse cars, cable and electric. There is no question of a practical nature that more nearly concerns the denizens of large cities than that of rapid transit to and from their places of business or occupation.

You have come together in a friendly spirit of enterprise to exhibit and adopt all the most modern and practical improvements in the various methods of surface transportation.

Cleveland is highly honored by your presence, and in behalf of her citizens, it affords me pleasure to extend to you a cordial greeting, a hearty welcome and the liberties of the city. Being strangers in our city, I deem it my duty to admonish you of the dangers and pitfalls that may beset your paths while here. In all cities the size of Cleveland, there are certain streets that are considered more or less dangerous, especially after nightfall. But we are indebted to a New York paper for the information that danger lurks in some of our most beautiful streets at all hours, both of the day and night. This is a verification of the old saying that a man must go away from home to learn the news.

In the New York *World* of August 15, there is a communication written from this city, two and a half columns in length, which opens with these startling head lines:

"A TROLLEY RIDDEN CITY,"

"CLEVELAND, OHIO, IN THE THRALL OF DEADLY, HIDEOUS WIRES."

"WHERE NEW YORKERS SHOULD GO FOR AN OBJECT LESSON."

"THE SECOND MOST BEAUTIFUL STREET IN THE CITY PRACTICALLY ABANDONED TO THE ELECTRIC JUGGERNAUTS."

"EXTRAORDINARY RULING OF THE COURT AGAINST THE PEOPLE."

"HUMAN LIFE AND VALUABLE PROPERTY SACRIFICED."

I have only time to read one or two extracts. The writer says:

"Prospect, from one of the finest residence streets in the country, had been transformed into a street where life was almost a burden. The electric cars, with their horrible uproar, were tearing up and down it at all hours of the day and night and at intervals of less than a minute. The charged rail was continually knocking horses high into the air and sending them sprawling to the ground. Driven mad by the electric shock and terrified by the electric motor with its indescribably horrible uproar, the crazed animals tore through the streets strewing the roadway with wrecks of carriages and with thrown riders. Women, children and men were constantly knocked down by the cars. Many of these accidents were fatal."

The mind shrinks back appalled at the contemplation of such a scene. Beautiful and peaceful Prospect Street, strewn with dead and mangled bodies, like the path of the noble six hundred at the charge of Balaklava! Think of it! Vehicles, frenzied horses, gentle women, tender children and stalwart men, all involved in the common ruin! Horses knocked high in the air! You may search in vain for a man, woman or child who ever saw one of these horses, that was knocked so high in the air, come down again. Where have they gone? Perhaps beyond the reach of the earth's attraction and they may be still soaring through space, their red nostrils widely distended, their flaming tails steaming in the blue ether, like Encke's comet. What a picture Prospect Street, as portrayed by this writer, would be for the brush of a Raphael, a Reubens or a Michael Angelo! It must be stopped. Such a state of affairs, if allowed to continue, would soon enrich the undertakers and drive every accident insurance company into bankruptcy.

Let us read a little further: "The East Cleveland company, three of whose four branch lines concentrate in Prospect Street between Case Avenue and Erie Street, has just got its charter so widened as to permit the carrying of freight as well as passengers. It is the plan of the company to extend its lines eastward to Painesville, a distance of thirty miles. When this is done the company will run regular freight trains bringing into the City country produce and even heavier wares. With the passenger cars already running at intervals of less than a minute each way it can be faintly imagined what the once beautiful Prospect Street will be when to this traffic are added numerous heavy rumbling freight trains."

Now, throwing aside all jokes, this correspondent is a clever writer and the greater portion of his article is well written and truthful; but his statements, as to the carnage and devastation on Prospect Street, and as to the rumbling freight trains that are soon to appear on the East Cleveland company's lines, are unwarranted exaggerations. The writer must either be gifted with an imagination that would rob Munchausen of his laurels, or he has been imposed upon by some disgruntled old moss back who is opposed to all modern improvements. No grant has been given to the East Cleveland company to run freight trains on any of its lines within the City limits, and I have ridden on the trolley cars of that company on Prospect Street three or four times, nearly every day for a year and a half, and I have not yet seen a man, woman, child or horse killed or injured by the trolley wires. I have heard of several horses being killed, in various parts of the city, by the breaking of the trolley feed wires, and I have also heard of a number of persons who have been killed or injured by the electric light wires, traceable in every case to faulty construction, but I do not now remember a single instance where a human life has been lost by reason of the trolley wires.

It is true that accidents often happen and a good many persons have been killed or injured by the rapid running of the motors, but not more, perhaps, in proportion to the amount of travel, than occur by the steam railroads or by any other method of rapid transit. Many of these accidents could be prevented by placing proper guards over the wheels and by proper care on the part of the motormen, by slowing up and ringing bells at all crossings. Another fruitful source of accidents is the employment by the company of "green" men to run motors. No man should be placed in charge of a motor until he has passed an examination by an experienced electric motor engineer and has been licensed the same as locomotive and stationary engineers. Laws should be passed compelling the companies to adopt such regulations.

I am opposed on general principles to overhead wires; they are often an obstruction to the effective working of the fire department; they are unsightly and more or less dangerous, and as soon as possible they should all be placed in conduits underground. But no practical method has yet been devised for running motors by underground wires, and until that time arrives I would rather bear the ills we have than to go back to the barbarous system of horse cars. If it were put to a vote to-day in the city of Cleveland, there would be twenty to one in favor of the electric or cable system. The noise of electric cars on residence streets is a great annoyance, but it can be overcome in a great measure by improved methods of gearing.

The use of electricity as a motive power is yet in its infancy, and it is only a question of time when all these desirable improvements will be accomplished. It is less than five years since the first electric street railway was put in operation in the United States. You will find in the *Forum* of September, 1891, a very able article on this subject from the pen of Frank J. Sprague.

He says, that "there were, then in operation and under contract, in the United States, Europe, Australia and Japan, not less than 350 electric street railways, using more than 4,000 cars and 7,000 motors with 2,600 miles of track and a daily mileage of nearly 500,000 miles and carrying nearly a billion passengers annually."

This was over one year ago, and the tabulated statement contained in the *Electrical Industries* of October, 1892, shows that on the 15th of September last, just one year later, there were in the United States alone 469 electric roads with 5,446 miles of track, using 7,769 motor cars and 3,790 trail cars. If these statements are both correct, wonderful progress has been made in the construction of electric railways during the past year.

There are now in operation in Cleveland about fifty miles of double track electric street railways and sixteen miles more of double track in process of construction, which, when completed, will make a total of 132 miles of track using the trolley system. We have also one of the best constructed cable roads in the country operating eleven miles of double track. This road is splendidly equipped with all the most modern improvements known to the cable system. Including horse car lines, there are altogether about 175 miles of street car tracks in Cleveland.

It is gratifying for me to know that I am not addressing a convention of fossils. No fossil ever succeeded in anything except to leave the marks of its lineage on the rocks or in the crust of the earth. I doubt if it would be possible to get together a body of men more representative of the "push" and "pull" of American life than those I see before me. Coming from the different cities of the country, you embody in your collective capacity, a system which has evoluted from small and crude beginnings into 1,500 street railway companies. You are fast taking harness off horses and putting it on lightning and steam. The words "grip" and "wire pulling" have received from you a new and enlarged meaning. You propose to divide the use of the streets with the people, but you take your half out of the center. You ask a right of way through the principal thoroughfares, and when it is granted, the right to keep out of your way is the only valuable right that remains. Knowing your tendency to absorb everything in sight, rails are laid down to keep you where you belong.

The longing for a future life has always been regarded as a strong proof of the immortality of the human soul; but corporations have no souls, and therefore their strong desire for continued existence would seem to disprove this theory. Eternity itself seems too short for some of them. There was a time when a shrewd man was spoken of as being "as sharp as a Philadelphia lawyer," but now they say "as sharp as a street railway grabber." You often obtain franchises, as in this city, worth millions of dollars, without paying for them one penny into the cities' coffers. But who is most to blame for it? The municipal legislature. And who is to blame for the municipal legislature? The people who elected it.

In Ohio you have appealed to Cæsar. A bill is now pending in the legislature of this state to extend, for a mere nominal percentage of the gross receipts, all street railway franchises for a period of ninety-nine years. Gentlemen, this is a mistake. You are asking too much. The legislature that will enact such a law will be doomed to eternal infamy. If you persist in such demands, the time will soon come when municipalties will own and operate all street railways the same as they now own and operate water works, and in some places gas plants.

Nothing could be more appropriate than your selection of Cleveland as the place for holding this national convention. It is another evidence of your shrewdness, because while here you can leave your orders for everything necessary for the equipment of your various roads and possibly they may be filled before you reach home. In speaking of the prosperity of Cleveland, I will make no invidious comparisons between this and other cities. We should all rejoice at the growth and prosperity of any and every city in this broad land, whether East or West, North or South. I take no stock in a man who is jealous of the growth of any city that is protected by the Stars and Stripes. We are one country with one flag and one destiny, and what-

ever benefits one section or one city adds to the general prosperity of the whole. A man who is so small that he can see nothing good outside of his own city or his own folks is not big enough to be called an American citizen. The marvelous growth and prosperity of American cities, along the sea coast, the great lakes and rivers and in the interior is without a parallel in the history of the world, and every man who loves our free institutions should be proud of every one of them. Cleveland is a growing city and the growth is solid and substantial. The true way to judge of the prosperity of a city is by the growth of its industries, the increasing volume of its business and the number of its buildings and permanent improvements.

The books of our building inspector will show that in the past four years there were erected in this city 11,000 new buildings and 5,000 new additions at a total estimated cost of over $21,000,000. This would be an average of about 2,700 new buildings every year. The Census of 1890 will show that during the decade between 1880 and 1890, we increased over 100,000 in population. During the same decade we added 1,010 new manufacturing establishments to the number we had in 1880, so that we now have 2,065. In 1890 these factories gave employment to 47.000 adult males, and 5,000 adult females, making a total of 52,000 hands. There was paid to them in 1890, over $30,000,000 in wages alone. The cost of the raw material necessary to run these factories in 1890, was over $56,000,000, and the value of the manufactured products in the same year amounted to nearly $100,000,000. These facts and figures as to our industrial growth are official. You will find them in the address of General Porter, superintendent of Census, recently delivered in this city. It was published in pamphlet form for free distribution by the Board of Industry, and I hope each one of you will receive a copy before leaving our city,

In that address he sums up the growth of Cleveland in the following language :

"In ten years you have doubled the number of your establishments and the value of the products. You have nearly trebled the capital invested in manufactures, multiplied the total number employed two and a half times, and you are paying out annually in wages more than three times as much as you did in 1880."

He also says "that Cleveland is the largest ship building port in the United States, and the largest in the world, except Clyde, in Scotland." He also adds : "These are cold, clear, official statements of facts."

Few, if any, cities in the world can present such a record of growth and prosperity. The manufactories in Cleveland are, perhaps, more diversified than those of any other city in the world. These 2,065 industrial establishments manufacture nearly every kind and variety of articles in the shape of iron, steel, brass, copper, wood and rubber that can be found anywhere in the markets of the world, or of which the mind of man can conceive.

This brief review must suffice. We might exhaust ourselves in trying to exhaust this subject. I will now commit you to the tender mercies and generous hospitalities of the street railway magnates of Cleveland. I need not tender them the liberties of the city; they have taken them already, and will share them with you. Like yourselves, they are great "hustlers." They will doubtless keep you on the move and afford you every opportunity to enjoy the varied social and business life of Cleveland. If anything should be wanting to make your stay pleasant and agreeable, they know how to appropriate it. I trust that your convention will be of profit to yourselves and to the public in whose service you are enlisted.

The address of welcome of the Mayor was received with applause, and was followed by the address of President John G. Holmes, given on page 635.

The next business was the report of the Executive Committee.

Report of the Executive Committee.

Your Executive Committee respectfully submits the following report :

MEMBERSHIP.

At the opening of the meeting in the city of Pittsburgh the membership numbered 184 companies.

At that meeting, and during the year, the following companies have become members, being arranged in alphabetical order :

Akron, O.—Akron Street Railway Co.
Allentown, Pa.—Allentown & Bethlehem Rapid Transit Co.
Amsterdam, N. Y.—Amsterdam Street Railroad Co.
Birmingham, Ala.—Birmingham Electric Street Railway Co.
Boston, Mass.—Boston & Revere Electric Street Railway Co.
Bristol, Tenn.—Bristol Belt Line Railway Co.
Carbondale, Pa.—Carbondale Traction Co.
Colorado Springs, Colo.—Colorado Springs Rapid Transit Railway Co.
Denver, Colo.—West End Street Railroad Co.
Detroit, Mich.—Wyandotte & Detroit River Railway Co.
Fort Wayne, Ind.—Fort Wayne Street Railway Co.
Haverhill, Mass.—Haverhill & Groveland Street Railway Co.
Hazleton, Pa.—Lehigh Traction Co.
Johnstown, Pa.—Johnstown Passenger Railway Co.
Mansfield, O.—Citizens' Electric Railway, Light & Power Co.
McKeesport, Pa.—McKeesport & Reynoldton Passenger Railway Co.
Nashua, N. H.—Nashua Street Railway Co.
Newark, N. J.—Newark & South Orange Horse Railroad Co.
Norwich, Conn.—Norwich Street Railway Co.
Oil City, Pa.—Oil City Street Railway Co.
Paterson, N. J.—Paterson Central Electric Railway Co.
Pawtucket, R. I.—Pawtucket Street Railway Co.
Petersburg, Va.—Petersburg & Asylum Railroad Co.
Portland, Ore.—Metropolitan Electric Railway Co.
Pottsville, Pa.—Schuylkill Electric Railway Co.
Scranton, Pa.—Scranton Street Railway Co.
Springfield, O.—Springfield Electric Railway Co.
Steelton, Pa.—Middletown, Highspire & Steelton Street Railway Co.
Syracuse, N. Y.—Syracuse Consolidated Street Railway Co.
Vincennes, Ind.—Vincennes Citizens' Street Railway Co.
Yonkers, N. Y.—Yonkers Street Railroad Co.
Youngstown, O.—Youngstown Street Railway Co.

The following change by consolidation has taken place :

Portland, Ore.—The City & Suburban Railway Co., in place of the Willamette Bridge Railway Co. and the Transcontinental Street Railway Co., the former company having been a member.

The following companies, now being controlled and operated by member companies, have withdrawn :

Passaic, N. J.—Passaic, Garfield & Clifton Street Railway Co.
Philadelphia, Pa.—The Thirteenth & Fifteenth Streets Passenger Railway Co.
Port Huron, Mich.—City Electric Railway Co.

The following changes of names of members have taken place :

Baltimore, Md.—City & Suburban Railway Co. in place of the Baltimore Union Passenger Railway Co.
Davenport, Ia.—Davenport & Rock Island Railway Co. in place of the Davenport Central Railway Co.
Detroit, Mich.—The Fort Wayne & Belle Isle Railway Co. in place of the Fort Wayne & Elmwood Railway Co.
Easton, Pa.—Easton Transit Co. in place of the Easton, South Easton & West End Passenger Co.
Little Rock, Ark.—The City Electric Railway Co. in place of the Capital Street Railway Co.
Lowell, Mass.—The Lowell & Suburban Railway Co. in place of the Lowell Horse Railroad Co.
New York City.—Union Railway Co. in place of the Harlem Bridge, Morrisania & Fordham Railway Co.
West Superior, Wis.—Superior Rapid Transit Co. in place of the Douglas County Street Railway Co.
Wilkes-Barre, Pa.—Wilkes-Barre & Wyoming Valley Traction Co. in place of Wilkes-Barre & Kingston Passenger Railway Co.

The following members have withdrawn :

Cedar Rapids, Ia.—Cedar Rapids & Marion Railway Co,
Galesburg, Ill.—College City Street Railway Co.
Harrisburgh, Pa.—Harrisburgh City Passenger Railway Co.
LaFayette, Ind.—LaFayette Street Railway Co.
Newton, Mass.—Newton Street Railway Co.
Sioux City, Ia.—Riverside Park Railway Co.

As a result of these changes, the membership is now 206 companies, being a net increase of twenty-two companies since the opening of the session of 1891.

MINUTES OF EXECUTIVE COMMITTEE.

Inasmuch as it was impossible for the Executive Committee to meet directly following the last meeting of the Association, it was decided to hold a meeting of the Committee in the city of Cleveland. This was arranged for, and the minutes of that meeting form a part of this report, as follows :

Minutes of special meeting of the Executive Committee, held at the Hotel Hollenden, Cleveland, O., on Wednesday, February 10, 1892. at twelve o'clock, noon.

There were present, the president, Mr. John G. Holmes, and Messrs. McLean, Lang, Watson, Perrine, Bean, Penington and the secretary.

The president announced that he had made the following appointments in accordance with the authority conferred on him by the Association at the annual meeting at Pittsburgh :

Standards for electric street railways : Thomson-Houston, O. T. Crosby, president Union Belt Line Railway Co., Utica, N. Y.; accountant, H. I. Bettis, assistant treasurer Atlanta Consolidated Street Railroad Co., Atlanta, Ga.; Electrician and Short, E. E. Higgins, general manager Short Electric Railway Co., Cleveland, O.; Mechanic and Short, C. W. Wason, general manager East Cleveland Railroad Co., Cleveland, O.; Westinghouse, R. W. Rippetoe, president Terre Haute Street Railway Co., Terre Haute, Ind.

Power house engines : T. W. Wrenne, president United Electric Railway, Nashville, Tenn.; L. H. McIntire, engineer Union Railway, New York ; F. S. Pearson, chief engineer West End Street Railway Co., Boston, Mass.

Relative cost of operation of horse, cable and electric roads : Wm. McC. Ramsey, electrical superintendent Federal Street & Pleasant Valley Passenger Railway Co., Pittsburgh, Pa.; F. R. Greene, secretary Chicago City Railway Co., Chicago, Ill.; John L. Heins, superintendent Brooklyn City & Newtown Railroad Co., Brooklyn, N. Y.

The question of subjects for reports of special committees was next considered.

On motion of Mr. Watson, the following subject was designated : "A Perfect Overhead Electric Construction."

On motion of Mr. McLean, the following subject was named : "Indemnity Insurance for Street Railways."

On motion of Mr. Bean, the following subject was selected : "A Model Electric Street Railway Roadbed and Underground Wiring."

On motion of Mr. Watson, the following subject was named ; "Economy of Machine Shops for Electric Railways."

The Committee then took a recess until six o'clock.

The Committee reconvened at six o'clock.

The secretary stated that Mr. Allen R. Foote, special United States census agent for the investigation of the electrical industry, had been in correspondence with him as to the formulation of a schedule for obtaining a uniform system of accounts, in accordance with resolutions which were adopted at the last annual meeting.

Mr. Perrine moved that a special committee, consisting of Messrs. McLean, Watson, Bettis and Warren be appointed to prepare a form for obtaining electrical statistics from the street railway companies of the United States for the Census Bureau, and that they submit the same to the Executive Committee. Carried.

The letter of Mr. J. H. Bickford, chief engineer of the Naumkeag Street Railway Co., of Salem, Mass., in regard to the formation of an engineers' auxiliary of the American Street Railway Association, and referred to the Executive Committee, was read.

Mr. Lang moved that it is the judgment of the Committee, after having duly considered the question of the formation of an auxiliary association of engineers, that it would be unwise to form such an association at present. Carried.

A recess was taken until ten o'clock Thursday morning.

Thursday: The Committee met at the time named.

The question of the selection of a place for the twelfth annnal meeting was considered.

Mr. Penington moved that Mr. H. C. Payne, vice-president of the Milwaukee Street Railway Co., be corresponded with by the secretary in regard to the selection of Milwaukee as the place for holding the twelfth annual meeting, and that the correspondence be submitted to the Executive Committee.

A personal letter from Mr. D. F. Longstreet, of Denver, Colo., to the secretary, sketching the ante-natal history of the Association, was read.

Mr. Watson moved that Mr. Longstreet be requested to prepare a history of the events which led up to the formation of the American Street Railway Association, and present the same at the next annual meeting. Carried.

On motion, adjourned.

WM. J. RICHARDSON, Secretary.

SPECIAL REPORTS.

It will be seen that it was the judgment of your committee that electricity, having come to stay, should be considered carefully and largely at this meeting; and we, therefore, provided for the preparation of reports on a number of subjects of vital interest to the members of the Association in regard to electrical construction, equipment and operation.

The subjects were selected with great care, and assigned to gentlemen in every way competent to treat them understandingly and profitably. It is the desire of the committee that all the subjects shall be thoroughly discussed in order that the fullest and best information relating to the operation of street railways by electrical power may be obtained by all present.

The special papers noticed to be read will also be found to be of unusual interest, and will, doubtless, receive their well merited share of discussion.

ADVANCE COPIES.

The decision of the Association, at its last meeting, authorized the printing of advanced copies of special committee reports, and the distribution of the same among the member companies. Only two reports were received in time to be printed and distributed before this meeting. Since then four reports have been received in time to be printed and distributed at the outset of the meeting; but not in time, of course, to be carefully read and digested before being read to the Convention.

This being the first time in the history of the Association that advance copies have been prepared, it was thought that it would be almost impossible to have all the reports distributed in advance of the meeting. We trust that hereafter all the reports will be received in time to be sent out in advance of the annual meetings.

STREET RAILWAY LAW.

The following judicial decisions have been issued during the past year, and constitute parts of Volumes VIII and IX of "Street Railway Law."

1891.

November—Fenton *vs.* Second Avenue Railroad Co.

December—O'Connell *vs.* St. Louis Cable & Western Railway Co.

1892.

January—O'Neill *vs.* Dry Dock, East Broadway & Battery Railroad Co.

February—Wynne *vs.* Central Park, North & East River Railroad Co.

March—Alexander *vs.* Rochester City & Brighton Railroad Co.

April—The People, *ex rel.*, the Union Trust Co. *vs.* Michael Coleman *et al.*

May—The Mayor of the City of New York, *et al.*, *vs.* Dry Dock, East Broadway & Battery Railroad Co.

June—De Lesdernier *vs.* Houston City Street Railway Co.

July—Keller *vs.* Hestonville, Mantua & Fairmount Passenger Railroad Co.

August—Sheets *vs.* Connolly Street Railway Co.

September—Heffron *vs.* Detroit City Railway Co.

October—Ehrisman *vs.* East Harrisburgh City Passenger Railway Co.

AMERICAN STREET RAILWAY DECISIONS.

The editors of the work entitled "American Street Railway Decisions" have nearly finished the preparation of their manuscript for the work, and promise the speedy completion of the entire publication. Copy is in the hands of the printers, two volumes are promised to be issued by the close of the year, and the remaining volumes as soon as practicable thereafter.

THE TECHNICAL PRESS.

We take occasion to express our earnest appreciation of the hearty expressions of good will and manifest interest in the welfare of the Association that have been made from time to time during the year by the street railway and electrical press of the country.

THE NEXT REGULAR MEETING.

In conformity with the action of the Association at its last annual meeting, which empowered the Executive Committee to select the place for the next annual session, the Association having been very cordially invited by the city of Milwaukee, and satisfactory arrangements having been made through Mr. H. C. Payne, general manager of the Milwaukee Street Railway Co., your Committee has selected that city as the place for holding the meeting of the Association in 1893. Its nearness to Chicago makes Milwaukee an especially desirable city in which to hold our convention, because of the advantage it offers to delegates by making it possible for them to attend both the World's Fair and the meeting of the Association on the same trip.

PROPOSED AMENDMENTS TO BY-LAWS.

Based upon a motion adopted at the last annual meeting, referring the selection of the place of meeting to the Executive Committee, the following resolution relative to the amendment of Article VII of the by- laws is submitted:

Resolved: That Article VIII of the by-laws be amended by the insertion of the words "by the Executive Committee," immediately following the word "designated" on the third line as printed.

When the third week in the month of October was chosen as the time for holding the annual meeting of the Association, we believe those who made the choice of that time of the year builded better than they knew; for during the ten meetings already held in all parts of the country, covering usually three days, the weather, both as to temperature and humidity, has been delightful with but two exceptions; one being when the weather was rather too cool for comfort, and the other when rain disturbed the convention for one session only.

This year, by reason of the inaugural exercises of the World's Fair in the city of Chicago occurring during the same week of the meeting of this Association, the question of changing the time of meeting was seriously considered by the Executive Committee. It was decided, however, after careful consideration, that it would be unwise to change the date of meeting, a prominent reason being that it would require a special meeting of the Association for the purpose. In order that the Executive Committee may hereafter have power to change the date of meeting, in case sufficient reason should in its judgment arise, the following resolution is offered for adoption:

Resolved: That Article VII. of the by-laws be amended by the addition to the first sentence of the following words "unless otherwise ordered by the Executive Committee."

OBITUARY.

Your Committee is called upon to record the death of the presidents of two member companies during the Associational year.

Lewis Lyon died in the city of New York, October 29, 1891, of heart failure, after a short confinement to his home. He was the president of the Third Avenue Railroad Co., of New York City, for the last thirteen years, and was known as the pioneer cable railway man in that city, having been instrumental in introducing cable traction there. He was faithful to the great business interests devolving upon him, and his friends were warmly attached to him.

John H. Bonn was president of the North Hudson County Railway Co., of Hoboken, New Jersey, at the time of his death from apoplexy, November 16, 1891. He conceived the idea of developing the street railway traffic of Hoboken, and was for many years president of the company organized by him. He left the property in a most flourishing condition. His was a genial nature. He was beloved by all who knew him intimately, and highly esteemed in the community in which he lived so long.

Again we are called upon to mourn the loss of an ex-president of the Association. Calvin A. Richards departed this life February 15, 1892, after a brief illness, the result of an attack of the grip. He was for many years president of the Metropolitan Railroad Co., of Boston, and for a short time general manager of the West End Street Railway Co. He was president of this Association for the year 1884-'85. We shall miss his joyous presence at our annual gatherings which he was always anxious to attend.

OUR BUSINESS FUTURE.

The outlook for business was never better. With scarcely an exception, the pleasant and harmonious relations between the employes and the managers in the street railway business in America have been undisturbed. The community of interest of both parties has been fully appreciated; and with the desire to work together harmoniously, with the purpose of furthering the best interests of the companies with which we are connected but little friction has developed. May this state of affairs long continue! The financial outlook is the best. With peace at home and abroad, the people prosperous and happy, with the best country in the world, we look forward to the future with the brightest hope. Respectfully submitted,

JOHN. G. HOLMES,
THOMAS H. MCLEAN,
ALBION E. LANG,
H. M. WATSON
LEWIS PERRINE, JR.
W. WORTH BEAN,
W. J. RICHARDSON, Secretary.

The treasurer's report was then read, a summary of which is as follows :

SUMMARY OF TREASURER'S REPORT.

RECEIPTS.

Balance	$1,742.06
33 admissions	825.00
1 anuual dues, 1888–89	25.00
1 annual dues, 1889–90	25.00
8 annual dues, 1890–91	200.00
166 annual dues, 1891–92	4,149.75
8 annual dues, 1892–93	200.00
Tenth annual banquet	280.00
"American Street Railway Decisions"	105.00
Miscellaneous reports	22.50
	$7,574.31

EXPENSES.

Secretary's salary	$1,749.97
Tenth annual banquet	1,600.00
Publishing tenth annual report	1,001.68
Miscellaneous printing	276.25
Compensation, special committee reports	250.00
Special Executive Committee meeting at Cleveland	244.96
Postage	230.00
Expenses incident to tenth and eleventh annual meetings	219.10
Printing legal opinions, "Street Railway Law"	198.00
"American Street Railway Decisions"	162.00
Printing "Public and State Treatment of Corporations," No. 3	60.00
Return of annual dues, second payment, by error	25.00
Insurance, telegrams, stationery, etc	17.68
Expressage	14.90
	$6,049.54
Balance in bank	1,524.77
	$7,574.31

The World's Fair committee reported as follows:

Report of the World's Fair Committee.

CLEVELAND, O., October 19, 1892.

Gentlemen :—The World's Columbian Exposition Committee respectfully reports :

That under date of May 25, 1892, a circular letter, of which the following is a copy, was sent to every dealer in street railway supplies, whose address was obtainable, as well as to every member company :

OFFICE OF
THE STREET RAILWAY ASSOCIATION,
CORNER ATLANTIC AND THIRD AVENUES.

BROOKLYN, N. Y., May 25, 1892.

Gentlemen :—The special committee appointed by the American Street Railway Association for the purpose of securing as commendable an exhibit as possible of all that pertains to the street railway business at the forthcoming Columbian Exposition at Chicago, desires to urge upon you the importance and necessity for making application at once for such space as you will need to make a proper exhibit of your manufactures.

This Association has secured 50,000 sq. ft., and the allotments of space as to desirability will be made in the order in which applications are received. Unlike any other World's Fair, the management of the Columbian Exposition will arrange the exhibits regardless of nationality, in departments, each comprising all that relates to any particular industry or subject. All, therefore, that relates to transportation will be in one building, and that devoted to street railways will all be gathered together in one section of the building.

The Exposition will make no charge whatever for space. It will be necessary in estimating the amount of space required, to state just the number of square feet needed for the exhibit, independent of aisle room. A limited amount of power will be supplied without charge. Exhibits will begin to be received as early as November 1, 1892, and no article will be admitted after April 10, 1893. Complete rules covering the entire subject will be sent on application to Mr. Willard A. Smith, chief of the department of transportation of the World's Columbian Exposition, Chicago, Ill.

Mr. John B. Parsons, vice-president and general manager of the West Chicago Street Railroad Co. has kindly consented to serve the Association as its sub-committee, to advise with Mr. Smith in reference to the exhibit under the auspices of this Association. All applications for space and information in regard to the exhibit should be made to Mr. Willard A. Smith, chief of the department, for which purpose an envelope, duly addressed, is enclosed.

The committee desires especially, as stated in the outset of this letter, to impress upon you the necessity for immediate action as hereinbefore set forth, should you desire to be represented by an exhibit at the World's Columbian Exposition.

Very respectfully yours,

GEO. W. PEARSON, Washington, D. C.
G. HILTON SCRIBNER, New York, N. Y.
JNO. B. PARSONS, Chicago, Ill.
E. B. EDWARDS, Philadelphia, Pa.
AMOS F. BREED, Boston, Mass.
THOMAS LOWRY, Minneapolis, Minn.
CHRS. GREEN, St. Louis, Mo.
E. LUSHER, Montreal, Can.
J. L. WILLCUTT, San Francisco, Cal.
JNO. G. HOLMES, Pittsburgh, Pa.
WM. J. RICHARDSON, Brooklyn, N. Y.
Columbian Exposition Committee.

Our committee has been advised by Mr. Willard A. Smith, chief of the department of transportation exhibits, that the circular met with a hearty response, and that the exhibit of manufactures and inventions, under the auspices of this Association, at the World's Columbian Expositon, to be held in Chicago in the year 1893, will be altogether creditable to the street railway industry.

We earnestly request all intending exhibitors, who have not yet attended to the preliminary arrangements necessary to secure admission of their novelties and products at the Exposition, to do so forthwith, in order that the exhibit shall be systematically arranged, as well as perfect in the ground covered. Respectfully submitted,

GEO. W. PEARSON, Chairman.

The first paper read was by by Mr. D. F. Longstreet, of Denver, Colo., in which he traced the successive steps which were taken to create an organization among the street railway men, and which culminated in the formation of the American Street Railway Association in Boston, Mass, December 12th, 1882. (See page 655.)

On motion of Mr. Cleminshaw, of Troy, a vote of thanks was passed to Mr. Longstreet for his interesting sketch.

The next paper was that of Mr. George W. Baumhoff, of St. Louis, Mo., entitled "A Model Electric Street Railway Roadbed and Underground Wiring." (See page 635.)

On motion of Mr. McLean, of New York, a vote of thanks was passed to Mr. Baumhoff; and it was ordered that three copies of the report be distributed to every company a member of the Association, and one copy to every street railway company of America.

The hour for taking a recess having arrived, the discussion of Mr. Baumhoff's paper was deferred until the evening session.

The secretary then read a letter of invitation from the Short Electric Railway Co., inviting all in attendance to visit the works of the company and take luncheon on Wednesday afternoon. A letter was also read from the Walker Manufacturing Co., of Cleveland, inviting the delegates and others to visit their works on Friday, and take luncheon as the guests of the company.

On motion of Mr. Cleminshaw these invitations were accepted.

The meeting then took a recess.

In the afternoon all in attendance at the Convention were taken in special cars to the works of the Short Electric Railway Co., and entertained in a very agreeable manner. Souvenirs were distributed by this company and also by the Swan Electric Lamp Co. The weather was perfect and the affair was one of the most pleasing features of the Convention. A full account of this excursion will be found on another page of this issue.

Wednesday Evening Session.

The meeting opened at eight o'clock.

The following companies applied for membership.:

Roanoke, Va.—Roanoke Street Railway Co.

Washington, D. C.—Washington, Alexandria & Mt. Vernon Railway Co.

Wilmington, N. C.—Wilmington City Railway Co.

The discussion of Mr. Baumhoff's paper was then taken up.

MR. EPPLEY, of Orange : I would like to hear the experience of some of the gentlemen in reference to the merits and demerits of the railway track chair, as compared with the recent form of girder rail, nine or ten

inches high. I should like to hear from some of the gentlemen who have been laying the new rail, and who have also used the chair which has been in use for the past six or seven years.

MR. PAYNE, of Milwaukee: Up to within a year ago we used the girder rail on chairs—we had twenty miles of road of that construction—and about a year ago we commenced to lay the eight inch rail spiked directly to the ties. It is laid twenty inches apart, centers. The rail on the chairs has not proven satisfactory, and we are replacing it in some places. The other rail is very satisfactory indeed; you can hardly tell where the joints are. We think we have the best track in the world.

MR. RICHARDSON: What weight?

MR. PAYNE: Eighty pounds to the yard.

MR. RICHARDSON: The chair?

MR. PAYNE: I cannot give you any particulars about the chair; I only know that it was not satisfactory. Our present construction is the one in which we use the eighty-eight pound rail. It is eight inches high, and it has taken the place of the other rail which was only down two years and had to be discarded.

MR. LITTELL, of Buffalo: The road I am connected with has lately contracted for twenty miles of track, with the privilege of increasing it ten more, and we are going to use a nine inch girder rail without chairs. Splice bars three-quarters of an inch thick and thirty-two inches long; twelve one-inch bolts; tie rods every five feet; eight foot ties, three and a half feet apart, 5×7. We use yellow pine or oak. The rail is ninety-three pounds to the yard.

MR. RICHARDSON, of Brooklyn: The company of which I am president recently obtained about twelve miles of seventy pound rail, six inches in depth, and four and a half inches wide at the base, laid on chairs. The substructure is made up of long leaf, untapped Florida pine, free from sap or defect of any kind, 5×9, seven feet long. The ties were laid two feet six inches apart from center to center, and under each joint we laid a special joint support of about thirty-six inches in length, of forty pound T rail reversed, properly supported by chairs. We have not yet operated this track with electric motors, but we thought when we laid it we would have a perfect track. I think, however, we have decided on something better, and we are now laying a ninety pound rail, nine inches in depth, five inches across the base, and we lay this on the same kind of ties. In addition, at each rail joint, we put in a 6×12 ins. seven feet long tie, thoroughly tamped and laid as well as it can be. At each joint of the rail we have plates twenty-six inches long, three-quarters inch thick, supported by two rows of bolts, four in each row; I think the size is an inch and a quarter. One thing referred to in Mr. Baumhoff's report I am doubtful about. The gentleman said in hot weather the joints may be laid close together; if not in warm weather there must be a space.

MR. LITTELL: There is nothing in that.

MR. RICHARDSON: That is my opinion; and that the best plan is to make a perfectly close and tight joint, with smooth ends to your rail, and bring it up as close as possible, and make it as nearly a continuous rail as possible.

MR. PAYNE: I want to ask if in the use of these deep rails you would not be governed somewhat by the question of paving?

MR. RICHARDSON: I have investigated that subject and find that paving with Belgian block, or granite paving, eight, nine or ten inches deep, is equally satisfactory to the people in New York and Brooklyn.

MR. HURT, of Atlanta: My experience has been that it is not the size or strength of the rail that you use; it is entirely the strength of the joint. In the construction I adopt, I endeavor to have no variation in the joints; I object to the difference of a thirty-second of an inch in the elevation of the ends of the rail. I think if you have weak joint in a rail, to magnify that weakness you should use a large rail; the stronger you make the rail, the weaker is the joint, because it throws the whole strain on the weak point. I lay track with seven inch deep rail, on stone bearings, and there is no weak point about the track, except where we break grade, and then we have a little difficulty about weak joints.

MR. LITTELL: My experience is that the best rail to lay is a deep rail, an eight inch rail without any chairs. Chairs are a delusion. We tamp with broken stone or gravel, as the case may be. If we are laying the track where there is gravel, we tamp with gravel; if there is no gravel there we use broken stone.

MR. PEARSON, of Boston: I think we have tried nearly every joint. Up to this time we have not found a joint which is perfectly satisfactory. The Johnson standard girder joint is the one which gives the most promise. We have not laid any of the deep rail, and consequently have not had any experience with it. We have, however, detected a fault which we think will be inherent in any girder rail laid on ties. The ties are cut into very rapidly by the rail. You will notice on steam roads in the winter, when the ground is too hard to admit of tamping, that they place wedges under the rails to hold them up till Spring, when they can be tamped. It seems to me that in the deep girder rail that same fault will arise by the constant pounding on the tie. The width of the flange on the rail has not sufficient surface on the tie to prevent that; and unless you put a broad plate, ten or twelve inches long, and six or eight inches wide on each tie, it seems to me that the deep girder construction will go to pieces the same as all the lighter rails. On the steam road you can get at the tie, but in the street railroad you cannot. I think that with the six inch girder rail, laid on a stringer with proper joint construction, Johnson joint or something similar, you get a good construction. In the stringer construction we get a large bearing surface; the rail bears its whole weight on the stringer, and there is not that cutting into the rail that we will find with the use of a nine inch rail. If you are going to use ten inch girder rail, you will want long fish plates, thirty-six inches long, two rows of bolts, say twelve bolts to a joint. Another fault in rails, which I do not think is looked into carefully in laying track, is the importance of a slight difference in the height of two rails abutting together. You get a sixteenth or even a thirty-second of an inch difference in the height of the two rails, and you will have a bad joint, no matter how good the fishplate may be.

MR. LITTELL: Especially with an eight wheel car.

MR. PEARSON: It does not seem to me that an eight wheel car will wear on the track more than a twenty foot car.

MR. HENRY, of Pittsburgh: I think that we have most of us been in error as to the construction of our trucks. I think that has nearly as much to do with the breaking down of our joints as anything else. I think we are all of us operating nearly the same kind of trucks. They are rigid on the axle boxes. Half of the weight of the motor and the whole weight of the truck goes down on the rail like a sledge hammer when an obstruction is met. We have got to find something that will take off that compression, that impact. It is like taking a weight of four or five tons and hammering it down on the rail. Every time you hit it, it goes lower. The sooner we come to understand this, the less trouble we will have. We are putting an elliptical spring on top of the axle box, and suspending the whole weight by this spring, so that the wheel box will work up and down as you come to a depression or elevation on the track. It allows the wheel to go up and down. I believe that the tracks have something to do with the rail joint.

MR. LAWLESS, of Paterson: I think the deep rail is what we require for electric cars. We have heard a good deal of discussion in reference to joints. I have found that a great deal of the trouble with the joints is due to the defective tamping of the joint tie. That is one of the main troubles with the joint. If you will use a good wide tie under your joint, put on your splice bars and tighten up your bolts with a wrench, tighten them as well as can be, you will find that the trouble with the joints will be considerably overcome.

MR. WHARTON, of Philadelphia: I wish to pay tribute to the complete and exhaustive paper which has been presented to us on this subject. As to the matter of rails,

we all know that if it were possible to use a T rail, nobody would use anything else; unfortunately, the railway companies are obliged to do what the local authorities direct. In regard to the joints, I think one point has been overlooked, and that is in the proper tightening up of the bolts, in forcing them home. After they have been once tightened up they should be removed, and the oxide or other matter which may have come there should be cleaned off, and the bolt put back and tightened up again. They should be again screwed up in about two or three months after, and the track would remain fairly permanent. On the steam roads they are continually tightening up their joints, and they have track walkers whose business it is to look after weak points and especially to tighten up the nuts. This is quite an easy matter with steam roads, but not so simple with street railroads.

Mr. A. L. Johnson, of Cleveland: My recommendation to any man laying a street railroad track is to put down at the joints extra large ties and ballast them in the best manner. The ballasting is what tells. The man who puts in an engine puts in a solid foundation. You can use all the heavy rails and heavy ties and heavy joint plates, and if the track is not properly ballasted, it will not stand. There is a road in St. Louis, which my brother is interested in, and which is managed by Mr. Minary, where the rail is seventy-eight pounds, laid on rock ballast. It has stood up for the past two years and is as good a track as any I have ever seen. In straight track I put the joints opposite each other; you can take better care of your track in that way. With curve rails it is better to divide the joints. The thing I think the most important of all for street railroad people to do is to ballast the track thoroughly; it will last longer.

Mr. Beckley, of Rochester: Three years ago last spring, the company with which I am connected commenced the construction of an electric road in Rochester. It was the first electric road in Rochester. It was a suburban road and constructed of forty pound T rail. That rail is in use to-day upon that road, and I venture to say that no gentleman who has occasion to ride upon the cars can count the joints. The T rail is the best where it can be used under the ordinances of the local authorities. We have heard a great deal about girder rails of eight, nine and ten inches in depth. I do not believe in that kind of construction at all. Our company in the past three years has constructed about 130 miles of track, on which we have been operating for nearly two years with electric cars. The reason why a T rail has been found to be the most satisfactory where it is in use is that it does not have a great depth. Take the T rail now being laid by the New York Central & Hudson River Railroad, and you will find that it has little depth. It has thickness; it has stability. My own judgment is that the best track which can be laid for electric traction is a track consisting of a rail weighing fifty-two to sixty pounds to the yard, say four and a half or five inches in depth, and where you have paved streets, giving the necessary space for your paving blocks. I would put them on stringers, vulcanized preferably, upon cross ties two and a half feet apart. The stringer, it seems to me, should be six inches in width. giving you an opportunity to place the paving stone without interfering in any way with the track construction. I have had a track constructed in this manner recently, and I am satisfied that that track will be standing up, doing its work, when a great deal of the track which has been spoken of to-night will be in process of repair. My own judgment is that a rail which is five and a half inches in depth is the proper rail to be laid where you have very heavy and frequent travel.

Mr. Ramsey, of Pittsburgh: I have not had the years of experience that some of you have had. I heard a civil engineer once say that if he was building an electric railway, or any kind of street railway, he would put under each joint tie two feet of concrete and surround it with stone, and he would have a permanent construction. He said he would recommend a better ballasting and a better foundation under the joint plate than under the rest of the track. A perfect joint is, of course, a joint that will not be noticeable when the cars pass over it and remain permanent. The plan of our company is to put exactly as good construction under the whole length of the rail as we put under each joint.

Mr. Baumhoff, of St. Louis: I believe it is customary in submitting a report of this kind for the committee to be put on the defensive—that is to say, to reply to the discussion. I am pleased to note, however, that after all the discussion that has taken place there have been only two exceptions taken to the report. The principal one seems to be on the question of what space should be allowed at the joint. I desire to say that, in submitting a report of this character, embracing as it does a territory with such wide variations in climate, it was my desire to be on the safe side. In St. Louis, where we laid upwards of two miles of rail of the seventy-eight pound pattern, we laid the ends of the rail as closely together as it was possible to get them. If I had the same rail to lay in that climate to-day I would do the same thing. I would not advocate that for a rail of less weight, or of shallower depth. To be on the safe side, I have suggested that rail, when laid in cold weather, should be laid with a joint to allow for expansion. In regard to the ballasting for the roadbed, I advocate that, before the tie is laid, as you will notice by the report, that not only should the soil be well rolled, but the ballast, after it has been placed, should also be well rolled. The character of the soil must be considered, and the method adapted to it. In a sandy soil I should not provide drainage; but in a yellow clay or more solid soil would do so. I am pleased with the reception the report received, and wherever a recommendation is made, I know you will consider that it is made with a view to perfect construction and not the haphazard.

Mr. Janney, of Philadelphia: In regard to bad joints, I think the trouble has principally been that you gentlemen trust too much to the fishplate. Some times the holes in the rails have been drilled a trifle larger than the bolts, and the bolts cut through. I have seen a half inch bolt cut half way through. This in many cases will account for bad joints. I do not see, nor can I believe, a ten inch rail is any better than a six inch rail. The nearer you get the head of your rail to the tie, the better track you have; that is conceded. If you get a seventy-eight or a sixty-six pound rail on a good chair, that would carry the weight of the rail and the car, you have just as good a track as with the use of a ten inch rail. We are to-day running a ten ton dummy over a sixty-six pound rail, and have been doing it for eighteen months in a street not paved, and subject to all conditions of weather.

Mr. Richardson: How often does the dummy pass over the track?

Mr Janney: About every five or seven minutes, and carries a trail car, with 100 to 150 people.

Mr. Payne, of Milwaukee: Of course, every city is governed by individual conditions, and the action of the Common Council. In our city we got special permit from the Council, and in streets not paved put down a rail five and a half inches high, weighing about fifty-six pounds. We have about twenty miles of that track, and it gives us exactly as good service, and we use it as frequently as where the street is paved and we have an eight inch rail weighing eighty-eight pounds to the yard. We run over some parts of it every two minutes with electric motors and it gives us just as good service in every respect.

Mr. Wason, of Cleveland: In order to get as nearly as possible a continuous rail, we made an experiment in the early part of the present year and put down about 1,000 ft. of track riveting the joints with red hot rivets and put in by boiler makers. The rails were placed end to end as close as we could get them, fifty-six pound rail spiked to the tie, and six red hot rivets put into each joint. The joints were first put together with bolts and then pulled home, and then one by one the bolts were taken out and replaced with red hot rivets. That was on one of our suburban lines. It is true that it does not have a large amount of traffic, but it was principally done to see whether the summer would have any effect in twisting it or throwing it out of line. It was put down in March, and it is just as straight now as when first put down.

The joints are absolutely imperceptible; and in my opinion, so long as you depend upon bolts, which are bound to work loose in time, the track will be in trouble. What the results will be with this track in the winter I do not know. The hot weather had no effect whatever on it.

MR. RICHARDSON: I do not think it is expected that there will be trouble with red hot rivets in hot weather; they are not likely to shrink then. I think, however, it is the experience on the elevated railroads and elsewhere, where they have done their riveting with red hot rivets, that when it comes to cold weather the rivets will get loose.

MR. PEARSON: It always seemed to me that in this way you might possibly get a good joint. I do not think we need fear anything from expansion. It is true that in certain elevated railroad work, where the joints were not proportioned properly, and the rivets have been pressed into place, when the structure had expanded they began to get loose. Another method of looking after joints, is by having joint boxes. We have tried joint boxes, not a great many of them, and we have some on hand; but we do not think we shall use them. Our experience has been that while you can take off the cover and get at the joint, as a rule when the bolt needs to be tightened up the tie needs to be retamped. In consequence of this, the joint box is of no particular use. We think it is easier to take up the pavement and tamp the tie and tighten up the joint plate.

The following gentlemen were appointed a committee to consider the question of a permanent industrial institute for the exhibition of all inventions and supplies relating to the street railway business: H. C. Payne, of Milwaukee; D. F. Longstreet, of Denver; O. T. Crosby, of Boston; Wm. Wharton, Jr., of Philadelphia; H. A. Everett, of Cleveland.

The report on "A Perfect Overhead Electric Construction" was then read, as printed on page 639.

On motion of Mr. Payne, the report was received and ordered to be spread upon the minutes.

Thursday Morning Session.

The president, John G. Holmes, having been called away by the receipt of a telegram, announcing the sudden illness of a relative, the first vice-president, Mr. Thomas H. McLean, of New York, presided.

The secretary announced the Committee on Nominations, as follows: W. W. Bean, St. Joseph, Mich.; Charles Cleminshaw, Troy; W. A. House, Baltimore; A. L. Johnson, Cleveland; J. E. Rugg, Pittsburgh; G. W. Baumhoff, St. Louis; and V. Cronyn, London.

The report of the Committee on "Economy of Electric Street Railway Machine Shops," was then received. (See page 640.)

MR. PAYNE: I hope this report will not go upon the records without discussion. I think every street railroad man recognizes the fact that in his machine shop lies the secret of the successful operation of the road, so far as producing results to the stockholders is concerned. There are a good many points that we are undecided about, I have no doubt, the question whether all repairs of the machine in all its details, the manufacture of parts, ought to be under the control of a master mechanic, with or without electrical knowledge. I know there is a difference of opinion on these points, and it is a matter that could be discussed with profit to the members. There is no doubt that practical results in the operation of an electric road come from economy in the machine shop.

MR. WARDWELL, of Duluth: The repair shop, if it is not properly cared for, will be the largest institution about your place. The repair shop may contain four times as much material and tools as are necessary. In a number of cities I have noticed that the motors are running without any covers, your gear cases are not on, your pinions exposed to the dust, and in some places where you have sharp sand flying about, and I warrant you your gears will last about half as long as in the cities where they have a soft soil. If you do not take care of your motors on the street, you can take the machine shop and make a fine organization out of it.

MR. LAWLESS, of Paterson: There is no question that a machine shop on a proper scale is desirable for a cable or an electric road. The trouble is that when it is once started it keeps growing. It is astonishing when you get a good mechanic or machinist how he likes to get in expensive tools and other equipment, and unless you watch him carefully, in a short time you will have a shop that will supply half a dozen roads. There are a good many things it is cheaper to buy than to make yourself. If you have a machine shop do not have it too expensive or elaborate; have it in accordance with the size of the road.

MR. RAMSEY: I agree with the gentleman as to drawing a line at certain points in making parts in your own shop. The results of our observation for the past three years confirm the views of the committee on this subject. We had nearly all the raw material finished for us for the first three months of our operation, but found that the cost was beyond our reach. This compelled us to put in planers and lathes and other machinery for finishing it completely, and we now get the raw material and finish it ourselves. There is a point where we draw the line, and that is a point where you will differ with me, and that is in the matter of gear cutting. We could not figure that there was any economy for us to do this for ourselves. A machine shop, such as may be found all over the country, where a number of men are employed, with a dozen or fifteen gear cutters, side by side, can do this work much cheaper than you can, with one man, to whom you pay good wages, with not more than half enough work. We cannot manufacture gear wheels as cheaply as we can buy them. The commutators used to cost us seventy-six dollars three years ago; we produce exactly the same commutator now for nineteen dollars. This relative reduction in the cost of parts applies to nearly everything in connection with our motors. I suppose, however, that this experience is familiar to most of you gentlemen.

MR. WASON: I think there is one point outside of the machine shop that should be taken into consideration in the repairs of motors, namely, the pits in which you do your work, the manner of handling the motors to facilitate putting them on and taking them off. The number and length of the pits should, of course, be in proportion to the number of cars you operate. There is such a thing as having a pit too long; for it will generally be found that the car which requires only simple repairs, and which is first needed, is invariably the last one on the line, and the others must be first moved. In our shops the pits are so arranged that you can put four cars over them, but three are all we take over each pit. We have a hydraulic lift underneath the car, running on the track, which we have found very serviceable; and when I tell you that we have taken off two motors and put on two, and had the car running out in thirty minutes, you will be sure it is a handy pit. We have taken an armature out and put one in, and had the car running on the road, in five minutes. The facility of handling your cars in your pit will greatly help the men, and I think it as essential as a complete machine shop.

I think our machine shop comprises about the number of tools that the report suggested. We have ninety motor cars, and I do not think we have any superfluous machines. I am sure that we have more than paid for all our machinery, in the saving over what we would have had to pay to have the work done, especially taking into consideration the saving in the matter of cartage. I am confident that taking the motors from underneath the car rather than raising the car bodies up is preferable. We have found this system very advantageous and complete. We have a thirty-five horse power, Sprague stationary motor for generating the power that we put in three years ago, and have not had any trouble with it. We are not doing more than ten or twelve horse power work with it, but we start it and stop it, and put a little oil on it once a month, and that is all it requires. It is run from the street railroad circuit. I think it will run very many years without any trouble.

MR. BAUMHOFF, of St. Louis: Several years ago I

made an inspection of the various machine shops and other departments of electric railroads; and among others visited the shops of Mr. Wason's company, and I advise you all to take this opportunity of going there. We do a great deal of manufacturing, but we sometimes find it more profitable to buy of the numerous supply dealers. When we first started in about three years ago we found the prices for the various materials connected with electric railways so high, that for our own protection we were compelled to inaugurate a machine shop system. In doing so we found it profitable to press on our own wheels. We also found it profitable to manufacture our commutators and to cut our pinions and gears, and in the matter of gears it is not so much a question of the cost of the cutting as the quality of metal used. Our shops are operated by the same style of motor as Mr. Wason described

Mr. McCulloch, of St. Louis: My remarks apply more to cable road machine shops. Some years ago we began to establish a machine shop in a small way, and in a little time we had all the implements and tools for doing our own repair work. It worked very well, until, being very much engrossed in other matters, I personally neglected the machine shop for some little time. It began to grow to such proportions that it was about the biggest part of the establishment. There were very expensive men in it, and they seemed to be turning out very little work. I remonstrated with the master mechanic, but it did very little good. I finally discharged the master mechanic, and closed up the shop, and re-opened it on a new basis, and since then it has operated very well. It has been very profitable and very satisfactory; but you must watch it closely. Without this watchfulness, it will become a great burden.

On motion of Mr. Wm. Richardson, a resolution was passed condoling with President Holmes, in the bereavement he had sustained in the death of his father-in-law.

The report of the Committee on the "Relative Cost of Operating Horse, Cable and Electric Roads," as printed on page 642, was then read.

Mr. Baldwin, of Cincinnati, presented the following letter, giving the comparative cost of operating cable and electric roads in Cincinnati:

Cincinnati, October 17, 1892.

The American Street Railway Association.

Gentlemen:—There have been a great many statements made at various times, which give a detailed account of the "actual" (?) cost of operating a large electric railway, the statements being made with a view to show "how much cheaper it is to operate an electric road over the cost of operating a cable or horse system."

The experience of our company (The Cincinnati Street Railway Co.) leads us to think that there is a "screw loose" somewhere, and just where, we don't know. Our "operating expenses" do not agree with those published, nor does the cost of repairs, attention, etc., correspond. In making up these statements for "publication," much must have been "forgotten," or "overlooked," or else other cities are being favored with "skilled labor," supplies, etc., at much lower figures than we find it possible to obtain them, or else the surrounding conditions are such that they do not have the number of breakdowns, burnouts, wear, etc. that we have.

Agents from various "supply companies" have called upon us and agreed to furnish material that will do "thus and so," but upon trial it does not come up to the guarantees. Where is the trouble? Is our company the only one that finds the expense of operating an "electric road" so much more than it was "calculated" to be, taking the published statements, or the agents' word as a basis of calculation?

Take for example our cable road with about sixty cars in service; it requires only six men in the repair shop to keep these in first class order. Then look at the number of expensive men that are necessary to keep up the repairs in our electric road repair shops. Armature and field winders, lathe hands, vise hands, planer hands, men to operate drill presses, gear cutters, presses, etc., which number as high as eighteen men to keep up the same number of cars. Then the attention and care of the motor cars. It requires more than double the number of men to clean motors and make the usual repairs to electrical apparatus; most of these men are "high" priced men in place of being ordinary laborers, so that when "cost of this labor" is taken into account it is found to be fully three times that necessary to keep the cable cars in good order. In operating an electric road, especially in heavy rain or snow storms, it is impossible to maintain the same regular service that is possible upon a cable system. As to "actual cost per car mile," we find that operating the cable road is far cheaper than operating electric cars over a similar route.

We think that it would be a great assistance and of great value to every Member of the American Street Railway Association to have the question of *cost* sifted down to what is actually the case, the "actual cost" of operating various roads all over the country. The items can be reduced to such terms that it will be an easy task, for the different members to fill in the items of cost for operating, repairs, etc., per day, and the number of miles run per day, also number of passengers carried per day, so that all can be reduced to cost per car mile; in this manner we would have a table, "generated" by a large number of roads, from all parts of the country, showing cost per car mile, as follows:

Cost per mile to carry a passenger.
Cost per car mile, for repairs.
Cost per car mile, generating station expense.
Cost per car mile, attendance and cleaning.
Cost per car mile, line repairs.
Life of gear in car miles, etc., etc.

Also length of road, average grades, speed of cars and other data by which the various "costs" can be compared.

In view of the foregoing, we would suggest that a committee be appointed with power to act, who will have such printed forms prepared, that will be sent to each member of the Association, asking them to fill in the "blanks," as accurately as possible, and return the same to the committee, who will embody the results in a report, which can be one of the "special subjects" for our next annual meeting.

Cincinnati Street Railway Co., and
Mt. Adams & Eden Park Inclined Railway.
Bert. L. Baldwin, M. E.

SUGGESTED FORM OF BLANK FOR COMPANY OPERATING AN ELECTRIC ROAD.

(similar blank would be required for cable roads.)

Name of Company.....
City of.....
State of.....

Total length of road in miles.....

Total amount and average per cent of grades.....

Name of System in use.....

Number and arrangement of trolley wires { Double trolley..... / Single trolley..... / or Underground.....

System of return wiring.....
Make and type of motors.....
No. motors to each car.....
Length of cars used.....
No. cars run singly..... No. cars run in train.....
Style running gear used.....
.....

Power House:

Number, size and make of engines.....
.....
Number, size and make of boilers.....
.....
Style of furnaces used.....
.....
Kind, quality and cost per ton of coal burned.....
.....

Number of men at power plant:

Engineers.... Firemen.... Dynamomen....
Switchboardmen.... Cleaners.... Helpers....

"A" Cost per car mile for all station expenses, including wages, fuel, oil, waste, water, repairs on machinery, interest, insurance, taxes, etc.....

Repair Work:

Do you perform the following class of work at your own repair shop?

General Repairs.
Wind armatures..... Wind field coils.....
Repair rheostats..... Controllers.....
Motor switches..... Lightning arresters.....
Trolley poles..... Wheels..... Details.....
Cut pinions..... Gear wheels.....
Make motor brasses..... Shafts..... Axles.....

What material do you find best for your gears?

Material in Gears.	Armature pinions	
	Intermediate pinions	
	Intermediate gear	
	Axle gear	
Life of Gears.	Armature pinion,	in car miles
	Intermediate pinion,	" "
	Intermediate gear,	" "
	Axle gear,	" "
Cost of Gears.	Armature pinion,	cost per car mile
	Intermediate pinion,	" " "
	Intermediate gear,	" " "
	Axle gear,	" " "
Cost of Repairs to Electrical Apparatus on Cars.	Armatures	cost per car mile
	Fields	" " "
	Rheostats	" " "
	Controllers	" " "
	Motor and reverse switches	" " "
	Lamps and wiring of car	" " "
	Trolley poles, wheel, bases, etc.,	" " "
Life of Running Gears.	Average life of:	
	Car wheels	in car miles
	Brake shoes	" "
	Axles	" "
	Brasses	" "
	Pedestals and springs,	" "

"B" Cost per car mile for repairs upon electric cars, including all labor connected with the cleaning and repairing of same, and material used.....

"C" Cost per car mile for all other expenses not named in the foregoing: Office expenses, salaries to officers, receivers, conductors, motormen, linemen, barnmen, trackmen, switchboys, taxes, insurance and interest upon property and equipment, legal expenses, etc., etc.....

"D" Average number of passengers carried per car mile.....

Then by adding together all station expenses "A," cost of repairs "B," and office and miscellaneous expenses "C," we would have cost to operate an electric car, one car mile, which equals .....

And cost to carry a passenger one car mile, which equals.....

The recommendation was referred to the Executive Committee.

MR. RAMSEY, of Pittsburgh: I would say, in answer to the gentleman who has just spoken, that he is in line with our committee in the position which he takes. The committee, in their investigation, came across several cases similar to his own. Outside of a personal investigation of the subject, there is no better way to get at the matter than by the appointment of a committee such as he has suggested. I might argue in support of the report presented this morning for a long time, but I will spare you. The report was presented to the second largest cable railroad in this country for a preliminary reading, and it was returned with the statement that "our views on this important subject are fully expressed in the attitude which our board has taken in regard to further extensions of some thirty miles of electric railroad, which we are about to build."

MR. LAWLESS, of Paterson: I had the honor to be connected with one of the first cable lines built in this country, and have been connected with the construction of a number. I was always a strong advocate of the cable and still am, in its proper sphere. The cable railroad sphere is limited; but in that sphere it holds its own. There are some districts where, I claim, cable railroads can be operated more economically than any electric railroad.

As regards car mileage, I find that some roads have made wonderful results in the operating expenses per car mile. In those districts where the electric cars are run into sparsely settled sections the results are better than cars run in thickly populated portions. Where you can run at the rate of about twenty miles an hour you can make about 130 miles per day; but in the heart of the city you can only make from eighty-five to ninety. If you pay the same wages per day, the results are better in the former case, so that it is pretty hard to get at accurate figures in that respect. The results were rather in favor of cable lines three or four years ago; but since the single reduction motors have come in, and the cost of repairs has come down, in thickly populated sections, even, the electric line is going to press the cable pretty hard. We have no reason to expect that we have come to the end of improvements in the motors, and as these progress, the conditions will be increasingly in favor of electric traction.

The Committee on Formulating Standard System of Accounting Forms for Statistical Information reported that the work had been too considerable for them to accomplish it, and recommended the employment by the Association of a statistical clerk to compile such information as might be necessary.

On motion of Mr. Lang, of Toledo, the question of appointing this clerk was referred to the Executive Committee.

An invitation from the Walker Manufacturing Co., of Cleveland, to visit their works at ten o'clock Friday morning, and partake luncheon, the guests to be conveyed in carriages to the works, was read and on motion accepted.

The Convention then took a recess.

Thursday Afternoon Session.

It was announced that the Worcester, Leceister & Spencer Street Railway Co., of Worcester, Mass., had joined the Association.

The first business was announced to be the report of the Committee on Standards.

Mr. Crosby, the chairman of the committee, said that it was scarcely expected that the report would be discussed. It was important, however, that some attention should be given to the subject of the rating of the motors. As stated in the report, it was the most difficult, and at the same time one of the most important, matters to be determined. He hoped that some expression would be given concerning the two methods proposed in the report. He was exceedingly anxious to have the matter determined, and hoped the Association would give expression in favor of one of the methods.

The report was then read. (See page 645).

MR. HOLMES, of New York: I desire to thank Mr. Crosby for the persistent manner in which he has been hammering this matter of standardising motors into us. This matter of rating motors is in my opinion a very important one. The manufacturers of dynamos for electric light stations have been accustomed to rate them according to the number of lamps they will burn in candle power. One company will say, here is a machine that will develop 400 incandescent candle power lights; another company says, here is a machine which will also develop 400 incandescent lights; but the difference between the two machines is the difference between six and five. Now, gentlemen, if we can standardize our motors as dynamos ought to have been, we shall not be subjected to confusion by overheating generators by subjecting them to greater duty than they are supposed to perform. I, therefore, offer the following resolution:

Resolved: That it is the sense of this Convention that the standard rating of railway motors shall be the horizontal pull which the motor can exert when running the car at ten (10) miles per hour with thirty-three (33) inch wheels, and that when so running the temperature of the motor shall not be raised more than sixty-five (65) degrees Centigrade above surrounding atmosphere after a ten (10) hour run.

The resolution was adopted.

The recommendation in the report of the employment of a statistical clerk was referred to the Executive Committee.

On motion, the Executive Committee was empowered to appoint another Committee on Standards.

The Committee on Nominations then reported the following names of gentlemen nominated for the officers of the Association for the ensuing year: President, D. F. Longstreet, Denver, Colo.; first vice-president, A. Everett, Cleveland, O.; second vice-president, Joel Hurt, Atlanta, Ga.; third vice-president, W. Worth Bean, St.

Joseph, Mich.; secretary and treasurer, W. J. Richardson, Brooklyn, N. Y. Executive Committee, John G. Holmes, Pittsburg, Pa.; J. D. Crimmins, New York City; T. J. Minary, Louisville, Ky.; J. R. Chapman, Grand Rapids, Mich.; B. E. Charlton, Hamilton, Ont.

These officers were elected.

Messrs. Watson, of Buffalo, and Martin, of Cincinnati, were appointed a committee to escort the newly elected president to the chair. Mr. Longstreet fittingly acknowledged the compliment paid him in his election, and expressed the hope that he would meet all in attendance at this meeting at the convention to be held in Milwaukee next year, and the year following in Denver.

Mr. F. M. Eppley, of Orange, called the attention of the delegates to the merits of a new fender and ground brake as a safety device, a model of which he presented. This device was illustrated in our last number.

The secretary reported that the Executive Committee had considered the matter of the formation of a supply dealers' association in connection with the American Street Railway Association; and that in the judgment of the committee they could see no necessity for the formation of such an association at this time.

A communication was presented from the Massachusetts Street Railway Association relative to the subject of the provision of proper interacting signals at crossings of steam and electric railroads, as follows:

Boston, Mass., October 17, 1892.

To the American Street Railway Association.

Gentlemen:—At a recent meeting of the Massachusetts Street Railway Association, the subject of crossings at grade by street and steam railroads was discussed with considerable fullness. It was decided to present the matter for the consideration of your body, it being deemed of sufficient importance to warrant a broader and more comprehensive discussion. The undersigned, therefore, a special committee appointed by the Massachusetts Association for the purpose, beg with your kind attention to submit the following remarks:

Among the most serious of the cares and anxieties which surround the establishment and management of an electric road, the grade crossing must be named. As law and custom now stand, there is an entirely unjust discrimination against the electric line. We have passed the stage where the necessity of electric roads is questioned by the community; it is now universally recognized; and yet there remains this relic of the struggling experimental era, the favoring of the steam, to the detriment of the electric railway.

From various reliable sources it has been computed that the street railroads of the United States carry many more passengers than the steam roads. In the state of Massachusetts, for example, the Railroad Commissioner's Report for 1892, shows that 107,271,842 passengers were carried on the latter as against 176,090,189 conveyed by the street roads. And yet, despite this showing, there remains among the Public Statutes of Massachusetts, the following:

Chap. cxii. Sec. 40. A street railway company whose tracks cross the tracks of a steam railroad shall make the crossing in such a manner as to injure as little as possible such tracks; and shall not insert frogs therein, or make incisions into the rails thereof, without the consent of the directors of such road.

As custom goes, the steam road possesses a right of way superior to that of the highway. Their cars travel at very high rates of speed, and absolutely no notice of the highway traffic is taken, save to block it by a slender gate at such times as they wish to exercise their autocratic privilege. But it must be borne in mind that it is the public who are traveling on the highway as well as on the train; that that public, whether as passengers in street cars, drivers of other vehicles, or simple pedestrians, may properly demand that their safety and convenience be consulted with as great solicitude under those circumstances as when they use the steam road; they have a right to demand, and they do demand, that grade crossings, where the interests of the two classes conflict, should be rendered as safe and convenient *for both* as human ingenuity can devise means for doing.

Recognizing these facts, it seems eminently proper that the law should establish a uniform regulation for grade crossings which shall be fair to both parties. The points of conflict are not so numerous nor so deep as might be imagined, but unfortunately it has become the attitude of steam railroad companies to stand aloof from negotiation; upholding their strict and technical rights under the laws, they refuse even such adjustment of difficulties as could be made without cost or inconvenience to themselves; and by this course they imperil the lives, not only of the passengers upon street railroad cars, but of highway travelers in general.

To show how closely this subject concerns the electric railway industries of the United States, we have estimated that fully 75 per cent. of the electric roads in this country have one or more grade crossings with a steam road on their lines. These are a menace not only to the safety of their passengers, but in many cases to the road's financial success. Investors often regard the possibility of accidents at these crossings (entailing the payment of ruinously large sums as damages) as so great that no reliability can be placed on the net earnings; and, declining to lend their funds to the promotion of such a road, an otherwise promising enterprise fails. In view of these considerations, it has seemed good to the Massachusetts Association, to suggest to your body the following action, namely:

That a circular letter be sent, not only to every electric railway company in the United States, but to the Board of Railroad Commissioners in each state, or to that authority under whose jurisdiction the operation of railway comes, recommending the passage by each state legislature of regulations upon this important subject, on the following lines:

First, that whenever a grade crossing is necessary, between a steam railroad and an electric or other street railway, the details of construction at such crossing be arranged, if possible, by agreement between the respective parties. In case such arrangement cannot be reached, the matter to be referred to, and decided by, the railroad commissioners of the state, or other proper authority after due hearing.

Second, that in general, the treads of the respective rails be at the same level; that the rails of *both* lines be grooved or notched, in such a manner as to be suitable for the passage of the flanges of the wheels of each kind of car, and as not to afford a smoother crossing to one than to the other.

Third, that the cost of such crossing be apportioned between respective companies, and the cost of maintenance and repair be borne by both companies, in proportion to the number of tracks which each has laid at said crossing. There is ample reason for making the steam road pay a part of the expense of the crossing even when the steam road pre-exists. The establishing of the crossing is for the purpose of perfecting the use of the street and making it better adapted for the purpose for which it was constructed, namely, for public travel, in all ways, whether such travel is by foot passengers, persons in carriages, or people in street cars.

Fourth, that the railroad commissioners, or other proper authority, be empowered to approve or condemn any construction at such crossings, and to require that the same be made to subserve the safety and convenience of both lines equally; also to require from both lines the adoption and installation of whatever protecting devices they decide to be appropriate, including some form of automatic signaling device to be operated in connection with the gates as at present maintained, so as to show, at least 1,000 ft. distant upon the steam railroad tracks, a danger signal when and so long as the crossing is open for the passage of vehicles upon the highway. That at crossings embracing a large number of tracks, or where dangerous conditions are otherwise multiplied, automatic interacting signals between the two roads be required, so that the presence at the cros ing of either class of cars shall be shown in advance to the other. All of which is respectfully submitted. Yours very truly,

Geo. W. Mansfield,
Chas. S. Sergeant,
E. P. Shaw,
Committee.

On motion, the matter was referred to the Executive Committee.

A letter was read from Mr. E. G. Connette, of Nashville, Tenn., chairman of the Committee on Power House Engines, stating that owing to the slowness with which replies had been received to the circular letter of the committee requesting information, their report was not ready; but it would be put in shape and circulated among the members later.

The convention then took a recess until Friday morning.

Friday Morning Session.

On motion of Mr. McLean, the paper on "Experiments on the Expansion of Continuous Rails," as printed on page 650, was read by its title only.

On motion of Mr. Watson, the paper on "Is a Standard Rail Head Possible?" was read by its title only. See page 654.

Mr. Cronyn, of London, Can., offered the following:

Resolved: That the American Street Railway Association sends greeting to the tramway managers and officers of European and foreign countries, and most cordially invites them to attend the 12th annual meeting of this Association, to be held in Milwaukee, Wis., U. S. A., in 1893, during the World's Columbian Exposition.

Resolved: That the secretary take such measures as in his judgment may seem necessary to carry out the above.

The resolution was adopted.

Mr. McLean moved that the secretary be authorized to express to the Short Electric Railway Co. the appreciation of the Association of the courtesies shown by that company to the delegates in attendance at the meeting.

A vote of thanks was passed to the different traffic associations for their courtesy in granting reduced rates to the gentlemen in attendance at the meeting.

The Association then adjourned to meet in Milwaukee, Wis., the third Wednesday in October, 1893.

The Banquet.

This was the crowning event of the meeting, and was served in the large dining hall of the Hollenden, the occasion being enlivened by some music from an orchestra stationed in the balcony. Four tables were arranged parallel, extending the long way of the room, and were profusely decorated with cut flowers and growing plants, but there was only one floral piece, and this represented a fully equipped electrical car. There were no wall decorations, for the reason that the elegant finish of the room could not be improved by floral decorations.

The 300 and more guests being in place, grace was said by the Rev. Dr. Sprecher, when all were seated and partook of an elaborate and generous banquet as per the the following menu :

MENU.

BLUE POINTS.

Celery.

CLEAR GREEN TURTLE, VICTORIA.

Sherry. Olives. Salted Almonds.

LOBSTER, A LA NEWBURG.

Sauterne. BOILED SALMON, SAUCE VERTE.

Cucumbers. Dauphine Potatoes.

FILET OF BEEF, A LA MONTGLAS.

Pontet Canet. Sweet Potato Croquettes.

SWEETBREADS GLACE, JARDINIERE,

French Peas.

Cigarettes. FROZEN EGG NOGG.

Moet & Chandon. "Brut Imperial." BREAST OF PRAIRIE CHICKEN WITH TRUFFLES.

Saratoga Chips.

DRESSED LETTUCE.

NEAPOLITAN ICE CREAM. CAKE.

ASSORTED FRUIT.

WATER CRACKERS. EDAM CHEESE.

Brandy. Cigars. COFFEE.

MUSICAL PROGRAM.

1.—MARCH, "Welcome to All, ... *Zimmermann.*

2.—OVERTURE, "Raymond," . . . . *Amb. Thomas.*

3.—SELECTIONS from "Bohemian Girl," . . . . *Balfe.*

4.—WALTZ MOVEMENT, "Loin du Bal," . . . *Gillet.*

5.—PATROL, "American," . . . . . *Meacham.*

6.—POLKA, "Bei Kroll," . . . . . *Fink.*

7.—OVERTURE, "Martha," . . . . . *Flotow.*

8.—SPANISH FANTASIA . . . . . *Miund.*

9.—SELECTIONS from "Wang," . . . . . *Boethger.*

10.—CAPRICE, "The First Heart Throbs," . . . *Eilenberg.*

11.—SELECTIONS from "Erminie," . . . . *Jakobowsky.*

12.—MEDLEY—"Plantation Echoes," . . . . . *Ross.*

Thomas H. McLean, first vice-president, presided and acted as toastmaster in the place of President Holmes who had been called home by a sudden bereavement, and about eleven o'clock introduced the intellectual part of the evening, first calling upon the audience to rise and sing the national hymn, when the toasts and speakers were announced in the following order :

"SOME PHASES OF THE LEGAL LIABILITIES OF STREET RAILROAD COMPANIES."

BY HON. ANDREW SQUIRE.

Mr. Toastmaster, Ladies and Gentlemen :—I am sorry in some regards that the order of toasts has been changed. However, I can assure you that General Meyer is here and will respond in a few minutes to his toast, "The City of Cleveland." It is needless for me to say that I am pleased to meet with you to-night, and to say to you that I realize that in an association of this character there is gathered together at this time in the city of Cleveland as representative a body of busy, active, intelligent business men as this country affords. Of all the revolutions of this decade, I know of none that is attracting to it more attention, more brains, more capital, more activity, and more usefulness than the evolution in the street railroad system of the country. (Applause.) The putting on of cable cars ; the adoption of electricity ; the laying of solid, substantial track ; the introduction of cars of the latest and most approved patterns, convenient for the people ; the amount of capital it is taking to do this, and the rapidity with which it is being done, is something in itself astonishing. You, gentlemen, are all of you familiar with it. It is to you an every day occurence ; but to the man outside of the street railway business, if he will stop to consider it, it is something wonderful.

You gather here in this city in the interest of this progress ; you gather here to discuss how you can make the most of it, how you can make the greatest success of what you are undertaking ; to compare notes, to look forward to the future of your properties, each realizing that anything that the other company has that is better, that is more convenient, that is less expensive, that is a greater commercial success, may be worthy your attention and, perhaps, your adoption. I understand such to be, in a measure, the object of your Association. Now, having had some connection, for the past two years, with street railroads in this city, I approach the subject from a different angle, and I ask of you to pause in this construction, to pause in this development, and give heed, and give thought, along with all of the other things that are engrossing your attention, to the legal liabilities of street railroad companies. They are growing, as you are adopting more rapid locomotion, as you are crowding into the densely populated streets of the city, with instrumentalities which are dangerous. You are imposing upon the public greater duties, upon the private citizen greater care and greater caution, and at the same time you are imposing upon yourselves conditions which require the exercise of greater caution on your part ; and it behooves you, while considering the commercial phases, to consider also your legal liabilities.

I know there are the chronic grumblers ; I know you come in contact every day with thousands of people hard to please ; I know you are condemned for doing this and for not doing that. I believe I know something of the trials of a street railroad manager ; at the same time it is a sort of burden that you have taken upon yourselves. You must meet it patiently, considerately, and be thoroughly careful of your employes and of the public, providing the best possible equipment that you can, and the greatest possible safeguards to protect the lives of the passengers that you carry and the people upon the street, and even of the boys, no matter how annoying they may be, who seek to steal rides on your trains. I know they may be trespassers, but human life is dear to every one of us. I know they may have few rights, but caution on the part of motormen, on the part of gripmen, on the part of drivers, on the part of conductors, is one of the first lessons to be instilled. Accidents will happen, enough of them ; but that does not take from you the duty of being as careful, as painstaking, as thoroughgoing as you can. I know that steam railroads have their claim agents that meet every year of late, and discuss from their standpoint how accidents can best be avoided. I know that while you are discussing what you will do to make your companies commercially a success, that you will soon, and you cannot too soon, find it one of your duties to discuss how to make the roads safest, how to inflict the least injury upon the public and your passengers. It all comes back to the pecuniary standpoint in the end, because, unless you are safe, unless you do this, the public will make itself felt by reaching for the pocket of the street railroad company ; so from a commercial standpoint, as well as from a humane standpoint, it is a duty, it is an obligation, to be forgotten at no time.

Within the past few years, comparatively few, insurance societies, that are successful in many respects, are undertaking to insure street railroad companies against their liabilities. I will not stop to discuss whether this is likely to succeed or not to succeed. In this I am sure you will bear me out, that your observation will run along with mine, that they started in to do it too cheaply. No man can afford to have an article, no matter what it is, at less than cost, and you who are paying attention to this matter already know that in the last year, and especially in the last six months, many of these societies have realized

that they are doing it too cheaply, and are putting up the rates. It may be arranged on a basis profitable to the street railroad companies, in a pecuniary sense ; but one thing is certain, it will never be successful if it undertakes to relieve you, in a sense, of your responsibility. It must go hand in hand with the railroad company. The public must never come to feel that an insurance company stands between the railroad company and the public in such a way as to relieve the railroad company from its responsibility. Whenever the insurance company lends its aid, and inspects your machinery, inspects everything, and helps, and is an assistant, in caring for the public and the employe, in caring for the passenger, then it will be welcome, but not before that. It should simply be an assistant ; and the employers or the owners of street railroad companies, those who have invested their capital, must never feel in any sense relieved from their responsibility. They must use all caution and all care , and in doing this, they may reach out for any and every assistance that they can.

I have mentioned these matters, because I am compelled to look at these things from the legal side ; and I believe, understand them, perhaps, better than the man who is actively engaged in the commercial success of the railroad company. I can feel the public pulse and understand what it is. I know the matter has only to be drawn to your attention; perhaps it is unnecessary even to do that, to insure its careful consideration at your hands. I hope, and am satisfied it will be received in the sense and in the way in which it is intended ; and being thus received I am satisfied that it cannot result in harm, but that it will do good to call your attention to these things as subjects worthy of your discussion, that are worthy of your united action.

"THE CITY OF CLEVELAND."

By Gen. Edward S. Meyer.

Ladies and Gentlemen :—I esteem it a great pleasure, indeed, and no less an honor, to look into the faces of this representative body of men and women—men who are to-day transforming the methods of intercommunication almost to the point of a revolution. I stand in awe of the men to whose efforts, to whose intelligence, is due the exhibition that it was my pleasure to witness to-day. Be not deceived, the American people appreciate what you are doing (applause), and no community more so than this goodly city of Cleveland.

In this era of rapidly developing great cities, it is no light task to present, in an interesting manner, the merits of any one of them ; and yet we who live here, and have witnessed the growth and development of our city, are proud to be citizens of it. Cleveland was incorporated as a city in 1835, with less than twelve hundred inhabitants, a struggling, straggling community, but made up of great men and noble women. In the few years that have elapsed—it seems but a very few years since that time—its population has increased to nearly three hundred thousand souls. Situated as it is, midway between the exhaustless fields of ore to the north and magnificent and only partially developed tracts of coal, such as no other nation possesses, to the south, with fourteen railroads centering here, four of them parts of as many transcontinental systems, which, in their turn, bring into our markets not only the coal and the ores, but the wealth of one of the greatest agricultural States as well, whose magnificent harvests roll into the lap of this city, to make up its grandeur and its wealth. So in this short time all this has happened ; and as you look about, as you hear the hum of its thousands of industrial establishments, as you see mast upon mast in its harbor, as you see the puffing and steaming of the many railroad trains that are moving continuously, and you witness all the progress, all the business development, and view the endless stretch of magnificent homes, bear in mind that all this is the product of a single generation. We have two thousand and sixty-five manufacturing establishments, employing nearly sixty thousand mechanics and laborers, giving out over thirty-three million dollars in pay per annum, sending over these magnificent waters a home fleet of over three hundred vessels, with a tonnage of one hundred and seventy-one thousand tons, and our magnificent ship-yards, second to none on earth, turning out in the year 1889-90 no less of a tonnage than seventy-one thousand tons, thus wresting from proud Philadelphia the crowning glory of her prominence as the first ship city in America. Not only that, but, in addition thereto, our city, standing like a young giant amid the forests of her own masts, boldly confronts Clyde across the sea in a no longer unequal contest for the supremacy of the modern world. This is the great glory of our goodly city.

We hear now and then a croaker who sees in all this development a tendency of going toward damnation ; but they are 'most all dead, and the rest of them are erecting monuments to their own memory. So rapid has been the march of this progress here in Cleveland, that even to-day we find it necessary to put a tight board fence around the statues of departed heroes, lest they should leave their pedestals and join the procession as we march along. (Laughter and applause.) Do not be mistaken ; that enclosure on the square is not, as the New York *World* intimates, a cemetery for the victims of this "deadly trolley."

But that is not all. We have here a set of master minds at the head of the railroad interests. They have kept abreast with the rapid strides made in the development of our greatest interests, until they have to-day equipped and in operation — and I say it without a moment's hesitation—the best line of street railways in America. Notwithstanding this, we growl at them ; we find fault because they lengthen our right arms entirely out of proportion to our left, by compelling us to hang on to a strap in their cars. Of course, we know that we can manage their roads much better than they can ; but, nevertheless, we get along reasonably well with them. They have not only a local mileage of one hundred and thirty-three miles of roadway, but beyond the city limits a mileage so great that one of their master minds, unequalled in the street railroad business in America, has ridden upon his own line clear into a seat in Congress. There, strange as it may seem, the chosen representative of this goodly community, he boldly advocates, as fearlessly as he does everything else, free trade and the single tax, as the representative of sixty-four million dollars invested in protected industries here. (Applause.) In the meantime he leaves his jolly, genial, big brother at home, at the old stand, marketing the municipal chestnuts at five cents apiece. Be assured, ladies and gentlemen, that only through a profound regard for his innate and well known modesty, I hesitate to mention the name of our genial Tom.

We have another master mind in the street railroad business, who is a master of hospitality as well, and who, adding to the responsibilities of the presidency of a great line, the duties of a bank president and the director of a score of railroad and manufacturing establishments, occasionally finds time to turn to politics as a matter of diversion and recreation, making, and occasionally unmaking, legislatures, governors and senators ; and having achieved such great influence and power that every member of the Common Council makes obeisance, with his hat under his arm, whenever he passes him on the street ; and shrewd politicians, basking in the sunshine of his favor, do not hesitate to make genuflexion of the knee, that thrift may follow him. Keep your glasses upon current events, for you will find that his latest gubernatorial protégé, and the most able and honorable of them all, will be landed by this gentleman in the White House four years hence.

Again, the young men of your fraternity are not behind in this spirit of enterprise. They have occasionally, for matter of recreation, slipped across the border, and singularly enough have seized the choicest tree in all the Canadian garden, gathering the luscious, seedless fruit, while our English cousins are discussing their breakfast chop. Give the boys a chance. They will not only land that tree itself over here, but in due time they will shift the border; and carry with it as well the tricolor of our fathers.

But one would think, from what I have said to night, that grandeur and fame had only been acquired by street railroad men ; that is not the case. We have other interests, but I cannot enumerate them to night. There are other gentlemen to follow me, and to whom you will pay due deference when they make their appearance; but in all the industries everywhere, from the peanut stand to the great transportation lines, you will find master men doing master service. Why, our chewing gum itself is renowned the country over. Its proprietors have ornamented the highways and byways of the country with all the colors of the rainbow, in setting forth its merits. It has given jaws of iron and stomachs of brass to the rising generation. It is the champion of muscular development; and not content with this it now boldly marches up the Capitol steps of the nation demanding admission as the herald of a new era in American statesmanship. All this has come from Cleveland. It rides in magnificent yachts, it has a double mile race course, and dispenses an hospitality heretofore almost unknown.

But I must not tire you. Leaving merriment, let me say to you, that Cleveland to-day is trying, at least in a crude and, perhaps, unsatisfactory manner, to assist in solving the greatest problem that has yet confronted the American people ; that is, the proper government of these great cities. For the first time in the history of America, the epoch of great cities is upon us, and the future of this Republic—its future progress, its advance to the highest and grandest civilization—depends more largely upon the proper solution of this problem than anything else we have ever had to deal with. Ours is a cosmopolitan nation, and each city is in itself cosmopolitan, made up of a population gathered from every quarter of the earth, from the vine clad hills of Germany, from the steppes of Russia, from the vales and sunny valleys of France and Italy, from beyond the Andes, have come to us to help build up our institutions, if we wisely dissipate, absorb and assimilate them. If not, they become a menace to our institutions. Let us not in this or any other city, shove them apart into communities and clans by themselves, but make the best of it ; extend to them a warm helping hand and point out to them the beauties of our country, the glory of our institutions, and the great immunities and prerogatives of American citizenship. If we do this, we have nothing to fear in the future. When we who are here to-day shall have laid bown the burden and the armor, let us feel that

> Here on Erie's shores, from age to age,
> Our city shall lift its spires ;
> And gem with stars its history's page,
> And kindle still its altar fires.

"THE IDEAL STREET RAILWAY: A PROPHECY."

By Hon. L. A. Russell.

Ladies and Gentlemen of the American Street Railway Association and your guests :—It is your misfortune, and not my fault, that some busy member of your committee has discovered the fact that I am possessed of the prophetic gift; but I am, and I have a monopoly of it, and it isn't patented, either. I am not afraid to tell you about it, because it pertains to me, and is altogether unique. I have the real and truly infallible gift of accurate prophecy. Whenever the inspiration is sufficient, and amidst good cheer and good company, such as I find here this evening, I can, without the shadow of a doubt, or the possibility of error, foretell with precision the exact condition of the street railroad system of the United States, and especially of the city of Cleveland, to any indefinite time in the future that any member of this assemblage may suggest ; and the reason why I have it is because I have also the gift of prophecy in regard to the result of elections. Many men have heretofore made great money by backing the opposite of my predictions. (Laughter.) But all I have to do to be precise and accurate in regard to the street railroad business, as against the

matter of elections, is to run the same machine backward. In regard to elections, I always prophesy that the thing will be as I want it, but it never is. In regard to street railroads I am going to prophesy that they will be as I don't want them, and then I know the thing will be all right.

I would have the tracks solid and smooth ; I would have the cars swift and certain, and the intervals between them short. I would have the tracks on each alternate street, and I would live on the other street. (Laughter and applause.) I would have the motors exactly controllable, and always controlled. I would do no harm, and I would have no legal liability. By the way, that puts me in mind of the remarks that General Meyer made. He said that he stood in awe of street railroad men. He only said that because most of you are strangers. (Applause.) Every street railroad man in Cleveland who ever went to the municipal government to apply for more franchises, found that General Meyer did not stand in awe of him. Why, General Meyer would not let you repair a crossing frog in the city of Cleveland unless you gave up ten or fifteen years of your last renewal of franchise. (Applause.) Mr. Herrick, who sits over there, would not let you turn a car around on a turntable unless you vacated half a dozen streets and paved four blocks somewhere else with the best paving blocks. There are many things about street railroad men that are worthy of respect (laughter), but in the future there will not be, for after we have the ideal system completed, I understand that we are to turn it over bodily to the public, and make the blessed public a present of it. After that the fare will not be five cents.

I imagine, when my prophetic gift comes upon me strongly, that I can see a great future for street railways of this country. Some of you may have observed, or your attention may have been called to the fact, that man, among his other peculiar and interesting characteristics, is a moving animal ; and since the time whereunto the memory of man runneth not to the contrary, has been in the habit of having ways for his motion, and thus we have come to speak of highways. But after all, the way is not the great thing, although some times, in moments of enthuaiasm I have called the road the hol(e)y road ; that is, the middle of the road. But the fact of it is that the great thing to be considered at last is the man. The way is only the convenience for the man, and the railway or railroad is not the great thing of the street railway business after all. The road is only the appurtenance of the car ; you have not been in the habit of thinking so, but it is a fact. The road is only the mere appendage and appurtenance and convenience of the car, and the car itself, whether short or long, whether for smokers or for ladies only, it is only the appurtenance and the convenience of the man. It is an instrumentality of man's devising for his use and convenience. What, then, of necessity, must be the ideal street railroad of the future ? Not necessarily a street railroad in every street, but a perfect street railroad operated by perfect cars and a perfect system upon enough of all the streets and highways of the land to serve the convenience of the people of the land ; and that will never be until between all centers of men, all centers of population, all thoroughfare highways, there be rapid, swift, sure, controlled, safe, convenient locomotion for men by means of street cars. If you will but for one moment stop and consider the past growth of the ways of men, and consider what in its nature a street railroad is, you will then know that the best street railroad convenience is just as certain to exist in the main highways and thoroughfares of the people, and between the great centers of population, as it has been certain that the pike road has succeeded the corduroy cut road through the forest, that the plank road has succeeded the pike, that the paved street has succeeded the plank ; and just so sure will the street railroad succeed and follow on in the development of the ways of mankind ; and that that day is nearer to us than we can imagine, is shown by the great extent and stupendous rapidity with which the street railroad system has developed and improved in this country in the past few years. And it is a proud thing to me, as a citizen of our good city of Cleveland, that the development has been more rapid and more thorough and wider in the city of Cleveland, and done in less time, than any other city of the nation, Boston not excepted.

I trust that being entirely satisfied, as I take it you all are, of the absolute accuracy of my prophecy, you will be willing to let me give way to more entertaining speakers.

"THE CARRIER, FROM THE STANDPOINT OF THE CARRIED."

By James H. Hoyt.

Mr. Toastmaster and Gentlemen :—If I had been asked to respond to this toast some months since, I should have come here as the representative of the passenger class, bubbling over with bile, and eager to pour out upon the devoted heads of you street railroad men, not the "vials" merely, but the barrels, of my wrath ; for, at that time, I was simply one of the "carried" myself and had no interest whatever with the "carrier." But lately I acquired a few shares of stock in a street railroad company, and it is perfectly marvelous what a humanizing, liberalizing agent a certificate of stock in a street railroad company is ; how it softens asperities, and mellows criticism, and enlightens the understanding, and warms the cockles of the heart. For instance, this toast itself, selected as it has been by street railroad men, and which, a few months ago, would have aroused all my animosities and inflamed my passions as a red rag inflames the passions or a bull, now seems to my enlightened and stimulated understanding to be a statement of magnificent candor and absolute fairness,—"The Street Railway Carrier, from the *Standpoint* of the Carried."

In any argument, the man of liberal mind and broad ideas always admits the truth ; and this toast itself, gentlemen, contains a frank and refreshing admission on the part of the street railroad men, when you come to analyze it, that the contention made by the passenger, that he is not furnished with adequate seating facilities, is entirely correct ; indeed, it goes further and, with an unexampled fairness, boldly announces in effect that the standing room, even, of the passenger is restricted to a single point.

But let me illustrate this change of heart, which has come over me, in another way. The tracks of a street railroad company run in front of my door, and, prior to the making of the investment I have mentioned, the whirring and buzzing of the electric current, the soughing of the trolley wire, the banging and bouncing of the trucks, and the grinding and groaning of the improved, patented, noiseless, gearless motors were, to say the least, annoying. But now I am quite able to agree with my little daughter (five years of age), who remarked this fall, after her return from a three months' trip to the seashore, that it was very sweet to be at home again, where she could hear the pleasant electric cars go by. I never fully appreciated the truth of the Scripture before, which tells us that many things are hidden from the wise and prudent and are revealed unto babes.

I remember a story of an Irishman, who, after earnest solicitation, was finally persuaded to sign the pledge and become a total abstainer. He kept this arid obligation for about three days, and then, Nature proving too strong for him, he became gloriously drunk. A member of the Father Murphy Temperance Society, who had induced him to don the blue ribbon, met him and, with a voice full of reproach, said : "Why, Patrick, how is this? I thought you were a total abstinence man." To which Pat replied : "So I am a total abstinence man, sor ; but, be jabers, I am not a bigoted one."

Now, I come here this evening as the representative of the carried ; but, for the reasons I have stated, I am not a bigoted one, and I desire to acknowledge a few of the more significant benefits which the street railroads of this country have conferred upon the passenger class.

In the first place, gentlemen, owing to your unselfish efforts, it is no longer necessary for the ambitious spirit to go abroad in search of peril or adventure. The dense jungles of Africa and the slippery slopes of the mountains of Switzerland, thanks to you, no longer monopolize the excitements of danger. You have brought the deadliest peril and the most thrilling adventure within the reach of the humblest citizen, and all for a single cash fare of five cents. There is no need now for a Stanley to explore the Dark Continent or for a Tyndall to climb the Matterhorn in order that, by deeds of signal courage, they may challenge the admiration of the world. The average American citizen must be possessed of a more indomitable spirit, of a more heroic fortitude, every time he goes from his house to his office or crosses a street over which the lines of your railways run. If, when he goes through the usual, but entirely unnecessary, form of signaling one of your cars to stop, he avoids being paralyzed by an electric shock, he is sure that only the agility of a goat will enable him to reach the interior of the car without sacrifice of life or limb, and when, at length, he has gotten there (if, indeed, he ever does), and, at the risk of his life, has possessed himself of the standpoint which is named in the toast, and which you generously permit him to occupy, for a consideration, why there is the usual altercation, with the conductor still before him to sharpen his wits, and the pleasurable certainty in prospect that, unless he has courage for a flying leap, he will be carried beyond his point of destination. Why, gentlemen, I consider the street railroads of the present day, both cable and electric, as valuable educational agents. They exercise a man's muscles and stimulate his courage, sharpen his reasoning faculties, and last, but not least, induce a solemn and profound belief in the protecting care of Providence, since a single trip on one of your lines anywhere will convince even a scoffing sceptic that he could not have been preserved were it not for the aid of Omnipotence. I am informed that it is due to the street railroads alone that the Triennial Convention of Episcopalians, now in session in Baltimore, has decided to amend the noble litany of that church, so as to make it conform to modern needs, by adding this pregnant sentence : "From motor and cable cars, from overhead wires and sudden shocks, good Lord, deliver us."

But not only are you street railroad men aiding the physical, mental and religious development of the race; you are also, as I have been credibly informed, relieving us from some of the most onerous of our pecuniary burdens. Were it not for your generous and unsolicited donations of money, the salaries which members of City Councils would demand would largely increase the taxes of the people who elect them. These benevolences of yours, too, deserve the highest praise, because they are so unostentatious. In the language of the poet, you uniformly

"Give by stealth and blush to find it fame."

But there is yet another incalculable benefit which you have conferred and are conferring upon the "plain people." You have done much and, indeed, are still doing much to enrich and enlarge the vocabulary of the race. Where can more vigorous or forceful English be heard, I should like to know, than on one of your crowded cars about the hour of 6 P. M., especially if the night happens to be rainy? Why the daily impromptu dialogues between your motormen and conductors and the general public are shining, nay, lurid, examples of the vituperative art. I have heard some of your most efficient servants indulge in profanity which rivaled the electric flash itself in color and intensity. The motorman is not, indeed, like Chaucer, a

"Well of English undefyled ;

but, like Nature,

"Speaks a various language."

He is a sort of storage battery of *epithets*, and a storage battery that does not wear out or become exhausted by frequent use, and so is a commercial success, like the Ford-Washburn storage battery, in which I have an interest. I remember that a conductor once came into the car where I was swinging from a strap and accused me, in the presence of a large and interested audience, of having passed a plugged quarter on him. Now, of course, my first inclination was to prepare

his remains for instant burial; but, after listening to him for a few moments, I cheerfully handed him a sound quarter. I do not think, even after the lapse of years, that the plugged quarter was mine; but I cheerfully gave him the other as a slight testimonial of my appreciation of his perfect style.

But, gentlemen, let me speak seriously for the few moments left me. The street railroad has been and is one of the mightiest agents in the unparalleled development of this country. No city is without street railroads, for the simple reason that, but for them, it could never have become a city. They are the arteries running from its throbbing heart center and carrying life and nourishment to its extremities. Because of them, pleasant homes, pure air, the meadow's sweet expanse and blooming flowers are within the reach of every honest and industrious man. Wherever their rails extend, houses spring up, lands are reclaimed and the value of property is enhanced. The street car is the poor man's carriage and it is always at his beck and call, and yet it is curious that the very people that are most benefited by street railroads are usually the most eager to set up obstacles in the way of this great agent of human progress. Humanity has a strange characteristic—you have very often to help it in spite of itself. The problem of rapid transit is one of the most important which confront us, and the prosperity of our great centers of manufacture and trade depends largely upon the successful solution of this problem. We look to you and men like you to solve it. You have already done much and will yet do more. The cable or electric car of to-day is far ahead of the bobtail car of yesterday drawn by a single, flea bitten mule, but will be far behind the street car to-morrow. In spite of grumbling passengers and stupid and venal councils and ignorant and unjust criticism you are doing your work well and deserve the thanks and appreciation of every intelligent American. The public might as well try to dim the brilliance of the sun with a rush light or bring a herdic in competition with a street car, as to prevent your certain progress. Air and light are blessings so common that we fail to appreciate them until the eye is blinded or the lungs are clogged. It only needs a strike such as we had last winter, which paralyzed some of the great street railroad lines of this city, to convince the most captious critic that the street car has become a prime necessity. Every man, gentlemen, who lays an additional rail, runs an additional street car, or invents or adopts a useful appliance is a credit to the carrier and a benefactor of the carried.

"THE PRESS."

By W. W. Armstrong.

In a very modest way for many years, on various occasions, political, historical and social, I have responded to the toast of "The Press," but not now being actively connected with it, I approach the subject to-night with some trepidation and awe, for I find myself in the presence of the masters of a subtle and mysterious power, who may, if ancient chestnuts are fired at them, touch a button of some of their various systems and send me sailing up amid the little stars.

* * * * * * * * *

While the 400th anniversary of the discovery of this country is being celebrated, you people are only celebrating a science that has become a fact and a necessity within a quarter of a century. If equal progress is made in the next fifty years with what has been made in twenty-five years, what may not be expected from electrical science? There is nothing too daring to escape the mind of the American inventor and American scientist. It is, perhaps, safe to say that electrical science is in its infancy, but when I look over the wonderful display of American ingenuity in the Army and Navy Hall; witness the countless inventions that make electricity so direct a factor in our business and domestic life, which make it an employe in our shops in the city, in our mines under the earth, which make it light our vessels that plough the land and sea, which light up our mercantile palaces, our places of amusement, our palatial and humble homes, and is the means of our comfortable and swift conveyance in summer's heat and winter's cold, I cannot help but call to mind the first formal telegram that ever passed over the wires, from Professor Morse to a Washington lady, "What hath God wrought?"

In conclusion let me say that the press of Cleveland, which is not dilatory in its reports, entertains for you gentlemen from abroad, connected with the business for whose interests your convention has been called, the highest respect and only reflects the kind feelings our whole people entertain for the strangers within their gates, and it will do you full justice in its reports and give that prominence to your objects, that electrical science and electrical scientists deserve.

We of Ohio are proud of our state, the record of its statesmen, and its soldiers, but we hold in proud remembrance the attainments, the ingenuity, the talent and the masterful minds of such Buckeye lads as Charles F. Brush and Thomas A. Edison.

Hon. Tom L. Johnson, of Cleveland, was called upon, and among other things said:

I was at the street railroad convention in Boston at the birth of this Association. I have watched it with interest ever since, and it gives me great pleasure to night to be here and witness what has taken place since that time. Many familiar faces are here, and I see many gentlemen who were at Boston and took an active part in the formation of the Association, Coeval with the organization began the great progress in the street railway business which we have witnessed during the past ten years. One subject has not been touched upon to-night, the old subject that used to interest us in the early days—the collection of fares, and what was the best method of collection, and the best devices for registration, to insure us the necessary revenue that should come from the operation of our cars. We discovered in Johnstown, just after the flood, the best system in the world to secure all that was taken in on the cars—we ran them free.

The president-elect, Mr. D. F. Longstreet, was called upon, and after referring to the speeches that had preceded, and noting the lateness of the hour, expressed the hope that he should meet in Milwaukee all who were present at the meeting, and in two years hoped to have them all cross the plains to the most beautiful city on the face of the continent—Denver.

Mr. Wm. Richardson, of Brooklyn, on behalf of the Association, fittingly thanked the ladies and gentlemen of Cleveland for their very hospitable entertainment of the ladies and gentlemen of the Association.

All the speeches were presented in a happy manner, and were listened to with satisfaction. The banquet then closed by the singing of Auld Lang Syne.

Summary of the Convention.

The proceedings of the eleventh annual convention of the American Street Railway Association have passed into history and will mark it in some respects as the most remarkable, profitable and most enjoyable meeting yet held.

Although the attendance was not as large as we had anticipated, owing to the fact that many Western delegates were compelled to be in attendance at the Columbus fêtes at Chicago, yet the number of delegates (about 400) was larger than at any former meeting, and there were fully as many more representatives of allied interests and visitors.

THE PAPERS

read were of unusual interest, and reflect great credit on the committees, and will form a volume of valuable street railway literature, but the discussions following the reading of the papers were rambling and not up to the standard of the papers.

The advantages of having the papers printed and distributed previous to the meeting were not fully realized, from the fact that they were not handed to the secretary for distribution in time before the meeting to allow of careful study. The printed copies, however, proved of great assistance in following the reading and for ready reference. The hesitancy manifest on the part of the delegates to engage promptly in the discussion, and the tendency to ramble away from the subject in hand, show that it is as necessary to have certain parties selected beforehand, whose duty it is to open the discussion following the reading of particular papers, as it is to designate the committees who shall prepare papers, and also that the presiding officer hold the meeting well in hand and check any tendency to lug in side issues.

THE OFFICERS AND EXECUTIVE COMMITTEE

performed their duties in an admirable manner and rereceived the grateful appreciation of the members.

THE EXPOSITION OF APPLIANCES

surpassed that at any former meeting, as will be noted from the report in another column, and received the attention and praise of every delegate, while it evidences in a striking manner the enterprise of the various dealers and shows their interest in the welfare of the Association. The advantages of having the exhibits in one locality was strikingly shown, but the necessity of providing a much larger space for these exhibits at future meetings was not less marked. This difficulty must be met, for the overcrowding during the evening hours when the whole city seemed to be besieging the doors was dangerous and disagreeable both to exhibitors and visitors.

In case sufficient space is not available, there should be a small entrance fee imposed upon the public, or they should be admitted only during the business sessions, when the delegates are otherwise engaged. No reflection, however, is cast upon the local committee in this case, for the hall and the temporary building adjoining were supposed to be ample for all purposes.

THE HOTEL ACCOMMODATIONS

were ample, the attendance and entertainment satisfactory and rates reasonable. We heard no complaints, and we think every guest left the city with pleasant memories of his stay in Cleveland. The Hollenden proved to be a model "headquarters," and the new rule of excluding all exhibits and posters from the rooms, lobbies and halls was appreciated by all.

EXCURSION TO THE SHORT ELECTRIC RAILWAY CO.'S WORKS.

Following the adjournment of the first session, the delegates, ladies and visitors accepted an invitation from the Short Electric Railway Co. to visit its works, and boarded a train of ten electric cars that were in waiting on a temporary siding that had been laid with the overhead construction the night before on Bond Street in front of the Hollenden Hotel.

A pleasant ride over the Prospect Street line of the East Cleveland Railroad Co. brought the guests to the works, and the cars were run into a siding extending through the company's grounds, Mr. Short himself having acted as motorman on one of the cars which was equipped with gearless motors and truck of his own invention. Having alighted, the company were escorted first, through the business offices, Mr. Short and President Potter welcoming all in their private apartment. The halls, lobbies, private offices, furniture and railings were decorated with a lavish profusion of palms, flowering plants, cut flowers and festoons of smilax, while a string band, concealed behind a bank of huge palms, enlivened the scene with strains of enchanting music, reminding one the pictured scenes of fairy land. In answer to a question, we were informed that this was the ordinary every day furnishing of the offices.

Leaving the office building, each guest was handed a boutonnière, and the company was conducted across the street to the works and first made a tour through the cathedral building where was an endless variety of motors and parts in various stages of completion, the workmen being engaged at their ordinary tasks, making the contrast between the æsthetic and the practical as violent as can be imagined.

Passing on through the testing room where the great throbbing engine was performing its accustomed labor, unmindful of the presence of the admiring guests, to the rear room of the cathedral building, another surprising but agreeable contrast was met. Occupying a cleared space down the center of the room were long tables, loaded with the choicest viands, while the white linen, shining silver, glistening glass, delicate china and floral decorations were in marked contrast to the electrical material that was strewed all about. Never did dining room have such a setting, and never was a lunch more enjoyed or partaken with a keener relish; "And aft they ca'd it guid."

Mrs. Short graced the occasion with her presence and gave special attention to see that the ladies of the company were properly served. Among the table decorations was a large floral electric open car with the name of the company in purple flowers spelled out on the side sill. The cream was frozen in the form of a ring armature, showing the winding of the bobbins and other characteristics of the armature employed in the Short system.

After lunch a run was taken through the different departments of the works, when all were assembled in front of the machine shop and photographed in a group.

Again the cars were boarded, when a run was taken over the lines past the Garfield Monument and other interesting localities, when all were returned safely to the hotel, being profuse in their praises of the company's kindness and hospitality.

Any description of the excursion will be incomplete without reference to the cars in which the trip to the works was made.

One of these was the well known Accelerator, manufactured by the Brownell Car Co., of St. Louis, mounted on their improved non-teetering truck and equipped with two thirty horse power, single reduction, Short motor.

Another car, painted white, was manufactured by the Lamokin Car Co., of Philadelphia, which was mounted on the Robinson all-steel truck, and equipped with one twenty horse power, single reduction, Short motor.

The General Electric Co.'s system was represented by two cars, one an eight wheel car, manufactured by the J. G. Brill Co., the other a handsome closed car, manufactured by the Gilbert Manufacturing Co., and mounted on a McGuire truck.

The Sperry system which employs a single motor geared to both axles was illustrated on a highly finished car, built by the Pullman Co., mounted on the new No. 19 F., McGuire truck.

A handsome car, built by the St. Louis Car Co., served to demonstrate the advantage of the new gearless motor, and as noted above, was run by Mr. Short.

The officers of the Association were carried on the gorgeous private car of Mr. Short, which has recently been re-equipped, now having the new Short gearless motors and the Anger truck. This car, it will be remembered, was built by the Gilbert Manufacturing Co.

A car, manufactured by the East Cleveland Railroad Co., and mounted on the Fulton Foundry Co.'s truck, was propelled by two Short single reduction motors.

Four ordinary open cars, of the East Cleveland Co., equipped with Edison motors, completed the train.

Another interesting feature of the occasion was the construction of the siding on Bond Street from which the start was made.

This temporary track, which was laid on tiers above the pavement, was composed of the Johnson girder rail with electrically welded chairs.

A SPECIAL EXCURSION

which proved very enjoyable, was tendered the ladies who were present at the convention by Mrs. S. H. Short on the afternoon of the second day. The trip was made in the elegant private cars, above described, and the route was out Euclid Avenue to Lake View and return by way of Cedar Avenue to the Union Club where a bountiful luncheon was served by Mrs. Short. The floral decorations of the table were tasteful, and all the appointments were in keeping with the generous hospitality of the hostess. The guests were: Mrs. W. J. Stephenson, Washington, D. C.; Mrs. T. E. White, Washington, D. C.; Mrs. Church, Washington, D. C.; Mrs. T. E. Loyd, Washington, D. C.; Mrs. W. Worth Bean, St. Joseph, Mich.; Mrs. G. H. Bush, St. Joseph, Mich.; Mrs. A. De Bevoise, Hoboken, N. J.; Mrs. A. E. Lang, Toledo, O.; Mrs. Smallman, London, Ont.; Miss Richardson, Brooklyn, N. Y.; Mrs. Wm. Richardson, Brooklyn, N. Y.; Mrs. Wm. J. Richardson, Brooklyn, N. Y.; Mrs. J. S. Minary, St. Louis, Mo.; Mrs. G. H. Bunch, Memphis, Tenn.; Mrs. Wm. Hazleton, Cleveland, O.; Mrs. Lewis Perrine, Trenton, N. J.; Mrs T. H. McLean, New York; Mrs. E. P. Morris, Boston, Mass.; Mrs. Charles Cleminshaw, Troy, N. Y.; Mrs. W. Kemp, Troy, N. Y.; Mrs. Maxcy, Troy, N. Y.; Mrs. J. A. Hanna, Chicago, Ill.; Mrs. Clark Rude, Mansfield, O.; Mrs. Graham, Norwalk, O.; Mrs. B. Owen, Reading, Pa.; Mrs. Smith, McKeesport, Pa.; Mrs. Chapman, Grand Rapids, Mich.; Mrs. Longstreet, Denver, Colo.; Mrs. Ferguson, Denver, Colo.; Miss Ferguson, Denver, Colo.; Mrs. I. Burgess, Cleveland, O.

THE LOCAL COMMITTEE

of arrangements performed their arduous duties in an admirable manner and won the hearts of every member. The JOURNAL staff are especially indebted to them for courtesies shown. The generous hospitality shown by the local companies in providing for the guests, has placed the Association under many obligations. May they continue to prosper, we know, is the wish of every member.

THE LOCAL DAILY PAPERS

had representatives present and devoted considerable space to Association matters, and seemed to do all in their power to make the delegates feel at home. It is gratifying to find the press of so large a city in sympathy with street railway interests.

EXCURSION TO THE WALKER MANUFACTURING CO.'S WORKS.

A fitting close to the three days' session was the excursion and banquet tendered by the Walker Manufacturing Co. to all in attendance, of which over 250 accepted.

Carriages were in waiting at the Hollenden at 10 o'clock Friday morning, and after a delightful drive of half an hour the extensive works of the company, beautifully located on the shore of Lake Erie, were reached.

Although it was a legal holiday, the works were in full blast, the men having sacrificed their vacation in order to exhibit the resources and magnificent equipment of the works. These we will not stop to describe, as they were fully illustrated in our Souvenir edition.

After a pleasant visit through the foundry and machine shops, the guests repaired to the draughting room over the main office, where lunch was served. The room and tables were profusely decorated with flags, streamers, plants and flowers, making it indeed a "fairy land." Seats were arranged on each side of four long tables, and everybody was made to feel at home. The lunch was bountiful, and was partaken of with the keenest relish, Mr. Walker himself doing the honors of the occasion. The splendid tool equipment of the shops, and the great quantity of completed cable machinery awaiting shipment, was a revelation to many, and was the admiration of all.

A full description of the exhibits made at the Convention, as well as a list of many of the attendants, will be found on another page.

Storage Battery Cars in New York.

Two railway companies in New York are preparing to test storage battery cars in actual practice. One of these companies is the Second Avenue Railway Co., which will soon have ten cars in operation on the Waddell-Entz system, on Second Avenue between their main depot on Ninety-sixth Street and the Harlem River. The Ninth Avenue Railway Co. officials are trying an Acme storage car.

The Brooklyn Bridge Traffic During Columbus Week.

During the "Columbus Festival" in New York, the various lines of transportation leading to the metropolitan district, as well as those within its boundaries, were obliged to carry a largely increased number of passengers, as compared with their ordinary traffic, and at times within quite limited periods.

What was successfully done on the New York & Brooklyn Bridge Cable Railway in moving the congested masses of humanity is shown in the following summary of operations on the week which included the festival:

On this railway trains of from two to four cars each are run on headways of from fifteen to one and one-half minutes, each varying at the time so as to best accommodate the fluctuations of travel. Usually the cable runs from five o'clock A. M. to one o'clock A. M. following, or twenty hours, and the last train during this interval hauled by cable is dispatched from Brooklyn station at 12:39 o'clock A. M. During the remaining four hours and twenty-one minutes of the day of twenty-four hours the trains are hauled by locomotives.

To carry the crowds offering on Wednesday and Thursday, October 12 and 13, the cable was run continuously for forty-four hours, and trains of from two to four cars each, averaging 3.87 cars, were run on headways from four to one and a half minutes, averaging two and one-fifteenth minutes. During the twenty-four hours beginning at 8:45 o'clock, Wednesday, 770 trains were run, on an average headway of one and five-sixths minutes, and 258,953 passengers were carried, or nearly one-fourth as many as were carried on the day of the greatest travel over the five elevated railroads in New York, constituting the Manhattan railway system.

For comparison, the numbers of passengers carried on the days of the preceding week, October 2 to 8, are written in the table, showing what is the ordinary traffic, at this time. Each day during the two weeks was fair. From this it will be seen that the increase in travel due to the Festival, began on Saturday, October 8, and continued for one week. The greatest increase was on Wednesday, October 12, when 223,625 passengers were carried; more than twice as many as on the same day the week before, and over 40 per cent. more than had ever before been carried in one day on the railway.

NEW YORK & BROOKLYN BRIDGE CABLE RAILWAY.

Summary of Operations during the Week including the Columbus Festival.

DAY.—1892.	Length of Time the Trains ran.	Average Headway.	Total Number of Trains.	No. of Single Car Round Trips.	Average No. of Cars per Trip.	Passengers Carried.		Passengers Carried the same day of the prec'd'g week.	
						No.	Av. per Car.	No.	Ratio.
	H. M.	M. S.							
Sunday..Oct. 9.	24.00 *a*	3.12	453	1652	3.65	99309	30.0	81918	1.21
Monday. " 10.	22.32 *a*	2.28	549	2096	3.82	188677	45.0	167122	1.13
Tuesday. " 11.	22.45	2.27	558	2114	3.81	158085	37.4	120204	1.32
Wedn's'y " 12.	24.00	2.04	697	2622	3.76	223625	42.6	109790	2.04
Thursday " 13.	24.00	2.18	624	2383	3.82	144842	30.4	112464	1.29
Friday... " 14.	24.00	2.44	526	1931	3.67	123413	32.0	116479	1.06
Saturday. " 15.	24.00	2.45	524	1943	3.71	153588	39.5	162006	0.95
For the Week...	165.17	2.31	3931	14741	3.75	1091539	37.0	869983	1.25
b. From 8:15 A.M. Wednesday, Oct. 12 to 8:15 A. M. Thursday, Oct. 13	24.00	1.50	770	3032	3.94	*c.* 258593	42.6	.....	....
b. From 5:00 A.M. Wednesday, Oct. 12 to 12:39 A. M. Friday, Oct. 14.	43.39	2.04	1266	4895	3.87	*c.* 358913	36.6	.....	....

a.—To permit displays of fireworks, trains did not run one hour, and twenty-eight minutes Monday evening, and one hour and fifteen minutes Tuesday evening.

b.—The trains usually are sent out from Brooklyn by cable, from 5 A. M. to 12:39 A. M., that is, nineteen hours and thirty-nine minutes, and by locomotive the remaining four hours and twenty-one minutes. In this instance the trains were hauled continuously by cable forty-three hours and thirty-nine minutes.

c.—Estimated.

The operations here recorded illustrate the extreme flexibility of a cable railway system. During the period covered there was no halt or failure of the driving mechanism, and the increase in demand for hauling power was much less, comparatively, than the increase in traffic handled. The reliability of the driving mechanism employed was, however, but one element contributing to the success of the work done; the discipline, vigilance and efficiency of the employes operating the railway constituted another element fully as important; a few served twenty-six hours continuously, more twenty-four hours, and most of the others nineteen hours, all with entire willingness and a strong personal desire each to perform faithful and effective service.

"WE would recommend for small towns the construction of narrow gauge roads, and feel confident they would give greater satisfaction. The width of a narrow gauge road, being three, three and a half and four feet, prevents other vehicles from traveling on the track, thus preserving the roadbed and preventing it from being cut up. It has been found by experience that on a narrow gauge track a lighter car can be used. A car on a three feet gauge track requires 33 per cent. less power to pull it than does a car on the regular standard."—*Chicago Street Railway Convention*, 1883.

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THE STREET RAILWAY JOURNAL

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
Street Railway Publishing Co.,
World Building, New York.

The Souvenir which we issued in honor of the Convention, was well received, and we are grateful for the many pleasant things said for it and for the STREET RAILWAY JOURNAL.

That Averages are a Delusion and a Snare is strikingly illustrated in the paper on the "Relative Cost of Operating the Different Systems" and emphasizes what we have often said in regard to employing the car mile as a standard of comparison. The paper was carefully prepared and shows a prodigious amount of work, but thorough analysis of it must be deferred to a later number.

President Holmes' Address was ably conceived and admirably delivered, and received the hearty applause of the delegates. His prophetic allusion to the future of electric traction, were it not that still more fabulous predictions have already been fulfilled, would seem to be too extravagant to be entertained for a moment, but everyone realizes that the statement "that we are yet only on the threshold of electric traction" is true.

"A Perfect Overhead Electric Construction" was the title of a brief but excellent paper prepared by Mr Charles H. Smith and seemed to coincide so fully with the views of the delegates that no discussion followed. The concluding statement, however, is one that every manager would do well to ponder and practice: "I would say that no matter what expense is incurred, material or care used in constructing a good line cannot be ensured without a thorough daily inspection."

Valuable Recommendations and such as should receive careful attention at the hands of the committees and officers to which they were assigned, were contained in the able paper on "Standards." Mr. O. T. Crosby, chairman of the committee presenting the report, deserves a great deal of credit for the persistent efforts he has put forth at this and other conventions, to attain the desired end. The need of standardizing many parts is plain to all; especially is this true for rails and wheels, as is shown in another paper treating on rail heads. We shall have occasion to refer to this matter of standards in future issues.

The Character of the Metal from which rails are made has much to do with their life and efficiency, according to the able paper read by Mr. Baumhoff, and his suggestion that an order for rails be accompanied by specifications as to the chemical composition of the steel is a good one, and is already the practice of some lines. No paper read at the convention attracted more attention than Mr. Baumhoff's on a "Model Roadbed" and no other was so thoroughly discussed. Only one or two exceptions were taken to the recommendations of the committee, and we are pleased to know that the types of construction recommended coincide very closely with our own views on the subject.

The Mayor's Address of Welcome to the delegates at the Cleveland Convention was one of the most able and interesting speeches ever delivered before the association by a public functionary. Street railway men should not only read it, but should see that a copy, as printed in this issue of the STREET RAILWAY JOURNAL, is put into the hands of the mayor of every important city. It also contains some suggestions that railroad men would do well to ponder, especially those relating to long grants and the importance of employing skillful and well trained (licensed) motormen as a provision against accidents. Grip and wire pulling have indeed come to have a new meaning, as the mayor says, and coupled with the proverbial "push and pull" for which street railway men are noted, may be turned to the very best good of both community and operating companies.

It is Possible and Probable that a standard rail head will soon be adopted, the advantages of which are fully set forth in the carefully prepared paper presented by Mr. J. F. Ostrom. Not only can we have a standard head, but this will lead to a standard wheel, so that a great burden will be lifted from the shoulders of the wheel makers, and also from the users. The universal need for standards in these directions is evidenced by the numerous replies received from street railway companies to a circular letter sent out asking in regard to present practice; and where such a want is felt it will sooner or later be gratified. It is evident that a great amount of labor and study has been bestowed upon the paper, and the volume of statistics collected bearing on the subject will be of great value in solving other perplexing questions. As this work has been voluntary on the part of the writer, the Association is greatly indebted to him.

The paper presented by Mr. A. J. Moxham at the Cleveland Convention was a most valuable one in that it outlines the importance of definite experiments, investigation and tests to determine how far natural laws are affected by certain conditions. According to some of the experiments given, the laws governing the contraction and expansion of metals may, under certain circumstances, be ignored in the construction of street railway track. This would seem to be a bold theory, but it is confirmed by the practice cited; but other experiments in the line of a continuous rail on steam roads have not given satisfactory results. One of the conclusions of the

paper in regard to the joint, which is no doubt true, is that it is the space between the ends of the rails, and not the weakness of the joint, that causes the trouble. The paper showed most careful investigation, and contained much that is valuable and of the greatest interest to the street railway manager.

A Pioneer in many things relating to street railway practice, is a title well merited by Mr. D. F. Longstreet, as is shown in his paper on the causes that led up to the formation of the American Street Railway Association. Not only did he discover the need of system in the operation of the affairs of a company, and feel the need of the advice and assistance of others engaged in the same line of business, but, being of an inquiring disposition, he sought some device for assisting conductors to keep their accounts correctly, and in answer came the bell punch and register. We know of no publication in which the marvelous growth of the business is so strikingly illustrated as in this paper, and it was a happy thought which led to its publication. Judging by the past, it is reasonable to expect that the Association, which had its origin in the brain of its new president, will yet become a great power in influencing the growth and character of the street railway business throughout the world.

So Long as Grade Crossings Exist, experience has shown that accidents from collisions between steam railway trains and the occupants of streets are extremely liable to occur. Three serious cases of this kind, in which street railway passengers were the sufferers, were reported extensively during the first week of last month, and emphasize the fact, which we have always maintained, that the greatest care should be taken to guard such points. Two of these accidents took place on October 4. In one, a horse car in Orange, N. J., was struck on a crossing of the Delaware, Lackawanna & Western Railroad, and one person was killed and two injured. The second accident occurred in Cincinnati, where a switch engine ran into a loaded street car, killing two persons and injuring four others. The third was on October 6, when a Belt Line car in New York City was overturned by a freight train on Tenth Avenue, and three passengers and the driver were hurt. In each case the crossing was guarded by flagmen or gatemen who, however, seemed incapable of preventing the accidents. All grade crossings are, undeniably, points of danger, and should be protected by some system of automatic block signals or safety switches, by which the chance of such collisions would be greatly reduced, if not eliminated. Negligence and incapacity are qualities which, unfortunately, are liable to exist in guards and flagmen, and the sooner such crossings are supplied with automatic protecting devices the better.

Conventions of political, educational and religious bodies, of trades and professions, are characteristic of this age of combination and organization. In nearly every case, however, the membership of such organizations consists of those employed directly in a common trade or calling, the chief exception being political and religious bodies; but in this respect the American Street Railway Association is unique, as it embraces in its direct membership nearly every profession and trade, including men prominent in leading and financial circles, managing directors (men who have made street railroads and those whom railroads have made), executive officers, accountants and others composing the executive staff. There are also civil, mechanical and electrical engineers, veterinaries, workers in metal and wood of every class; while among the non-members are those composing the great body of visitors, manufacturers of and dealers in numerous appliances embracing every commercial industry, and last, but not least, the representatives of the daily and technical press. Notwithstanding these diversified employments, all are interested in the development, extension and improvement of street railways, and all seem to be actuated by the same laudable desire to give, receive and take home whatever will make for the common good and which may have come to the knowledge of each in his individual calling. It is not essential, however, that such knowledge must accumulate and be made available only once a year, for the STREET RAILWAY JOURNAL in its way, is a perpetual convention, and may be made the medium through which every man may give or gain that which will add to his own power or that of others for doing useful work. In any event the value of the conventions, or of this paper to the individual, depends largely upon his desire to know, and the consideration he has for the good of others.

All Industries are Waiting for More Skill, but with none is this fact more apparent than with street railway business, and those interested should be willing to pay a reasonable price for it in order to hasten its coming. This subject was incidentally treated in a paper on the "Economy of Machine Shops" read by Mr. J. H. Bickford at the Cleveland Convention, and deserves the careful attention of street railway managers. The men controlling this industry should not, if they could, compete in making labor come down, nor encourage any movement tending to this end. There are plenty of men controlling other industries who can easily beat in such a contest, but street railway men should be above it and never think that a downward competition is open to them. On the other hand, there should be a concentrated movement to raise the intelligence and skill of employes, so that this industry shall be above all competition. "What do you mix with your colors?" was asked of a painter; "brains," said the master, "brains." Labor tells just in proportion as it is mixed with brains, and for such a mixture managers can afford to pay a reasonable price.

* * * * *

The paper referred to above, besides being convincing, beyond question, that a well equipped repair shop is an essential and economical feature of an electric line, was in its method of preparation a model, the writer having supplemented his own experience by that of a number of other managers which he obtained by directly communicating with them. He complains, however, that from over 200 letters of inquiry sent out only sixty-six replies were received. From our experience in such matters we think he was extremely fortunate in receiving even so many. This raises a question which we have never been able to answer satisfactorily, why it is, in investigations of this kind, which are instituted wholly for the benefit of of the business at large, so many managers neglect or refuse to answer a set of simple questions relating to their ordinary practice. It argues at least that there is a large number of persons controlling street railway interests who have not yet caught the spirit of progress that marks the development of this business, and were it dependent upon them,

"No greatness ever had been dreamed or done."

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

The $350,000 Cable Road and the $46,000 Electric Road.

III.

(*Continued from* STREET RAILWAY JOURNAL *for August.*)

Drawing his inspiration from Census Bulletin No. 55, that admirable treatise on "*The Relative Economy of Cable, Electric and Animal Motive Power for Street Railways*," the writer in *Engineering Magazine* for May, 1892, whom I have before quoted, says: "No one would think for a moment of building a cable road if a franchise could be obtained for a trolley road, as they cannot carry any more people, route for route, than the electric road, and cost nearly ten times as much to build." This article is, throughout, so excellent a specimen of the current literature of this subject that I shall quote it frequently.

My July letter said, "for the small business now done by the cheap, half-built electric road with its occasional car, the cable system cannot compete; for a cable railway business the cost of a cable road is not ten times, or five times, or two times, or one and a half times the cost of an electric road."

The statement that a cable road cannot carry any more people than an electric road "route for route" is obscure. But our magazine writer—not content with making ten bills out of the seven he found wrapped up in his copy of the Bulletin—seems to imply that the cable road equipped with nineteen cars, of which about 30 per cent. are eight-wheel cars, "cannot carry any more people" than the electric road with 2.93 four-wheel cars, per mile of line.

It is safe, however, to say that a given business requires fully as many electric as cable cars.

And when we compare the $46,000 electric with the $350,000 cable road (which cost less than $217,000) it is well to remember that *the cost of an electric road bears a rather close relation to the number of its cars.*

Mr. F. L. Pope says in the STREET RAILWAY JOURNAL for February, 1891, "The whole outfit, *exclusive of roadbed, track and buildings*, for either system [overhead or storage] will aggregate perhaps $10,000 *per car.*"

The president of the West End Street Railway, addressing the Commercial Club of Providence, in May last, said, "* * * to provide this means of transportation it is necessary for some one to put in $10,000 for every *car.*"

In my July letter I said, "If we add fifteen or eighteen cars to the three [of the $46,000 electric road] an added investment of $150,000 per mile is necessary; not for the cars alone, but for the cars and what is necessary to run them."

The last two statements probably fall short of the truth in the premises, but neglecting the dollars for a while, and bearing in mind the principle, it is well to get a clear idea now of what the electric road of to-day really is as to its equipment and its capacity for business; and I want to emphasize the fact that the road everywhere compared with the cable railways so fearfully and wonderfully misrepresented in Census Bulletin No. 55, is a thing of three cars or less per mile of line.

Here are figures picked up at random:

THE ELECTRIC RAILROAD—ITS CARS PER MILE.

	Miles.	Cars.	Cars per Mile.
In 1888, *The Car*, Dec., 1891	48	95	2.00
" 1889, 26 Cities, *Railroad & Engineering Journal*, Oct., '89	380	538	1.40
" 1889, *Street Railway Gazette*, June, '89	592	966	1.62
" 1890, *New York Times*, April, '90	1,260	2,000	1.59
" 1891, *The Car*, Dec., '91	3,000	4,513	1.50
" 1891, New Mileage, *Street Railway Journal*, April, '92	1,538	3,300	2.15
" 1892, *Philadelphia Pamphlet*, March, '92	4,062	7,181	1.77
" 1892, *Street Railway Journal*, April, '92	4,061	8,892	2.19

It matters little whether the "miles" above are miles of line or miles of track; the difference in the case of the electric road, on large averages is probably less than 15 per cent. Wherever you find it the electric road is equipped for a very light business.

And moreover it is always this attenuated thing in the minds of those connected with the electric interest.

Mr. C. J. Field, in an estimate given in the STREET RAILWAY JOURNAL for October, 1891, proposes to take a street railway in a city of 100,000 inhabitants, and to equip it electrically "with forty miles of single track and sixty-five electric cars."

From the examination of a prominent electric railway man, before a committee in Philadelphia last March, I extract this:

Q. How many miles under this contract are to be covered in Brooklyn, and how many cars?

A. I do not know the number of miles, but six hundred cars.

Q. How many miles approximately?

A. *They run, say, three cars to the mile, and that, roughly, would be two hundred miles.*

Illustrations might be multiplied; this general impression is well supported by the facts.

Further than this, it may be said, there is probably *no where in existence* an electric road, the steam plant, electrical equipment, wiring and rolling stock of which are equal to *one-third* of the 1,242 "standard car"-miles of the average cable road of the Bulletin; while among cable roads we find such business as 2,000, 2,200 and 2,500 car miles per mile of line per day, not for exceptional days, but for yearly averages.

If there is as heavy an electric business anywhere else as that of the West End, of Boston, I do not know of it, and from such imperfect data as I can find I *estimate* the average West End business for the year ending September 30th, 1891, at about 300 car miles per mile of line (electrically equipped) per day, or allowing for long cars in use (and counting four wheels to the "standard car"), at about 375 "standard car"-miles.

It may be said, incidentally, that the West End Street Railway is not one of the "$46,000" electric roads. When finished, it will probably be found in a class by itself; and I doubt not that it will illustrate this truth: *The cost of an electric road bears a close relation to the number of its cars.*

Let us now add this: "*The cost of a cable road is better measured by its length.*"

Though these assumptions are not strictly true, they are so far consistent with the facts that a little study of the subject shows the electric to have a decided advantage on one end of the scale of business, and the cable road on the other.

It is admitted again that because of the cost, a cable road should not be built for 177 car miles per mile of line per day, or for a traffic that may be handled by single four-wheel cars on thirteen minutes' headway. Don't build a steam hammer to crack nuts; there are better ways of cracking nuts.

But I venture to predict that by the time *any* trolley road has reached *half* the business done by the *average* cable railway of this country, the writer quoted at the head of this letter will have had it forced upon him that, for a cable railway business, the cost of a cable road is not even one and a half times the cost of an electric road.

A glance towards Boston, or Brooklyn, ought to suggest this to observant people. The president of the great Boston system said, in May last, "The West End Railway has expended $9,000,000 and it is not quite finished yet [very truly]. * * * The company will have 1,000 cars [it had perhaps 550 of them at this time, electrically equipped]. * * It will cost the company upwards of $3,000,000 to get the power to drive the cars around," and so on. And the STREET RAILWAY JOURNAL, for June, tells us that the power house at Harrison Street and Albany Avenue will contain engines of 26,000 H. P., and the one now building at Cambridge 5,000 H. P. more; and these together be 31,000 H. P. The same Journal of Education informs us, by the by, that the total amount of copper purchased by the West End Company "*during the last three months* of 1891, in the shape of feed wire, trolley

wire, bonds, etc., aggregated a million and a quarter pounds." (Worth about fifteen cents a pound; but whether this is Information or Misinformation I cannot guess). An occasional glance at Boston or at Brooklyn, will dispel this popular $46,000 electric delusion.

From auditors' books I get details of the cost of sixteen miles of the cable railways included in Census Bulletin No. 55—parts of the systems of two companies. The figures were taken when the lines had been in operation about six months. From this sixteen miles of road an average mile is made, which is given below for the cable side of the table. In a parallel column is exhibited the *estimated* cost of corresponding details for an electric road, *similarly equipped, in the same place, at the same prices.*

On the cable side I have omitted only the estimated value of the old Horse Railroad property; but as the auditors' *distribution* of the disbursements was sometimes most *unprincipled*, from our point of view, I have to some extent reformed the records, leaving marks, generally, of the operation in the round numbers which will be noticed in the column on the left. This process I have carried far enough, perhaps (and not too far, I hope), for present purposes. Not a dollar of the *total* has "got away," which is an important thing.

In the electric side I admit a lack of entire confidence in details and total. Some critic will, perhaps, show us how to reduce the latter by 90, or 80, or 50, or 33 per cent. without a corresponding reduction of the cable side.

Of the sixteen and one-half miles of double track cable road, from which the average mile below was obtained, these details will be of interest:

Curvature in tracks, 111 degs. of double track curvature per mile of double track.

Length of curved track, about 133 ft. per mile of line.

Power houses, four, or one to four miles.

Cables, eight, of an average length of about 22,600 ft.

In their steam plant these cable roads are equipped for an *average* of 2,000 car miles per mile of line per day; and by this I mean that with 50 per cent. of their engines and 33 per cent. of their boilers in reserve, the engines using steam at eighty pounds, cut off at one-fifth of the stroke, have a nominal horse power equal to the *average* power required on these roads for this car mileage, made in twenty hours at an average car speed of eight miles per hour, including stops. (When we consider the possibilities of such a steam plant, with steam run up to, say, 125 lbs., it is obvious that these roads were heavily overloaded in this respect for the business and the car equipment with which they started out. This is the rule rather than the exception on cable roads, but who ever yet has seen an electric road with any such provision for future growth, with anything whatever in reserve for an extraordinary demand?)

I have endeavored to similarly equip the electric road, as to its steam plant, its electric plant and its wiring, with, however, a smaller reserve in the power plant.

Our two roads being now near enough alike for comparison, we find them to be, in cost, about 5 per cent. apart; and if we bring the rolling stock in each case up to the capacity of the power plant for an *average* day's work of 2,000 car miles (bearing in mind, what seems to be often overlooked, that the "average" can never equal the maximum), we shall not yet be equipped for the business of, let us say, the Olive Street line of St. Louis, but the difference in the cost of the two systems will have entirely disappeared.

In my next letter some concessions will be made in connection with this exhibit, which will impress the reader with my liberality; and taking up the *financial* aspect of the case, I expect to show how easy it is to be liberal when you stand on a cable railway business.

Incidentally, I would note that the $5,000,000 worth of

COMPARATIVE ESTIMATE, ONE MILE OF DOUBLE TRACK.

The Cable Road. [From Auditors' Books.]		The Electric Road. [An estimate for a road of like capacity.]	
Ground for Buildings, and Right of Way	$13,343	Ground for Buildings, and Right of Way	$13,343
Buildings, exclusive of machinery foundations and of Main Vault	20,552	Buildings, exclusive of machinery foundations	20,552
Foundations for Steam Plant and Winding Machinery.	2,400	Foundations for Steam Plant and Generators	2,400
Engines, erected, exclusive of foundations	4,396	Engines, erected, exclusive of foundations	16,000
Boilers and Appurtenances, exclusive of foundations	3,794	Boilers and Appurtenances, exclusive of foundations	
Winding Machinery	6,511	Electrical Equipment of Power House	13,000
Tension Carriages	595		
Other Machinery	422	Other Machinery	422
Electric Light Plant	209	Electric Light Plant	100
Shop Tools and Supplies	1,191	Shop Tools and Supplies	4,000
Main Vault	1,200		
Excavation	6,568	Excavation, 20 inches deep	3,500
Concrete and Brickwork	31,148	Broken Stone Ballast, 12 inches deep	4,200
Wheel Rail (Mostly 58 to 60 lbs. Girder, at $50 to $55),	9,350	Wheel Rails	9,350
Slot Rail and Paving Plates	10,892	Tie Rods (5 ft. apart)	1,300
Curved Rails	1,600	Curved Rails?	800
Switches, Crossings, etc.	1,610	Switches, Crossings, etc. (track)	500
Yokes	15,276	Ties (2 ft. apart)	2,500
Manhole Castings	1,600	Chairs	4,000
Bolts and Fastenings	4,150	Spikes, Joints and Brackets (on curves)	1,000
Line Machinery	3,739	Bonding, Materials and Labor	1,500
Track Laying	5,062	Track Laying	2,000
Paving	18,729	Paving	20,000
Drains	2,410	Subsoil Drains, connected with sewers	200
Cables	3,410	Poles	3,200
Gas and Water Changes	3,381	Trolley, Feed and Guard Wires (trolley switches, etc.)	4,000
Bridges and Viaducts	11,122	Bridges and Viaducts	15,000
Patent Licenses	1,318		
Engineering	4,922	Engineering	4,000
Rolling Stock (cars, grips, sweepers, etc.)	15,101	Rolling Stock (9 motor cars, 7 trailers, sweepers, etc.)	43,000
Legal	524	Legal	524
General Expense	1,996	General Expense	1,996
Miscellaneous Expense	900	Miscellaneous Expense	900
Insurance	23	Insurance	23
Damages	368	Damages	368
Taxes	47	Taxes	47
Discount, Interest and Commission on Bonds	12,659	Discount, Interest and Commission on Bonds	12,659
Cost of Securing Franchise	1,246	Cost of Securing Franchise	1,246
Grading Streets	1,722	Grading Streets	1,722
Total, so far	$225,486	Total so far	$209,352
Old Horse R. R., *say*	124,838.60	Old Horse R. R., *say*	124,838.60
Grand Total	$350,324.60	Grand Total	$334,190.60

"new stock" of a certain street railway, quoted at $194 per share in my last letter, is now selling at $255. "It is," indeed, "a healthy sort of a system," etc.

CABLE RAILWAYS.

(*To be continued.*)

Fare Taking in Europe.

The system of proportioning street car fares to the distance traveled by passengers is very popular abroad, and has been adopted on the street railway lines in practically all of the large European cities except Paris. Most of the lines also provide first and second class accommodations for passengers, with corresponding rates of fare, and this is done by the Paris lines, so that on a comparatively short road in Europe there may be five or six different rates in vogue depending on the distance traveled and the style in which each passenger wishes transportation. This practice is due largely to the rigid economy in regard to small expenditures practiced by many classes abroad, which would induce many of the short distance passengers to walk in preference to spending the amount required if a uniform fare of, say, five cents were in vogue. But while the lowest charges on European street lines are less than five cents, the charges for long distances are generally considerably in excess of the American standard fare, so that a fair return is given for the capital invested in nearly every case in spite of the arduous conditions



FIG. 1.

often imposed and the antiquated methods of operation. Indeed, under the conditions, it is doubtful whether many of the lines which now show a good profit over operating expenses would be able to exist with the system of a uniform charge for transportation.

Various methods are employed in the collection of fares, and this item has not proved so difficult as at first thought might seem. The street railway line is first divided into sections or zones of from three-quarters of a mile to two miles in length, and the minimum fare is for transportation within one section, the next higher rate for travelers through two sections, and the third or maximum, if three rates only are charged, through three or more sections.

A passenger upon boarding a car informs the conduct-



FIG. 2.

or of the distance which he wishes to travel, and then upon payment of his fare receives a fare receipt upon which is indicated the amount paid and the point at which he got on. The form of fare receipt adopted by the Great Berlin Horse Railway Co. is shown in Fig. 1. The O under section four indicates that the ticket was punched by the conductor and thereby the point of departure was recorded. Fig. 2 shows that employed by the Naples Tramway Co. The conductors on this line, however, tear the receipt or ticket at the proper point, instead of punching it. The receipt used by the Dublin Tramways Co. for 3d fares is shown in Fig. 3.

These receipts must be retained by the passengers and shown upon demand to any inspector of the railway company who may board the car. As these inspectors are not stationed at special points, but may get on a car at any time, the ticket must be always ready as evidence that the fare has been properly paid. Different classes of tickets are often distinguished by being printed on different colored paper.

Each receipt is numbered, and each has also the private mark of the railway company, so that old receipts cannot be secured by the conductors or saved by passengers for use a second time. As an additional precaution against fraud, the tickets are printed on long strips, or are pasted in blocks so that a ticket must be torn off in presence of the passenger. As the number assigned to each conductor upon starting out is recorded in the office of the company, the proper amount of receipts can be determined by the number of unused tickets turned in at the end of the day.

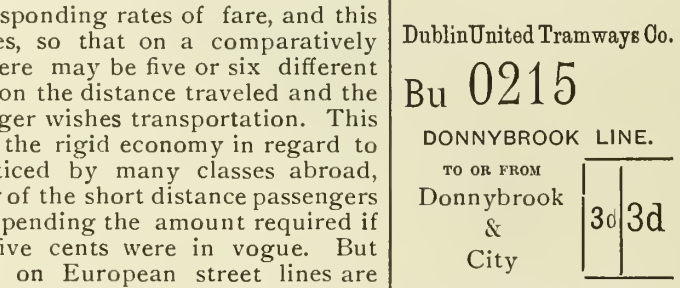


FIG. 3.

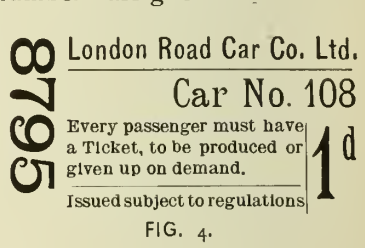


FIG. 4.

Upon the reverse side of the tickets is sometimes printed some local advertisement, and the income from this source, not only often defrays the cost of printing, but is of itself sometimes an item of considerable income.

The system of fare receipts is not only used for lines on which different rates of fare are charged, but it is also in force on many omnibus lines and short street railway lines which have a uniform fare. The form used by the London Road Car Co. is shown in Fig. 4.

A Street Railway for Sale.

The Fidelity Trust and Safety Vault Co., of Louisville, Ky., trustee for the mortgage bondholders of the Mobile (Ala.) Street Railway Co., has offered the rights, franchises and property of that company for sale under the deed of trust. The property includes a total mileage equivalent to twenty and five-eighths miles of single track, with switches turnouts, etc., and the right of equipping the line with electric power. The sale will occur in front of the Court House at Mobile on November 14.

Electric Traction Abroad.

The Corporation Tramways Committee of Glasgow, Scotland, has invited estimates for the equipment of certain of the street railway routes in that city on the overhead wire system. Communications should be addressed to the general manager of the committee, John Young, City Chambers, Glasgow.

Meeting of the Ohio Street Railway Association.

The next annual meeting of the Ohio State Street Railway Association occurs this month at Zanesville, O. The date is Nov. 9, and a large attendance is expected.

IN conversation with Mr. J. W. McNamara, of Albany, we learn that the Lewis & Fowler girder rail, which was laid on State Street two years ago, is standing up remarkably well under the electric car traffic.

Philadelphia Electric Railway System.

As already stated in the STREET RAILWAY JOURNAL, the plans of the electric railway system of the Philadelphia Traction Co., in that city, have been decided upon, and the work of installation is now being carried forward by the Field Engineering Co., of New York.

The first station to be built will be located at the corner of Kansas Street and Sutherland Avenue (see Figs. 1 and 2). The steam plant here will consist of six horizontal, return tubular, steel boilers, seventy-two inches in diameter and twenty feet long. These boilers are designed for 100 lbs. steam pressure, and are fitted with domes and set in two batteries of three boilers each. The longitudinal seams are triple riveted and the joints double butt strapped. Each battery is furnished with full cast fronts, and the boilers are so set that the gases are returned over their tops, the setting being arranged with covering bars forming a flue over the top of the shell for this purpose. The brick flue for carrying gases from the boilers to the stack is placed at the rear of the boilers, and adjacent to the cross wall between the engine and boiler rooms. The boilers are fed by means of two No. 10 Monitor injectors and two Snow duplex feed pumps, 8×6×10 ins.

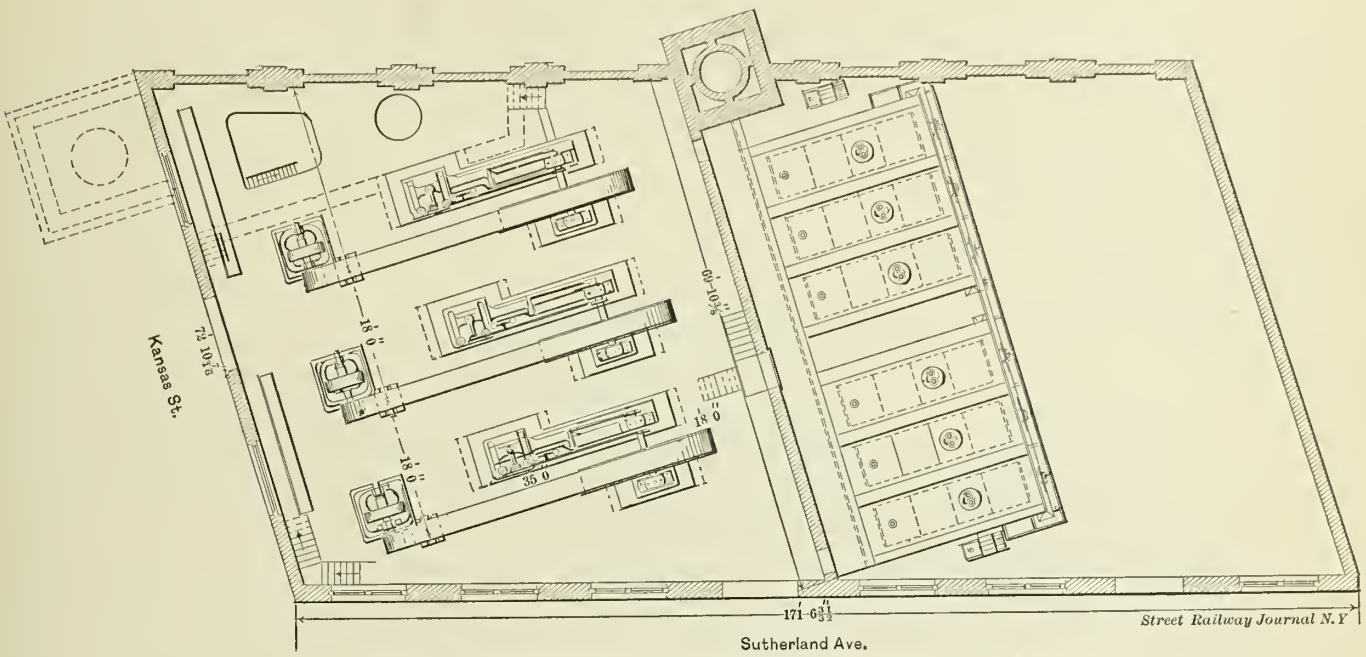


FIG. 1.—PLAN OF POWER STATION FOR PHILADELPHIA TRACTION CO.'S SYSTEM.

The engines are three in number, of 250 H. P. each, and of the horizontal, single cylinder, Corliss type, with all the latest improvements. The plan is to operate the engines at present non-condensing, but all arrangements have been made to enable the plant to be run condensing at any future date. The engine cylinders are twenty-two inches in diameter by forty-eight inches stroke. The flywheels are eighteen feet in diameter by thirty-four inches face, are made in eight segments, and have a total weight of 29,000 lbs. The crank shafts are hammered wrought iron, and provided with babbited main bearings. Both engines and boilers were furnished by Robert Wetherill & Co., of Chester, Pa., who are also the manufacturers of the feed water heater, which is of the water tube type.

The stack has an internal diameter of six feet, is 125 ft. high, and is made of wrought iron, lined with brick work for a distance of about forty feet from the base. The iron work of the chimney is supported on cast iron plates securely bolted to the brick base of the chimney, which latter also forms a portion of the side walls of the building by means of foundation bolts. The stack is made self supporting by means of wrought iron tie rods, which are secured at the base directly to the foundation bolts.

The steam piping is so arranged that any boiler may be connected with any engine, or *vice versa*, so that the liability of a shut down from repairs to the steam pipe system is avoided. The piping consists of one twelve inch main, which is carried under the engine room floor and has connecting branches to both engines and boilers, the branch pipes being connected to the main by means of two twelve inch valves. All piping made of wrought iron pipe is screwed into cast iron flanges, and is thoroughly caulked on the inside. All valves have steam metal seats with extra heavy shells, and were furnished by the Chapman Valve Co. The exhaust piping is so arranged that the heater can be cut out if necessary, without inconveniencing the operation of the plant. Coal can be delivered direct to the boiler room by means of teams.

The generating plant consists of three four-pole Westinghouse railway generators, of 186 K. W. capacity, and running at 525 revolutions. Power is transmitted from the engine by means of a thirty-two inch belt running over a stationary idler as shown in Fig. 2. The generators have each four brushes which rest on a commutator of ninety-five sections and seventeen inches diameter. The diameter of the shaft is four and a half inches. The series winding of the field magnets is arranged four in parallel and the shunt fields are connected in series. The commutator bars are all made of Eureka copper.

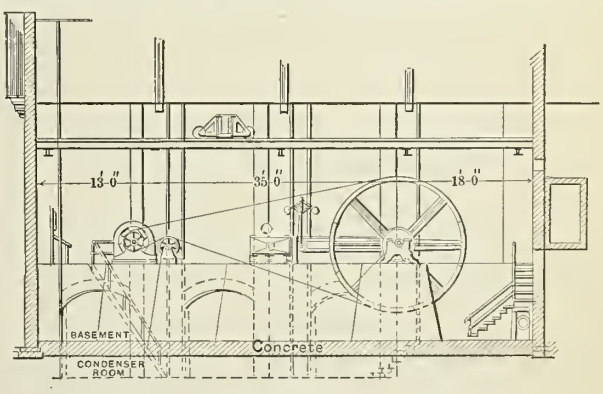


FIG. 2.—ARRANGEMENT OF ENGINES AND GENERATORS—PHILADELPHIA.

The generators are connected to a vertical switchboard built up of angle iron, to which are attached all the necessary ampere meters, automatic cut-outs, controlling switches, rheostats, etc., mounted on marble bases. This construction makes the board fireproof and very substantial. The feeder wires running from the board are conducted to a vault under the street, where connections are made with the underground feeder system.

The underground system adopted is the well known cement lined pipe set in concrete. The duct from the

station consists of eight pipes of three inches internal diameter, laid two feet deep and intended each to carry

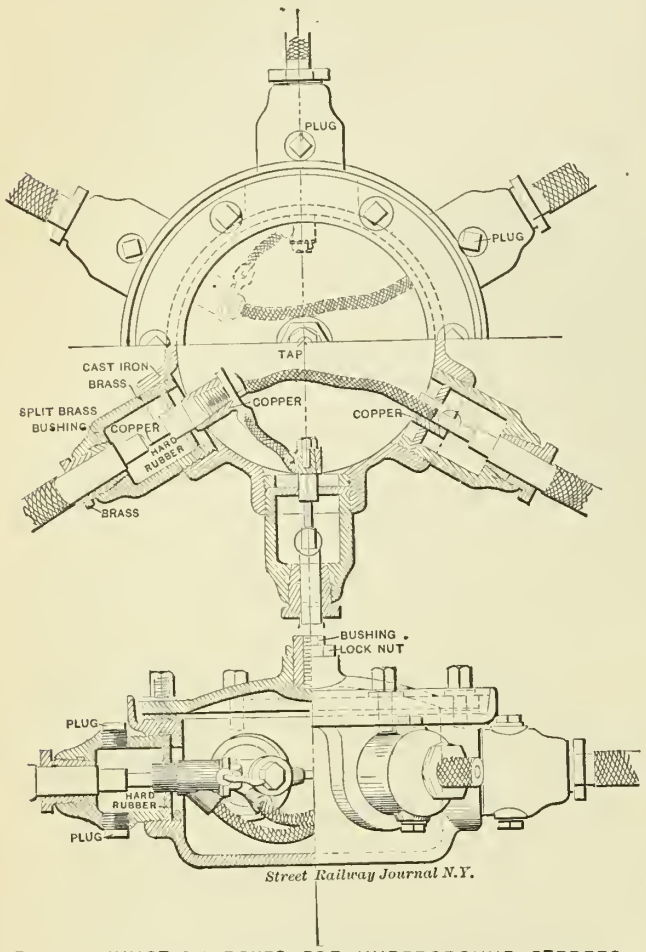


FIG. 3.—JUNCTION BOXES FOR UNDERGROUND FEEDERS—PHILADELPHIA.

two No. 0000 lead covered cables. Manholes are placed at suitable distances to enable careful and efficient handling of the wires, and also for dividing the line into sections for testing and disconnecting any defective part. The manholes are equipped with cast iron covers and water tight plates.

The junction box adopted is shown in Fig. 3 and has proved very efficient under severe service in other places. Connection is made to the line from the manhole through the inside of the nearest side pole, a special pole top being designed for necessary connections to the insulated span wire at this point.

The overhead construction is single track span wire with iron side poles. The side poles are twenty-eight feet in length, of six inch, five inch and four inch sections, extra heavy pipe, built up with telescope joints eighteen inches long. These poles are set in five and a half feet of concrete made up of the best Portland cement, sand and broken stone.

The span wire is No. 3 B. & S. silicon bronze wire, and attached to poles by means of the "Brooklyn" insulated turnbuckle. Double insulation is secured by the use of this insulator, and also by a round top bell insulator of moulded mica.

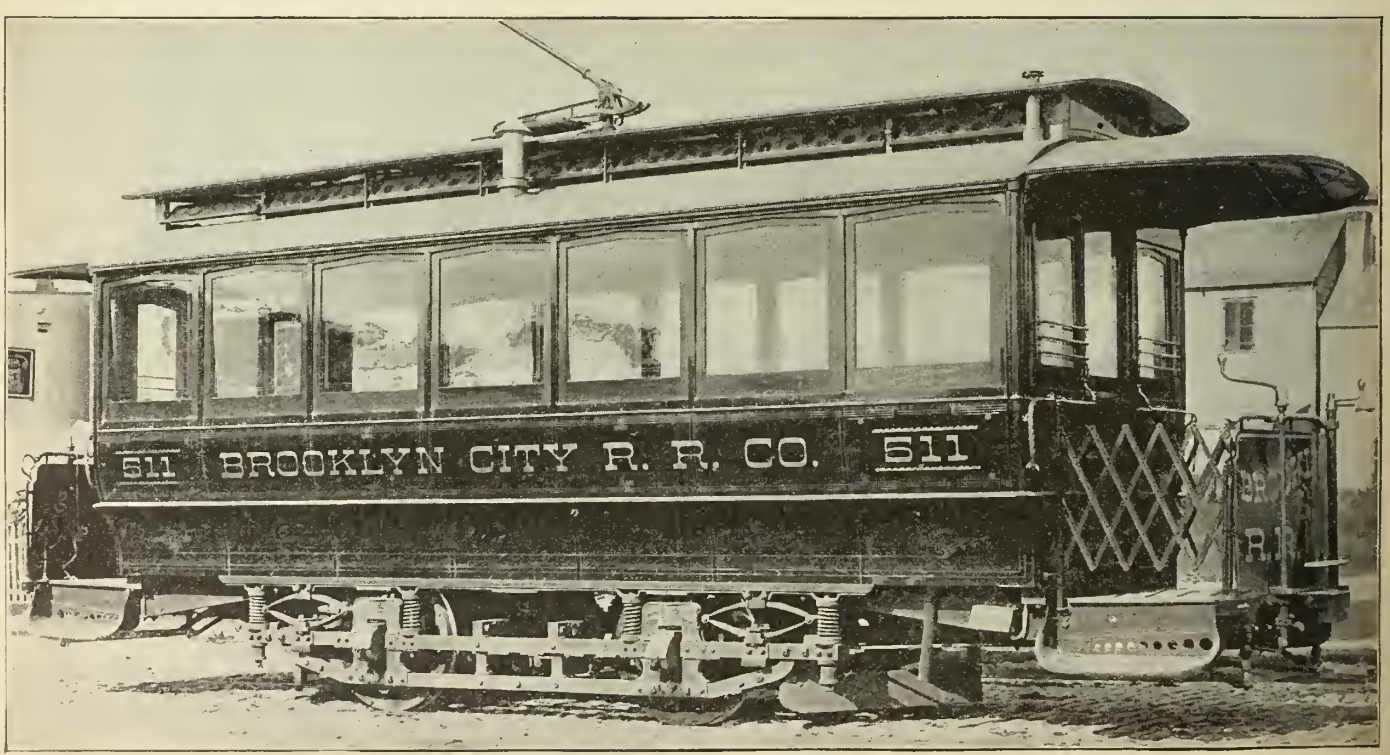
The trolley wire is No. 0 B. & S. hard drawn copper attached to insulator by soldered clips. To protect the trolley wire from other lines, two No. 6 B. & S. silicon bronze guard wires about three feet apart are used. All feed wires and mains are underground, the only wire overhead being those mentioned. The trolley line is divided into sections, each section being under direct control from station, and the wiring is so arranged that should should one feeder require overhauling, another can be placed in service.

This line is now supplied with current from the temporary power station of the Brooklyn City Railway, at the foot of 52d Street.

Car and Truck, Brooklyn City Railway.

The accompany engraving shows one of the new electric cars built for the Brooklyn City Railway Co. of Brooklyn, N. Y., and in use on the Hamilton Avenue division of that railway. The car body has a length of twenty feet, while the length over all of the car is thirty feet five inches.

The truck shown is one built by the Peckham Motor Truck & Wheel Co., of Kingston, N. Y., and entitled by the manufacturers the "5 A" type. An extended description of this truck was given in our last issue. The manufacturers of the car body were the Lewis & Fowler Manufacturing Co., of Brooklyn, N. Y.



ELECTRIC CAR—BROOKLYN CITY RAILWAY.

The Milwaukee Street Railway System.

Of the cities on the edge of the great West, Milwaukee may justly be said to be one of the foremost. Its progress may not have been so rocket-like as has been that of some other Western cities, but, built on a firm foundation and peopled with a slowly but surely progressive population, it has attained to a solidity and opulence which entitle it to rank as a shining gem in the eastern fringe of the West. With a speed relatively slow when compared with that which has marked the growth of Chicago, Milwaukee has spread out its streets and thoroughfares to meet the ever increasing demands of a growing population, and already has quite a respectable congregation of suburbs, as befits a city metropolitan in its territory. The German immigration to Milwaukee has been of the better kind, and it counts among its naturalized children many a philosopher and many sturdy merchant, who, weary of kingly and imperial exactions and procedures in the Fatherland, have come hither, bringing their knowledge and business instincts and desires to the development of the Cream City. This element, joined to the go-aheadiveness and adaptability of the modern American, working together, have given to Milwaukee a pre-eminence of which she is worthy and in which she takes justifiable pride.

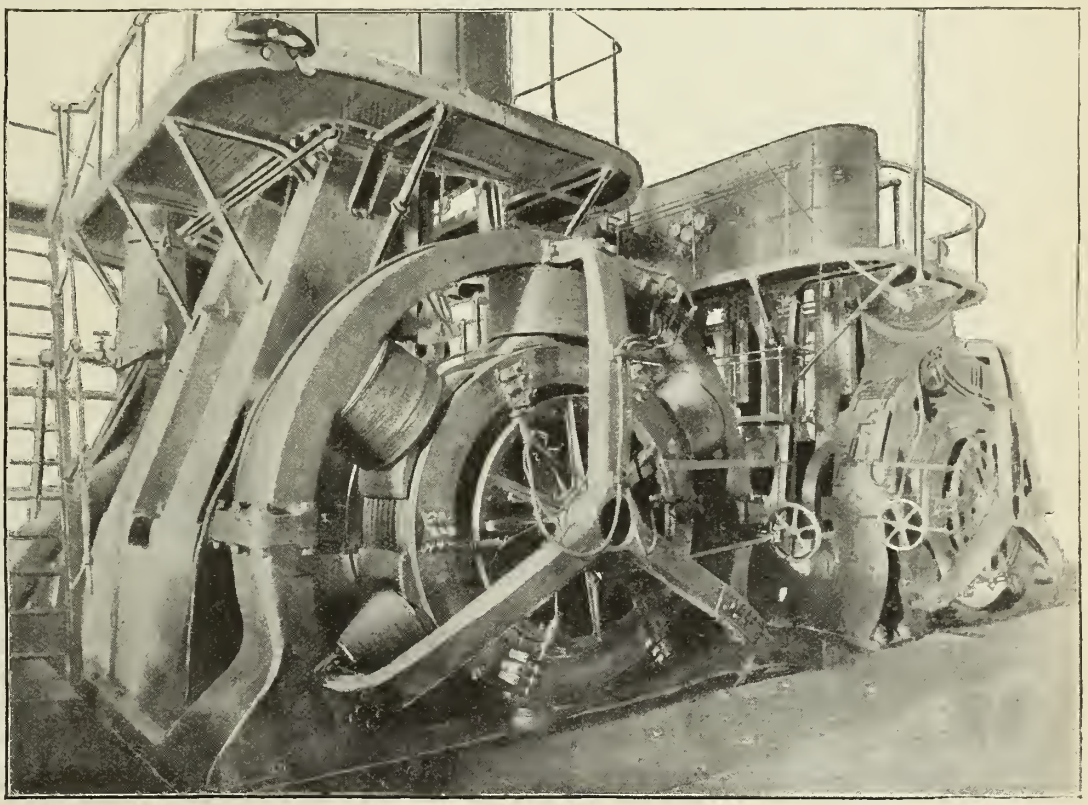


FIG. 1.—MULTIPOLAR ELECTRIC RAILWAY GENERATORS—CENTRAL STATION, MILWAUKEE.

Such a city could not long refuse to itself the blessings of rapid transit which New York City is still reluctant to adopt. The various horse car systems soon became far too antiquated for this Western city. Having tolerated them for many years, owing to the lack of alternative, it has suddenly set aside all objections, and, having chosen the trolley system, has now reason to bless it for the many benefits which its adoption has already conferred and is still conferring. The electrical installation there comprises all the latest known expedients for utilizing electrical power most advantageously, and is a monument to the progress made in the science of electricity as applied to commercial uses.

A short history of the early efforts of the Milwaukeans towards a satisfactory solution of the problem of the transportation of the city's inhabitants shows that they followed the usual beaten track, and that each new extension has been the work of private initiative prompted by the sharp commercial instinctive desire for more of the almighty dollar.

In 1859 the River & Lake Shore Co. was formed, with a capital stock of $50,000, to operate horse cars in the streets of Milwaukee. This line was opened in May, 1860, its extent being a track about two miles long, and was the first street railway company in that city. Its rolling stock consisted of four bobtail cars. This road was taken over after about ten years by the Milwaukee City Railroad Co., organized with a capital of $100,000, and a number of extensions were made. In 1869 the road changed hands again, and this step was followed by still further improvements and extensions, and in 1881 Peter McGeogh became owner. Under his management the line rapidly developed, and in 1888 he sold out to New York capitalists for $1,500,000, who in turn made it over to the present syndicate in August, 1890. It operated fifty-four cars regularly of the 103 owned, and owned 650 horses and sixty mules, with nineteen miles of double track.

1874 saw the creation of two other roads—the Cream City road and the West Side road. The former began operation in 1875 and was sold to a Pittsburgh syndicate in April, 1890, which, in August of the same year, yielded possession to the present owners for a consideration of $850,000, netting about $75,000 profit by the deal. Of its eighty-four cars it operated forty-four daily. Its ten and a half miles of double track was in a deplorable condition, in some parts being unfit even for horse service.

The West Side road was formed to operate cars in the west side of the city. It secured further valuable franchises in 1876, 1879 and 1880, and ran its course for another ten years when, in August, 1890, it was also absorbed. Electricity has since been its motive power. In 1888 Milwaukee began to tire of its horse cars. Two enterprising citizens, Messrs. Hinsey and Hinckley, saw that a cable line might be a valuable substitute, and secured a municipal authorization to lay cable lines over the whole city. This plan was, however, abandoned before it was put into execution, and, in 1890, authority was granted by the City Council to use electricity. Electricity was put in, but the road nearly failed, the question of finance proving one over which the partners could not agree. Matters were settled by selling out, and the streets allotted to the Hinsey company, but not occupied, were now taken in hand by the White Fish Bay Co. This line was consolidated with the Hinsey line in 1890, and in the same year, with the various other roads, was consolidated by the Villard syndicate into the Milwaukee Consolidated Street Railway Co.

The Villard people did not take hold of the transit system of Milwaukee with any intention of mincing matters. They boldly avowed their intention of using electricity, and started at once to make the installation. To the Edison General Electric Co., which has been merged into the General Electric Co., the electrical installation was confided, and it is not too much to say that it has skillfully performed the task entrusted to it. The task undertaken was one not entirely devoid of difficulties,

both from an electrical and constructural standpoint. The paving of the streets left much to be desired, and despite the appeals of residents, streets badly paved were left so by the city authorities. The track had also to be entirely relayed and several drawbridges crossed.

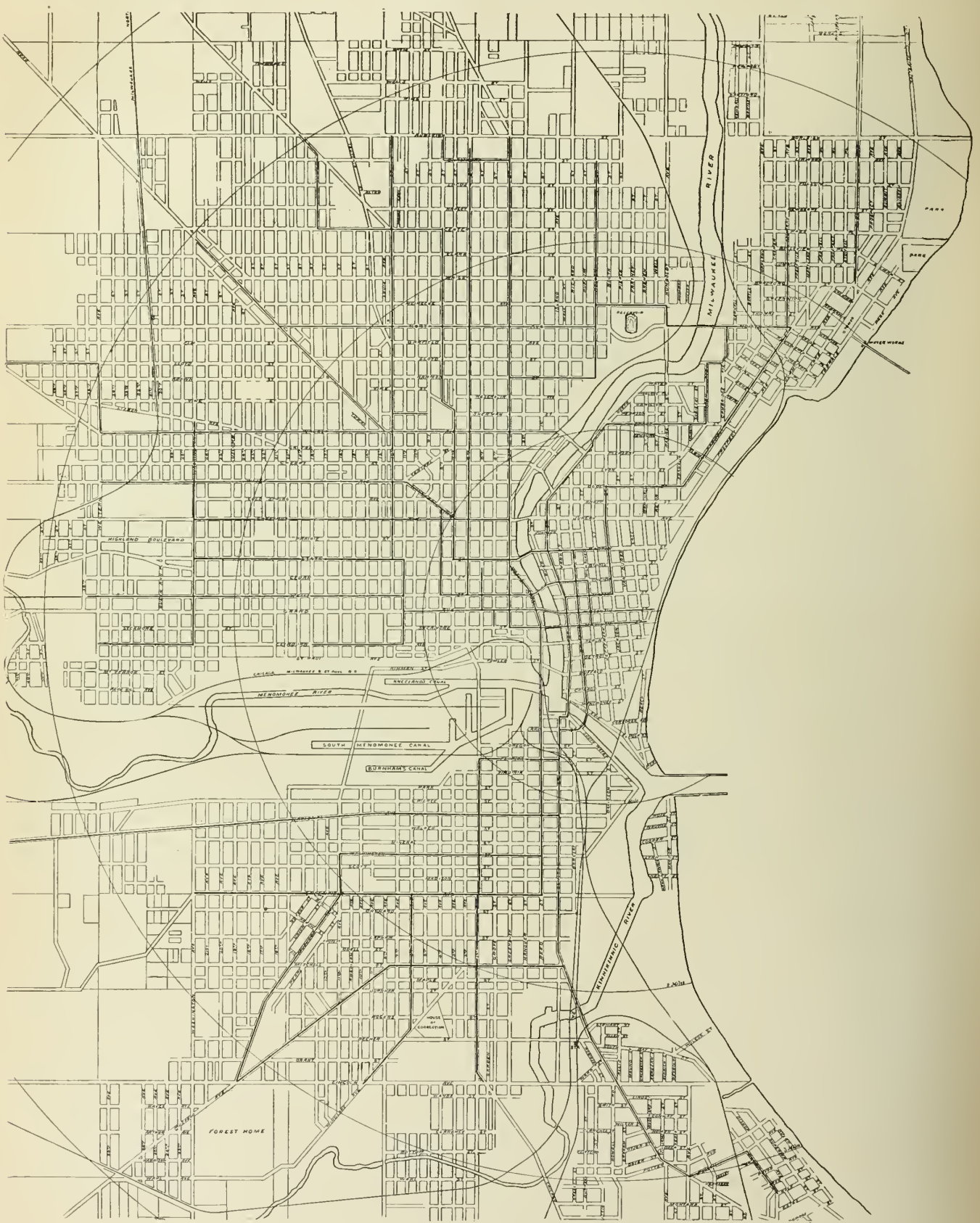


FIG. 2.—MAP OF MILWAUKEE, SHOWING STREET RAILWAY SYSTEM.

The power house is situated on the west side of the Milwaukee River between Oneida and Biddle Streets and fronts on River Street. It is a two story, fireproof, brick building, having a frontage of 100 ft. and a depth of about 115 ft. From this, two stacks, both 125 ft. high, shoot upward, one in the front and one in the rear. Through the center of the ground floor runs a substantial wall, thirty feet high, dividing the engine room from the boiler room. This boiler room (Fig. 6) has space for two tiers of boilers, the second tier at the present time being installed. The battery now consists of nine, internally fired, Galloway boilers, built by the Edgemoor Iron Works of Wilmington, Del. They are each twenty feet long and seven feet in diameter, and have a horse power of 350 each under 160 lbs. pressure. Space is left for a second tier of

nine boilers. These will be set as occasion arises. The steam from these boilers is fed into the two main headers, running along the wall of the engine room. These are sixty feet long and have a diameter of sixteen inches. The subheaders of twelve inch pipe run from these along the ceiling of the engine room, and the steam is fed from there by five inch steam pipes to the engines.

The engines (Fig. 1) for supplying power to the street railway of which five are at present in place, are of the standard triple expansion, vertical type, were designed by the Edison General Electric Co., and built by J. Morton Pool, of Wilmington, Del., and each runs two 200 K. W., multipolar generators. They have satisfactorily answered the purpose for which they were designed, and seem to prove correct the General Electric Co.'s surmise that the compact steamship type of engine was especially adaptable to electric power or light work. The cylinders are 16½, 23⅞ and 38½ ins. in diameter, and have a stroke of 30 ins. under a steam pressure of 160 lbs. They stand twenty-one feet high.

The engines for the electrical light work (Fig. 3) are situated on the second floor. These will consist of sixteen triple expansion engines,each running two 100 K. W., multipolar dynamos. One of these, having cylinders 11⅞, 17½ and 28¼ in. bore with a 21 in. stroke at 160 lbs., is already in place. It is at present supplemented by a temporary plant of two fifty kilo-watt, multipolar generators, two No. 20 and four No. 60 standard General Electric Co 's bipolar machines. Five surface Wheeler condensers, and four Blake combined air and circulating pumps, are comprised in the condensing plant under the main engine floor, for railway work only. The four feed pumps supply the engines from the hot wells. One condenser of 1,000 H. P., two air pumps and two circulating pumps comprise the condensing plant for the electric light work.

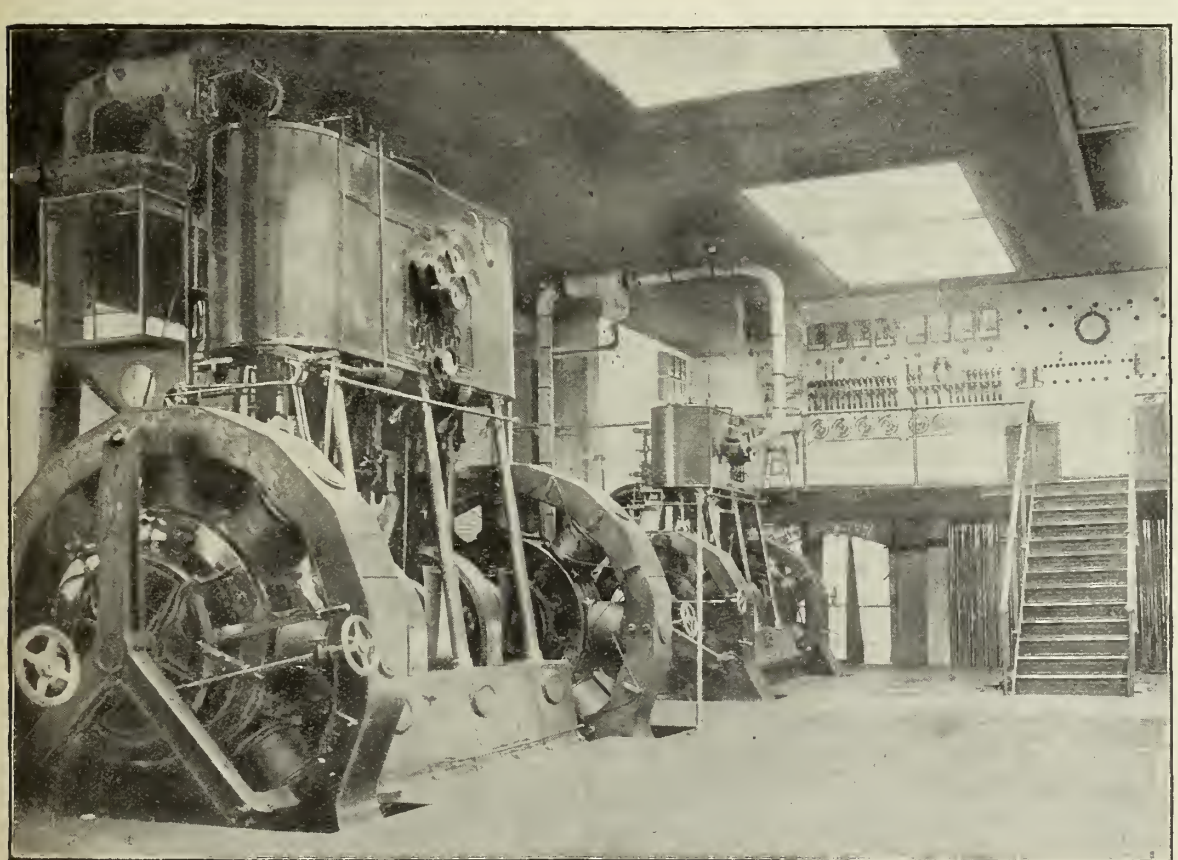
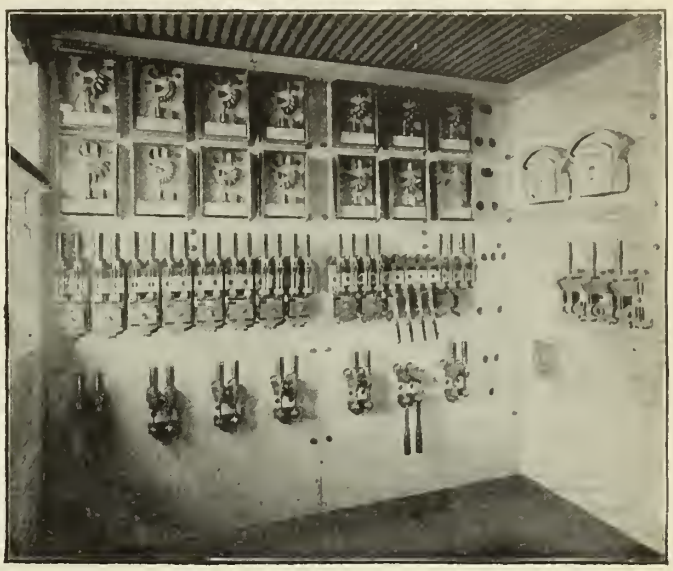


FIG. 3.—MULTIPOLAR ELECTRIC LIGHT GENERATOR AND SECTION OF SWITCHBOARD—CENTRAL STATION, MILWAUKEE.

Between the boiler and feed pumps are the necessary grease extractors of Wass type; and the exhaust and steam pipe of each engine is furnished with grease extractors and separators of the De Ryke make.

In the multipolar generators for the railway work are embodied all the latest improvements. It is the first time that generators of this type have been used for street railway work, and the fact that they have been adopted as against other types is worthy of record. The wound spools of the magnet fields are bolted inside the exterior polygonal frame, the interior surface of each core being



FI . 4.—ELECTRIC RAILWAY SWITCHBOARD—MILWAUKEE.

turned true, so as to present a perfectly true face to the armature. The latter is of the Gramme ring type. The winding consists of a series of U shaped copper bars slipped over a brass spider frame, and having their exterior ends connected by a second bar. Each of these is properly insulated, and when everything in the armature is in place the exterior surface is planed to a perfect level. The brushes rest on this surface which thus forms a perfect commutator.

A cast iron spider carries the brush holders. These are so arranged that by the manipulation of a small hand wheel on a shaft of a worm gear, a simultaneous adjustment of the brushes can be secured. Iron centers are double keyed directly to the shaft of the engine. The normal speed is 120 revolutions per minute for the 2 × 200 K. W. generators and 170 revolutions per minute for the 2 × 100 K. W. generators.

The feeder system as applied under the patents of the General Electric Co. has been adopted throughout for the distribution of the electric current from the station to the main lines of the street railway. These feeders are composed of the Edison tubing laid underground throughout the system as needed, and through junction boxes, and connected to the overhead mains by flexible cables.

The railway switchboard, shown in Fig. 4 in the station, is forty-two feet long, and is a remarkable piece of work. It consists of an iron frame, upon which are

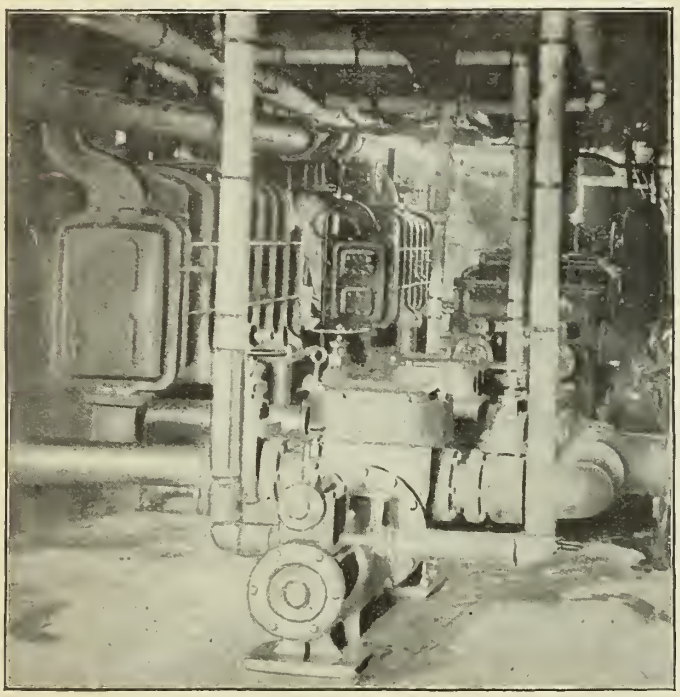


FIG. 5.—SURFACE CONDENSERS IN BASEMENT—CENTRAL STATION, MILWAUKEE.

mounted Italian white marble slabs. The ampere meters are mounted directly to the marble and have covers of polished brass and bevel glass. The switches of polished

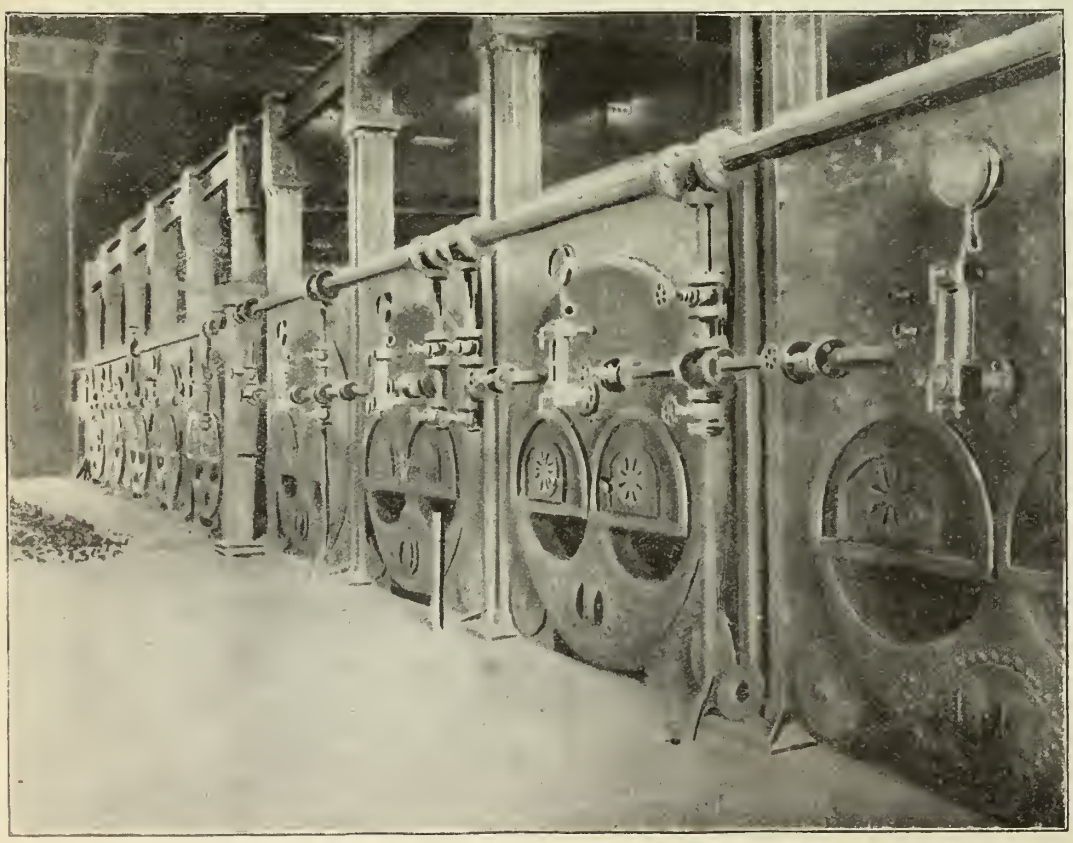


FIG. 6.—BOILER ROOM—CENTRAL STATION, MILWAUKEE.

copper are on separate bases, bolted to the board. The bus bars run along the back of the marble slabs, and from these the feeders run in the usual manner, connection being made by heavy, flexible cables. The switchboard is thus perfectly incombustible, and danger of fire in the station is reduced to a minimum by the further employment of safety devices of the latest improved type. The steam gauges are also mounted on this board.

The larger electric light switchboard has been erected in a gallery above the floor of the dynamo room, and is of the same handsome type as that for the power work. Connections between the machines and switchboards are made through incombustible tubing laid in the concrete of the floor.

The overhead system is as perfect in detail as the station. The poles are of latticed iron of a special type, are double armed and are set midway between the double tracks in the city. Wooden side poles are used in the suburban work. In setting these poles much difficulty was encountered. In certain cases they had to be fixed on flat bases and concreted in the earth a few inches only from the surface. In other cases they had to be specially made so as to ride astraddle of iron gas pipes before they could be properly concreted in their settings. The trolley wire is of standard gauge silicon bronze, and the overhead line appliances of the most improved pattern. The loss of pressure between the station and the car is about 10 per cent. only.

The track construction was described in the June issue of the STREET RAILWAY JOURNAL. A side bearing, seventy-nine pound rail, rolled by the Illinois Steel Co., spiked to the ties, is employed within the city. Elsewhere a fifty-eight pound rail is used. There are several grades in the city, some of from 6 to 9 per cent.

The rolling stock of the company consists of 130 cars of various makes, representing nearly all the large car builders in the country. Some are furnished each with two motors of the No. 8 Edison type, and others with the single reduction No. 14. The car switches are the latest barrel type with indurated fibre covers. The cars are all handsome, are well lighted, easy of control and extremely comfortable. The company also own a private vestibuled car, illustrated in our March issue.

The management of the company is in the hands of Mr. H. C. Payne, general manager, who is also vice-president. The credit for placing the road in such admirable condition is certainly his proper meed. The engineer in chief of the whole system is Mr. J. C. Henderson, already well known to all our readers. The construction of the road under his direction is only one more good point added to his already excellent record.

The superintendence of the company is divided into two separate organizations. Mr. Geo. W. Hummel attends to the West Side district from the Milwaukee River to about five miles out. Mr. A. W. Lynn is superintendent of the remainder of the system and has charge of a considerably larger territory than Mr. Hummel. To his untiring energy may largely be ascribed the present perfection of the Milwaukee Street Railway system. The main offices are at the corner of Mason and Milwaukee Streets on the second floor of the Colby & Abbott Building Here is the accounting department, as well as the vice-president's, secretary's and treasurer's offices. In this building, too, Mr. Stikeman, the chief engineer, and Mr. O. M. Rau, the electrician, have their offices. No expense, pains or ingenuity has been spared to give to the Milwaukee system that degree of

perfection to which the promoters and managers of the company aspired, and to them and to the railway and engineering departments of the General Electric Co. must be given the praise which is strictly their right.

"The objects of the Association are to be cultivated, and the benefits are to come. All will agree with me that

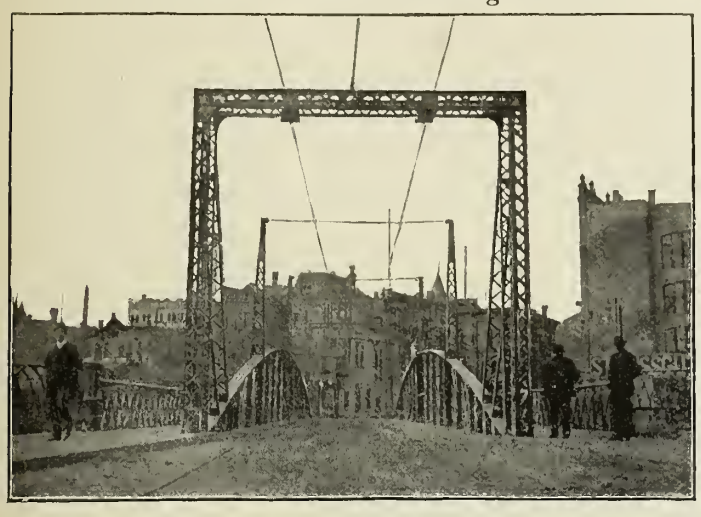


FIG. 7.—SWING BRIDGE—MILWAUKEE STREET RAILWAY SYSTEM.

what experience we have gained will greatly inure to our benefit. The position of the horse railroad president is not to be described. It is an onerous position. It calls for labor and attention, and all the strength of mind inherent to fully discharge the great duties set before him. The position calls for indomitable perseverance, because it supplies the demands of the public. The public will put up with everything in steam cars, but the least thing out of the way in horse cars will cause complaint. This is a peculiar freak of human nature. In Boston we have great difficulties to surmount. Owing to the great competition in this city between railway companies, the public has been educated to expect everything, and I should not be surprised if we were obliged eventually to back our cars up to the very doors of dwellings. There should be an exact understanding of what we have to do. We should consider the best way of feeding horses and caring for them; the best pattern and manufacture of cars, and how to make conductors honest. Above everything else,

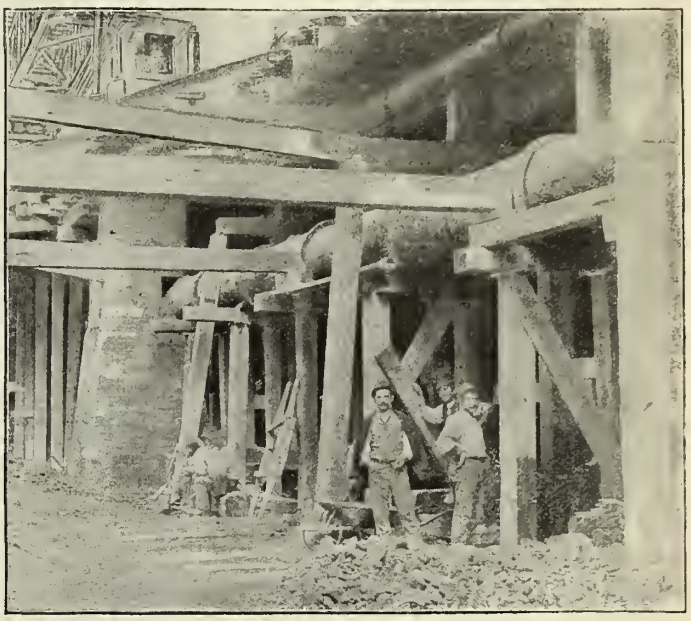


FIG. 8.—TOWER WAGONS—MILWAUKEE STREET RAILWAY SYSTEM.

let the members of this Association foster a brotherly regard for each other, so that, when we meet in strange cities, we shall be as brothers. That is what we should be. There should be no North, South, East or West with us. We welcome you here from every quarter, and only hope that you have found warm hearts, just as well as you would have in Ohio."—*Boston Street Railway Convention*, 1882.

Cable Construction on Third Avenue, New York.

The work of the track and conduit construction for the Third Avenue cable railway has been almost entirely completed between the upper terminus at 129th Street and Grand Street; and of the work below Grand Street the greater part has been finished. The power stations now present scenes of great activity. The foundations for machinery at the main station on 65th and 66th Streets have been practically completed. The walls of the boiler room, which will be 200 × 78 ft., have been carried up a distance of about thirty feet, to the height of the room, and are ready for the floor beams. The work of installing the boilers will probably have begun by the time this reaches our readers. The walls of the engine room have been carried up rather farther than those of the boiler room, and on the north side have reached such a point that the appearance of the interior finish, which will be of buff brick, can be observed. All the machinery in this room will probably be in place in about two months, and the road will be ready for operation, in the opinion of the



PRESENT APPEARANCE OF PULLEY VAULT AT 65TH STREET—THIRD AVENUE CABLE RAILWAY, NEW YORK.

engineers, by April 1. The contractors for the machinery at both stations are the Pennsylvania Iron Works, of Philadelphia, Pa.

The accompanying engraving is from a photograph taken at the foot of the main pulley vault, which is 146 × 61 ft. by 20 ft. deep, and extends for nearly the entire block from 65th Street to 66th Street, on Third Avenue. As will be seen, the elevated railway structure is directly over the pit. To supprt the pillars of the elevated railway, which rested on piers eight feet in height, sub-piers had to be built of brick supported on a layer of concrete. The total height of these foundations, from the surface of the street to the bottom of the concrete, is twenty-one feet six inches. Nine elevated railway piers had to be cared for in this way.

Another engineering problem was the disposition of the pipes, including a thirty inch water main, shown in the engraving as extending through one of the elevated railway piers and supported on timbers. It was decided to support the small pipes from the roof of the vault, but to carry the main entirely below the floor, where it will rest on a concrete foundation. A secondary vault between 66th and 67th Streets is 37 × 27 ft., horizontal dimensions, by 19 ft. in depth; the deflection vault for the down cables, near the center of 66th Street, is 24 × 12 ft., horizontal dimensions, by 17 ft. in depth, and the vault for the elevating sheave, between 65th and 64th Streets, is 10 × 6 ft., horizontal dimensions, by 17 ft. in depth.

Another especially difficult and interesting part of the work is the Post Office loop at the lower terminus of

the road. As stated in a former issue, three cables are run from the lower station at Bayard Street for service between Bayard Street and the Post Office. Two of these are high speed cables, and are for use by the cars until near the entrance of the loop, or to about opposite the *Times* Building on Park Row. Here will be located a rope transfer, and from this point the high speed cables on the down track are carried through a blind conduit around an end sheave fifteen feet in diameter, returning by a second conduit to the rope transfer, where they are picked up by the cars. The Post Office loop, which is operated by the slow speed cable, has a radius of forty-one feet, the entrance curve being of fifty feet, and the exit curve forty-one feet radius, respectively. The diameter of the curve pulleys is thirty-three and five-eighths inches, and there are thirteen on the entrance curve, forty-two on the main loop, and seven on the exit curve. All the wheels in the loop have gimbal bearings.

A point of curvature on the line is at Chatham Square, and the arrangement adopted here is most interesting. The curve is compound, 500 ft. long, and with radii varying from 280 to 500 ft. A special disposition is made at this point of the slow speed rope which is not used, of course, for operating the cars here. On the down track side, which is on the inside of the curve, the slow speed rope is carried through a blind conduit in three chords. The third rope on the up track is carried outside the high speed ropes and has a curve sheave at points twenty feet apart. In the conduit the high speed ropes are carried on curve pulleys placed four feet three inches between centers as in the main loop. To facilitate inspection, etc., of the curve pulleys, a passageway has been constructed on the inside of each conduit. This passageway has a section of four feet in width by five feet feet eleven inches in height, and is covered with six-inch I beams, reinforced on top with T irons, above which is the paving. Access is provided by manholes located at convenient points.



FIG. 1.—MAIN POWER STATION—BROADWAY CABLE RAILWAY, NEW YORK.

THE Detroit City Street Railway Co. has let the contract for the electric equipment of the Woodward Avenue line. The successful bidder was the Detroit Electrical Works, which equipped the Jefferson Avenue line of the same company, and not the least consideration which entered into the letting of the contract was the satisfactory manner in which the Jefferson Avenue line was equipped.

The Detroit company is to furnish the motors overhead construction, station equipment and all other adjuncts necessary for the line, and is to do all the work of putting them in place. The motors will be of 40 H. P. each twenty in number, and the cars will be supplied by the Pullman Car Co. The rails will be extra heavy and the ties will be imbedded in concrete.

The contract calls for the completion of the road in forty-five days.

Broadway, N. Y., Cable Construction.

All of the track and road construction of the Broadway Cable Railway, from 59th Street to Bowling Green, has been finished for some time, the only section of the road yet uncompleted is part of the short loop between Bowling Green and South Ferry, work upon which is now being carried on. Of the two power stations, the upper, at Sixth Avenue, 50th and 51st Streets, is the farthest advanced. This station is contained in a portion of the general building belonging to the Broadway & Seventh Avenue Railway Co., extending from Seventh Avenue to Sixth Avenue, and occupying most of the block bounded by these avenues, 51st and 50th streets. The cars will be stored in the western end of the building, which is the portion now occupied as a car house, and the cable will be carried from the Sixth Avenue, or eastern end, of the building through a blind conduit to Seventh Avenue upon which the roadway line extends between 46th and 59th Streets.

The interior of the upper station now presents a busy appearance. The machinery is being installed by the Pennsylvania Iron Works, of Philadelphia, who are the contractors of the entire plant, and the greater part of it is already in place. The power will be supplied by two Dickinson-Corliss engines, with cylinders thirty-six inches in diameter by sixty-inch stroke, and having a capacity each of about 1,000 H. P. The flywheels are twenty-four feet in diameter. Each of these engines is connected at one end by friction clutches to a common shaft which carries four driving drums ten feet in diameter, for operating the main driving drums. By means of the friction clutches, already mentioned, and two additional ones at the center of the shaft, either engine can operate the entire shaft, and so drive either cable of the duplex system or both engines can be disconnected, and the shaft, or either half of it, can be turned slowly by a small auxiliary engine placed in the center when the power of the larger engines is not available for this purpose. Each of the cable drum shafts is driven independently from the engine shaft by means of thirty-two foot drums connected with the ten foot drums on the engine shaft, the power in each case being transmitted by thirteen two-inch cotton ropes. The cable drivers are twelve feet in diameter, four in number and designed for five wraps.

The engine room also contains two traveling cranes, one of ten tons, the other of six tons capacity, furnished by the Yale & Towne Manufacturing Co., of Stamford, Conn.

The boiler room, which adjoins the engine room, at present contains six Heine safety boilers of 250 H. P. each. Further details in regard to the equipment were given in the issue of the STREET RAILWAY JOURNAL for May, 1892.

The work on the main power station at Houston Street, which will have a capacity of more than twice

that of the upper station, is being carried on rapidly, and by the time this reaches our readers the iron work will be nearly, if not quite, completed, and walls carried up to the second story. As will be seen upon examination of Fig. 1, which shows the appearance of the building when completed, the claim of the company that this power station will be the handsomest in the country, is well founded. The building will be eight stories in height, and constructed in the Rennaissance style. The lower part is of granite, and in the upper part buff brick with terra cotta trimmings will be used. As stated in previous issues, the driving machinery will be entirely below the ground floor, and on special foundations, so that any vibration of the machinery will not affect the building proper. Twelve boilers and part of the driving machinery are already in place. The upper stories will be leased for offices, stores, and light power purposes.

The location of the small power station for operating the loop between Bowling Green and South Ferry is on Front Street. Fig. 2, shows the method of placing the yokes at the loop of the main line at Bowling Green. The yokes rest on piers, and a passageway is left on the inside of the curve, by which access is easily had to the

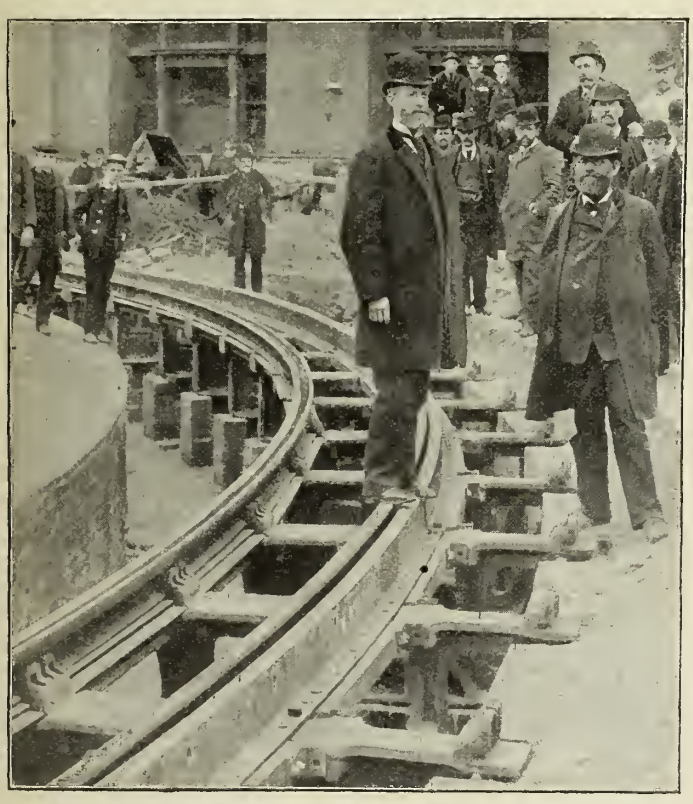


FIG. 2.—BOWLING GREEN LOOP DURING CONSTRUCTION—BROADWAY CABLE RAILWAY.

curve pulleys for the purpose of inspection, repairs, etc. The managers of the railway company expect to have the main line in operation by January 1, 1893.

Adaptation of the Cable System to Swing Bridges.

Navigable rivers have always proved a great obstacle in the construction of cable railways, and a device has long been needed which would avoid the necessity of tunneling, and hence save the large item which such a method adds to the cost of construction.

By the plan shown in Figs 1 and 2, the cars cross the river on a swing bridge, a special cable being employed to operate them while on the bridge. The main cable passes over an angle wheel, which guides it from the surface conduit downwardly into a vault formed in one of the abutments, whence it is carried on sheave or carrier wheels through a conduit of suitable dimensions, to a vault located within the center pier. Here it is lapped around a double grooved wheel carried on a vertical shaft within the center piece of the bridge, after which it is returned to the first abutment, and to the power station,

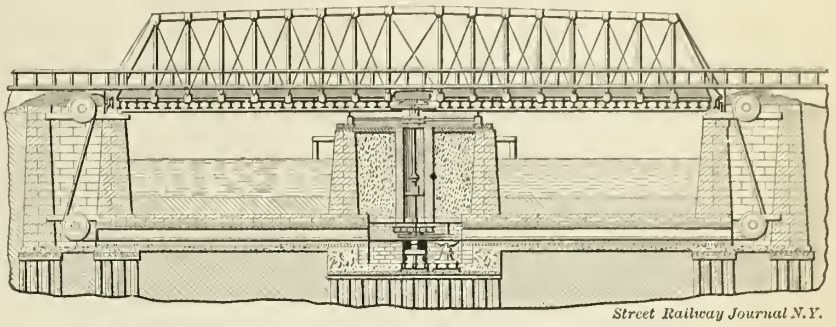


FIG. 1.—ADAPTATION OF THE CABLE SYSTEM TO SWING BRIDGES.

or else is carried entirely across the river to a vault provided in the opposite abutment, thence to the surface conduit and terminus of the route, to return through the same channel to the power house. The auxiliary cable on the bridge is driven by being lapped around a grooved wheel carried on the upper end of the vertical shaft, and then is carried around an adjacent idler and other idlers located at the ends of the bridge.

By a system of gearing from the shaft of the idler located near to the auxiliary cable driver, the bridge may be opened and closed at will by means of the main cable,

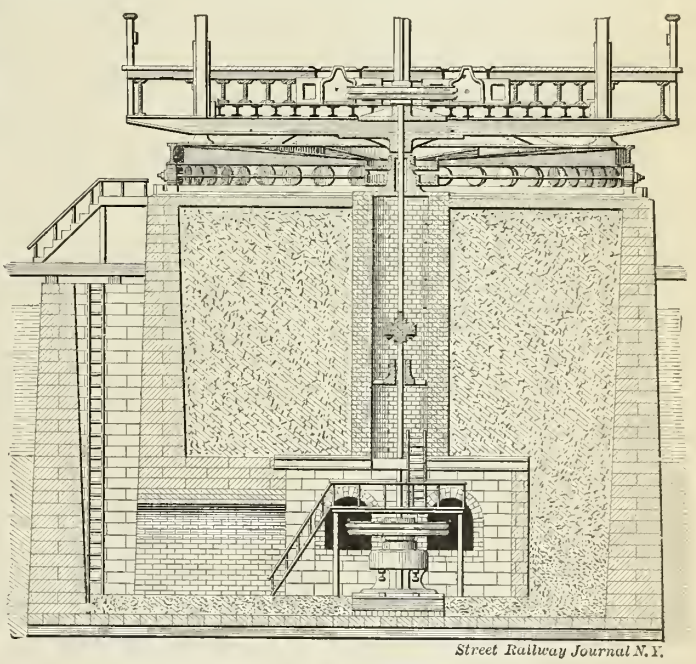


FIG. 2.—ARRANGEMENT OF CENTRAL PIER—ADAPTATION OF THE CABLE SYSTEM TO SWING BRIDGES.

being capable of swinging either to the right or left. Access to the vault in the center pier is had by means of a vertical opening formed in the pier, close to the vertical shaft. (See Fig. 2.)

When the bridge is closed trains are enabled to pass to and fro without interruption, the gripman letting go his main cable at the abutment, taking hold of the auxiliary cable as his grip passes to the bridge, letting go at the opposite abutment, and again taking hold when reaching the surface conduit. Safety appliances are used as adjuncts to the system, whereby it is rendered impossible for accident to happen to a train in case the bridge should be open. The details of construction and operative arrangements are simple and effective.

The system is the invention of William C. Metzner, of Chicago, and G. E. Buschick, who has long been connected with the West Chicago Street Railway Co., and has had an extended experience in cable railway engineering.

The New Cable Station of the West Chicago Street Railroad Co.

The West Chicago Street Railroad Co. are now erecting two new cable power stations whose equipment combines many features of interest. These improvements, together with the new tunnel under the Chicago River at Van Buren Street, will involve a total outlay of $2,000,000. Both of the stations are well under way. One of them will, in all probability, be in operation by January 1; the date when the second plant will be started is contingent upon the completion of the tunnel, the construction of which has been already delayed to such an extent by litigation that no one dares to commit himself to a prediction.

The larger of the power stations is located at the corner of Blue Island Avenue and Twelfth Street. The ground is irregular in shape, but the form is nearly triangular. As a reference to the drawing (Fig. 1) of the elevation on Blue Island Avenue shows, a six story building is to be erected adjoining the station. It will be a handsome structure, and will be divided for offices which the railway company will let for general and business purposes. It will be lighted by electric light, provided with elevators, and the tower will contain a clock with six four foot dials. The structure, which will cost $50,000 exclusive of the site, will be the most pretentious building in the neighborhood.

From the same drawing an idea of the general appearance of the exterior of the power station may be gained. The station, like the adjoining office building, is to be built of brick with cut stone trimmings, and will be covered by a truss roof, 100 ft. span, with corrugated iron inside and outside. Louvres are provided for furnishing light and air. The stack will rise to a height of 165 ft. Fig. 2 shows the Twelfth Street elevation of the building.

The sub-construction for the station was very expensive. When the excavations were in progress a slough was struck. To make proper foundations for machinery it was necessary to excavate thirty-eight feet below the street level and to use an enormous amount of concrete. The cost of this portion of the work was not less than $65,000. The West Chicago Street Railroad Co. constructed the building, and the entire equipment was contracted for by the Pennsylvania Iron Works Co. The cost of the building and its equipment will be about $500,000.

The boiler room is built with steel girders and brick arches. There are eight Otis steel boilers, the dimensions of which are 72 ins. × 20 ft., made by John Mohr & Co., of Chicago, and provided with furnaces for burning oil. Dodge injectors will be used, capable of furnishing the supply of water for all the boilers, and a large duplex Snow pump, with dimensions 14 ins. and 8 × 12 ins. will be available. Two Berryman heaters, each of 1,000 H. P., will be installed. Under the sidewalk will be located a cistern of sufficient capacity to hold a twenty-four hours' supply. This is an extremely important provision, as it has more than once happened in Chicago that the city supply has failed, and steam users have been subjected to extreme inconvenience for several hours. Oil will be burned as fuel, and two tanks, each of a capacity of 20,000 gals., will be built under the sidewalk.



FIG. 1.—BLUE ISLAND AVENUE ELEVATION, NEW CABLE POWER STATION—WEST CHICAGO STREET RAILWAY.

Power will be supplied by two high pressure Allis engines of 1,800 H. P. each, with flywheels twenty-four feet in diameter and weighing 100,000 lbs. each. All cylinders will take steam from the under side beneath the floor, so that no steam pipes will be seen in the engine room. The cylinders are provided with hand reversing gear consisting of a bronze rack on the wrist plate, and a pinion which is secured to a cast iron stand bolted to the floor, the starting bar being removable. A fourteen inch separator with steam loop arrangement is provided for each engine. The eighteen inch exhaust pipe is fitted with a Warren Acme A exhaust head. An electric light plant will be located in the engine room.

Power will be transmitted from the main line shaft, which is eighteen inches in diameter, by means of cut steel gear and 1,000 H. P. friction clutches operated by hydraulic cylinders. By this arrangement any of the four cables may be started or stopped by turning a small valve.

Four sets of winding machinery, consisting of Walker differential drums, will be installed, of which one will be kept in reserve. This provision is regarded as a wise one as it guards against prolonged delay in case of an accident to one of the drums. The vault sheaves are so arranged that any one of the cables may be transferred to the reserve drum in an hour and a half. For winding up the old cables two sets of the Pennsylvania Iron Works

Co's patent reels have been located between the tension runs which extend under the boiler room floor, the carriages being of the Root design.

From the plant will be operated three cables, two for the Blue Island Avenue line, and one for the Halsted Street line. The latter passes through a subway on Twelfth Street for half a mile before reaching the Halsted Street conduit. This cable will have a speed of ten miles per hour; of the two ropes on Blue Island Avenue, one will move at the rate of ten miles, and the other at twelve miles per hour.

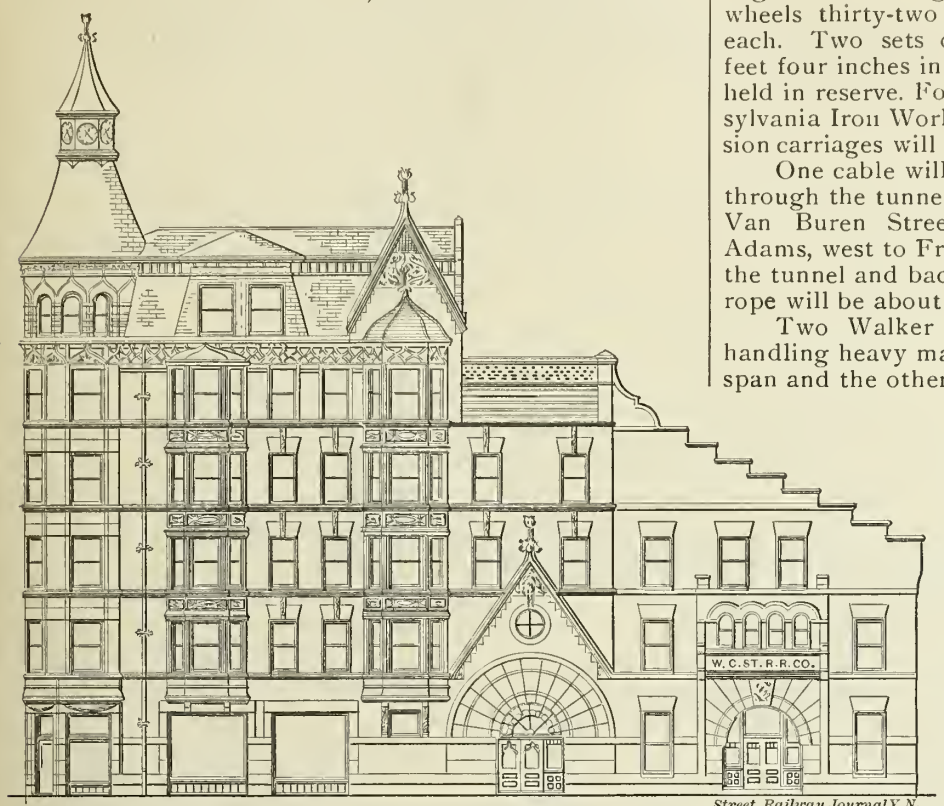


FIG. 2.—TWELFTH STREET ELEVATION, NEW CABLE STATION—WEST CHICAGO STREET RAILWAY.

It has been stated that the engine room is free from steam pipes, which have been kept below the floor. This plan was followed in order that the room might be clear for the operation of traveling cranes. It is doubtless true, as the engineers of the West Side Street Railroad Co. assert, that an equipment of cranes in a cable station conduces to the economy of the plant. When the inevitable accident comes, repairs can be made quickly, and an enormous saving in time is effected; and at the same time when these appliances are available it is no longer necessary to keep on hand the "rigging" for handling heavy parts, which in the aggregate involves the outlay of considerable money. The two cranes in the station were manufactured by the Walker Manufacturing Co. They are each of fifty-six foot span, and each has a capacity of twenty-five tons.

VAN BUREN STREET POWER STATION.

From the station located at the corner of Van Buren and Jefferson Streets, the cable for the new downtown loop will be operated. The building is L-shaped, with a frontage of 175 ft. on the latter street and fifty feet on Van Buren Street. The structure will be brick with cut stone trimmings. The stack will be 150 ft. in height with eight foot core. As in the case of the other station, the building is erected by the railroad company and the entire equipment is furnished by the Pennsylvania Iron Works Co.

With one or two important exceptions, the station has been planned on the same lines as the Blue Island Avenue station, and the description may, therefore, be materially abridged. Steam is generated in two Otis steel boilers, 72 ins. × 18 ft. under which oil will be burned. Dodge injectors and a Snow duplex pump will be used.

The two engines will be of 1,500 H. P. of the Allis make, with flywheels twenty feet in diameter, each weighing 100,000 lbs. In this station power will be transmitted by twenty-six three inch cotton ropes, the pinions on the engine shaft being eight feet in diameter, and the rope wheels thirty-two feet in diameter, weighing sixty tons each. Two sets of Walker differential drums, thirteen feet four inches in diameter will be installed, one being held in reserve. For winding old cables, reels of the Pennsylvania Iron Works Co.'s patent type will be used. Tension carriages will be of the Root design.

One cable will be operated from the station, passing through the tunnel and around the loop as follows: On Van Buren Street east to Dearborn Street, north to Adams, west to Franklin Street, south to the entrance of the tunnel and back to the station. The length of the rope will be about 12,000 ft., and its diameter 1⅜ ins.

Two Walker traveling cranes will be available for handling heavy machinery; one will be of forty six foot span and the other fifty-four foot span.

The electric light plant for lighting the tunnel will be located in the station. Seventy-five arc lights will be necessary for this purpose, and the current will be generated by a dynamo operated by a sixty horse power engine. A similar engine and generator will be held in reserve.

Both the stations will be complete in every respect, and every detail has been carefully worked out. They were both designed by S. Potes, chief engineer of the West Chicago Street Railroad Co., with whom was associated in designing the buildings H. B. Prudden of Kansas City. The work has been prosecuted under Mr. Potes' personal supervision, and when finished they will embody the very latest ideas in the design and equipment of cable power stations.

Street Car Fenders in Boston.

The committee appointed by President Whitney, of the West End Street Railway Co., of Boston, to examine into the merits of fenders for use on the electric cars of that company, and consisting of Thomas C. Clark, C. E. A Bartlett and George F. Swain, has rendered a most interesting report. The experiments made by the committee in its investigations extended over a period of more than eight months, and in all 211 types of fenders were examined. Of this number fifty fenders were selected for trial under actual service, and the tests made upon them consisted of equipping a car with the fender, and then experimenting upon three dummies made as nearly as possible of the size, shape and weight of a man, woman and child.

The committee reports that upon examination it found that all fenders brought to its attention could be divided into three classes, viz.:

Class A. Buffers which soften the blow given by the car to the person, and pick him up in a net.

Class B. Platforms which project beyond the dashboard of the car, and upon which a person could leap, or, standing up, could be caught and carried along.

Class C. Fenders which are placed below the car platform, and whose object it is to push along a body lying down upon the tracks, and prevent it from getting under the wheels.

There are three methods of operating the fenders, the committee finds, included in Class C, viz.:

First. Where they are supposed to be always ready to catch the body of the person.

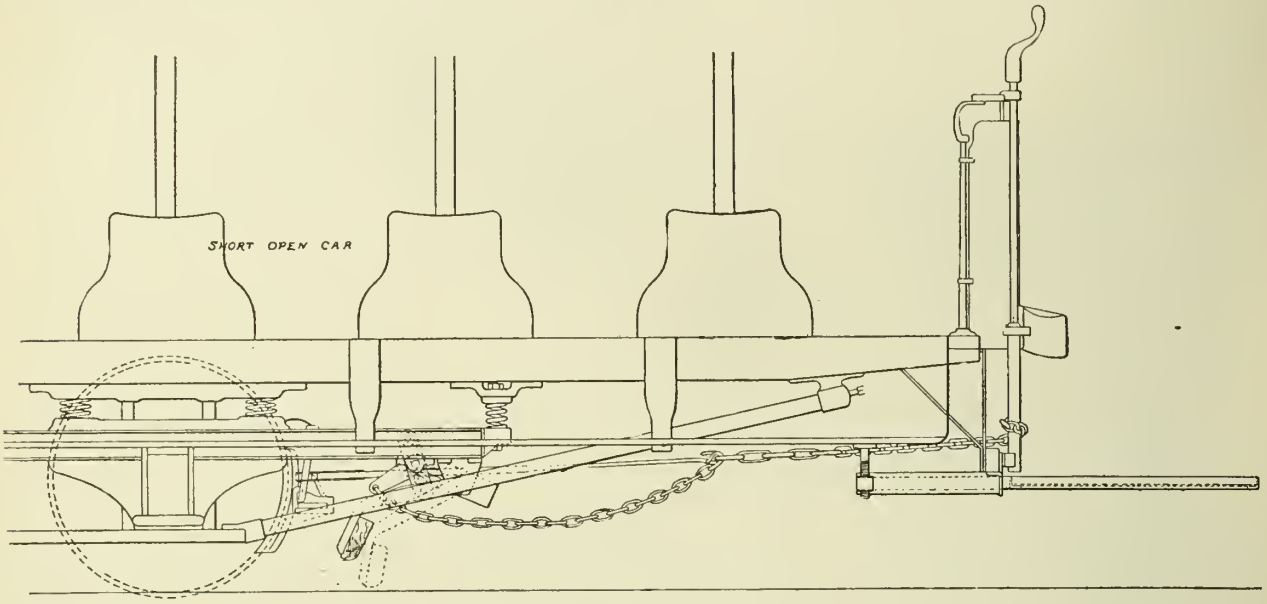
Second. Where they require the action of springs, levers, or some other device which is operated by the force of the blow struck against the body of the person.

Third. Where they require the direct action of the motormen to put them in operation.

The conclusion of the committee is that while it is

manifestly impossible to secure absolute prevention of injury to a person who has been struck by a car moving even at a slow speed after the brakes have been applied, the safety of the public can be increased by the adoption of two devices brought to its attention.

The first device recommended is included in Class B, and consists of a platform projecting in front of the car platform, known as the Cleveland Platform (see figure),



FENDER ADOPTED BY WEST END STREET RAILWAY, BOSTON.

and invented by T. L. Johnson, of Cleveland. This platform has been modified by the officers of the West End Street Railway Co., to enable it to be slid under the cars, or under the rear of any car, when it is not in use.

In addition to this platform, the committee considers there should be an elastic buffer, made of stout wire or metal strips, and curved so as to project from the front dashboard and receive, on a yielding surface, the blow of a person's head and shoulders. This buffer could, if desired, be easily detached and changed from one end of the car to the other. The meshes of the buffer should be large enough to enable a person to seize it with his hands.

In connection with this platform and buffer, the committee recommend the use of a fender as described in Class C and shown in the figure. This fender is normally held at a distance of three and one-half inches from the track, but is capable of being lowered, so as to prevent a person who has fallen down, and is lying on the track, from being run over by the wheels.

The three different methods of fender operation mentioned were carefully considered, and the first two modes were rejected as u idesirable. That finally selected was one submitted by L. J. Hirt, master mechanic of the West End Street Railway Co., and was that the fender should be lowered by means of the ordinary brake handle. The turning of the brake handle first applies the brake, and then lowers the fender down to the track; but the action may be made so quick that the two movements appear nearly simultaneous.

Sectional Condenser.

The condenser shown herewith has been recently patented by Elihu Nelson especially for marine use, and possesses the advantage of occupying considerably less space than the condenser now in use on seagoing and other steamers, while at the same time there is no diminution in the amount of condensing surface, nor is there any reduction of the vacuum. Incidentally, other advantages are obtained by reason of various details in the construction. It will be seen by reference to the cut that one or more of the sections of the condenser can be cut out by operating certain valves and passing the steam through the by-pass. This permits a damaged section or sections to be repaired while the engine is in operation. It will be seen, also, that one of the sections, namely, the first, can be used either as a heating or a condensing section. Beyond the last section is a receiver, R, for taking up the water of condensation and a safety branch or overflow pipe connected with the pipe that passes the water of condensation, from the heating section into the receiver. By these means several important improvements are effected, among which is that of relieving the air which has been drawn by the air pump from the condensing sections along with the water of condensation.

The peculiar shape of the hoods will be noticed, one side of each hood being flat and the two flat sides being located horizontally and facing each other, so that they can be connected by a straight vertical pipe, and thus cause the water of condensation to flow of its own gravity from one hood to the next. The center tubes W, of the first three sections are made somewhat larger than that of the last section, X, and a little smaller than the

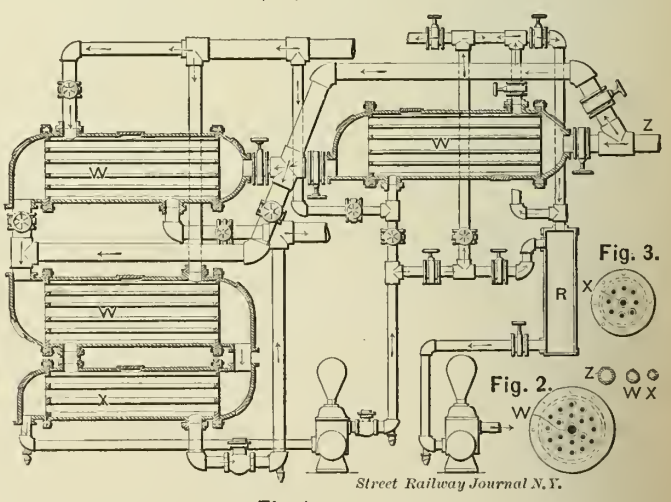


Fig. 1.
SECTIONAL CONDENSER.

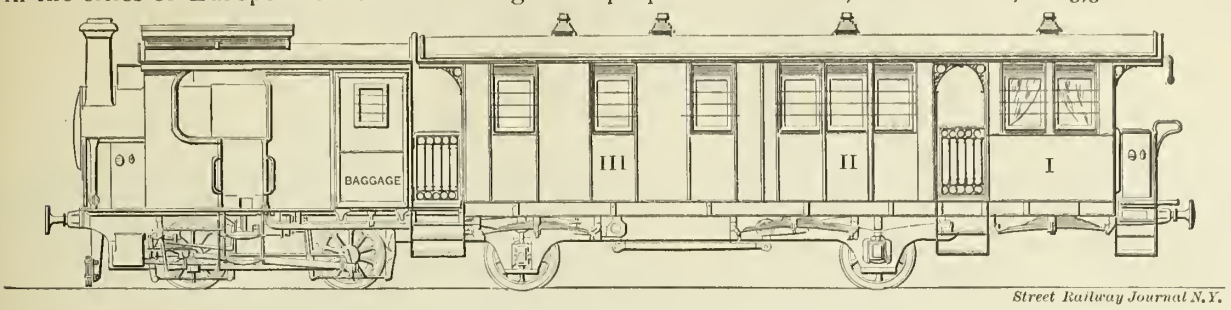
steam exhaust pipe, Z. The relative sizes of these tubes are shown in Fig. 4. All the center tubes are surrounded by smaller tubes, that in the last section being surrounded by a smaller number of tubes than those in the other sections. (See Figs. 2 and 3.)

Altogether, the Nelson condenser recommends itself to those who are contemplating the use of such an apparatus for marine or similar work.

A NEW electric railway company is being organized at Carlisle, Pa., by M. L. Funkhouser, to build an electric railway four miles in length.

Types of European Steam Locomotives for Suburban Lines.

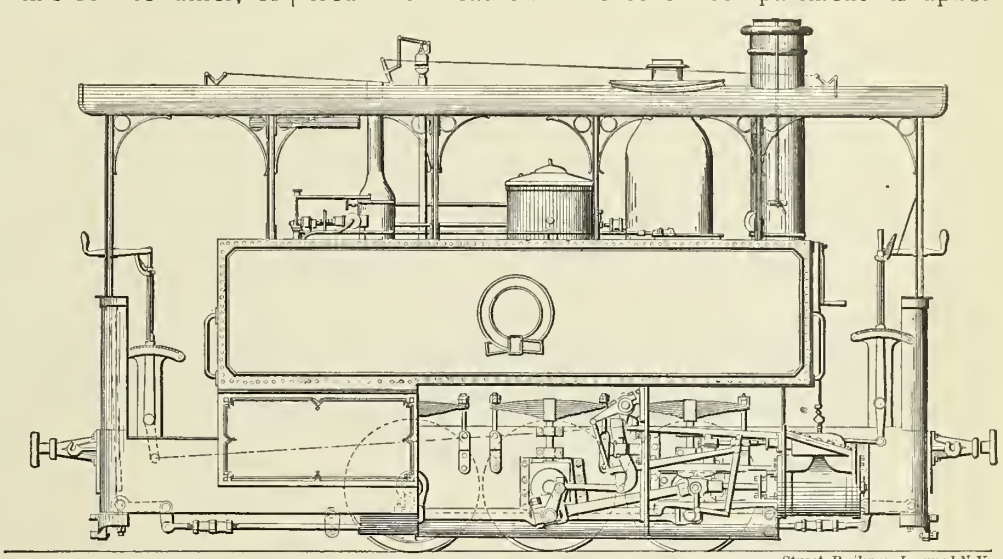
Steam railway service on street and suburban lines in the cities of Europe has assumed far greater proportions than in America. These lines, though rarely extending into the business centers, are sometimes laid on important streets, and the speed maintained equal to, or in excess of that on electric lines in America. The locomotives and cars employed in this service differ, of course, from those for trunk line service, and also from those employed in this country for similar work.



Street Railway Journal N.Y.

FIG. 1.—NOVEL STEAM MOTOR AND CAR—EUROPEAN STREET RAILWAYS.

Some recent types of locomotives and cars used extensively for city and suburban traffic in Switzerland and France and manufactured at the works of La Société Métallurgique, Brussels, Belgium, are shown herewith. Fig. 2 shows a locomotive built for a thirty-nine inch gauge and mounted on six wheels, all of which are driven. The principal dimensions of this locomotive are: Length 20 ft. 4 ins., height 11 ft. 8½ ins., width 6 ft. 10½ ins., gauge 39.37 ins., weight (empty) 33,660 lbs., weight (with coal, etc.) 42,900 lbs., diameter of cylinder 11.8 ins., stroke 14.2 ins., diameter of drivers 2 ft. 8¾ ins., number of tubes 160, total heating surface 345.4 sq. ft., steam pressure 180 lbs, traction (theoretical) 10,437 lbs., traction (effective) 6,785 lbs.



Street Railway Journal N.Y.

FIG. 2.—STEAM MOTOR FOR EUROPEAN STREET RAILWAYS.

Fig. 1 shows a novel type of steam motor and car built by the same manufacturers for a standard gauge. The vehicle complete has a total length of 49 ft. 7 ins. The wheel base of the locomotive is 7 ft. 3 ins., that of the car 16 ft. 7 ins. The cylinders have dimensions 8½ ins. diameter by a 13¾ in. stroke. The boiler is of the ordinary tubular type and has 150 tubes, 13⅓ ins. in length and 1⅓ ins. in diameter and with a heating surface of 239.3 sq. ft. The steam is supplied to the cylinders under a pressure of 180 lbs. The car has compartments for first, second and third class passengers, and three sets of steps. The compartments have seating capacity, respectively, of eight, fifteen and thirty passengers. The maximum speed is twenty-five miles an hour. The car is fitted with a Westinghouse brake. The total weight of the car and motor, without load, is 63,382 lbs. Fig. 3, shows a car built for dummy lines, having a gauge of thirty-nine inches, and provided with two compartments, one for smokers, and the other for general passengers, with open platform between the two about six and a half feet in length. Each of the end compartments has a length of about seven and a half feet. The smoking compartment is fitted up in old oak, the floor is covered with linoleum, and the seats and backs are covered with leather. The other compartment is upholstered in cloth, and seats and backs covered with plush. Each compartment is lighted with two oil lamps.

The frame upon which the body of the car rests is of iron; the wheels are of iron with steel tires.

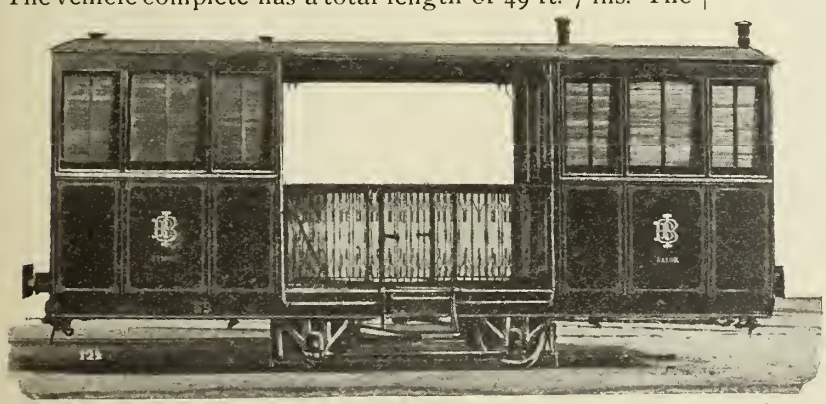


FIG. 3.—COMBINATION PASSENGER AND SMOKING CAR—EUROPEAN STREET RAILWAYS.

The Buffalo, North Main Street & Tonawanda Electric Railway has been put in operation. The road is five and three-quarters miles in length, and the track is laid on cedar ties, with sixty-five to ninety pound T rails. The road is rock ballasted all the way, and was built by the Field Engineering Co.

The reproduction of Columbus' caravel, the "Santa Maria," is being built by the Spanish government at the Carraca yard at Cadiz. The keel was laid on March 1. Great care is being taken with details, and the instruments and appliances of the time of Columbus will be in their places aboard the caravel. The "Pinta" and "Nina," it is announced, are being reproduced by American capital, so visitors to the Exposition, will be able to see the "Columbus fleet" complete The Spanish government will provide crews for the three caravels, dressed as were Columbus' sailors, and the trip across the Atlantic will be made under escort of a Spanish man-of-war. After participating in the naval review in New York harbor the caravels will proceed to Chicago. After the Fair closes they will remain the property of the United States.

A New Maximum Traction Truck.

The truck herewith presented is the invention of Otto Schmid, mechanic in the employ of the Lindell Railway Co., St. Louis, and is being put on the market by the Laclede Car Co., of the same city. It will be seen at a glance that simplicity of construction, fewness of parts and shapeliness are the distinguishing features. The bolster is of channel iron, and rests on two heavy bars which are supported by two latitudinal bars, one behind the driving wheels, and the other between the latter and trailing wheels. The latitudinal bars each rest on two heavy spiral springs. The latter are supported by the steel trussing of the truck in the ordinary manner. Objections might be raised against the bolster being in the way when the motors are to be removed or repaired. This is obviated by its being spare in construction, but any of these cases the small wheels will not climb the rails.

The Laclede Car Co's. patent dustproof box is used in connection with the truck, Jones & McLaughlin's three and a quarter inch cold rolled steel axles, and Missouri Car & Foundry Co's. wheels. The Lindell Railway Co. are at present using ninety of these trucks on forty-five of their combination cars. S. L.

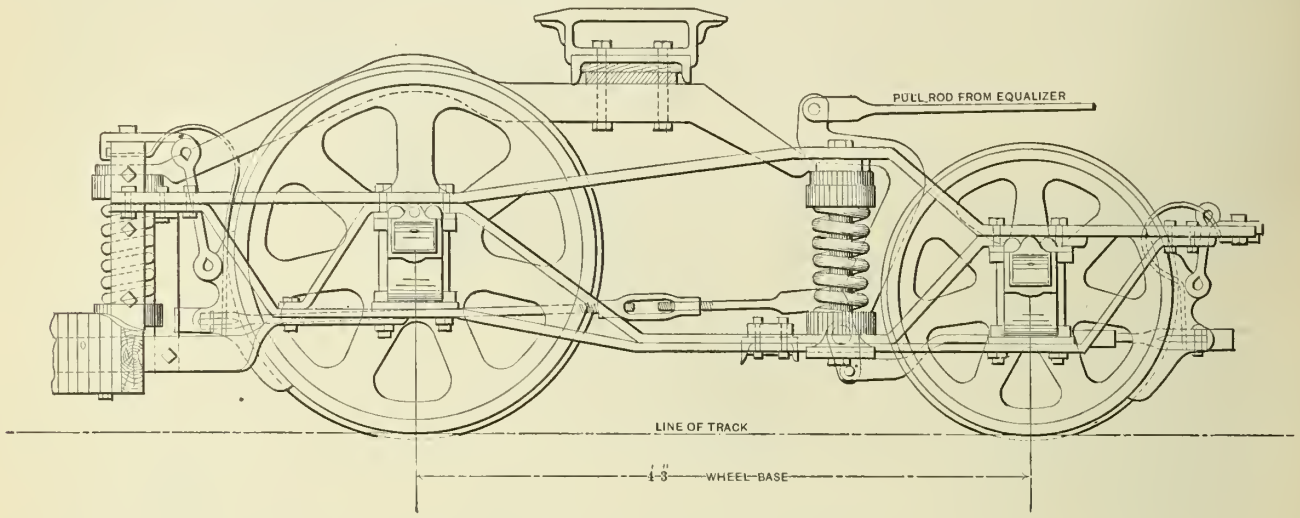


FIG. 1.—SIDE ELEVATION—NEW MAXIMUM TRACTION TRUCK.

THE total number of passengers carried on street railways in Massachusetts for the year ending June 30, 1891, was 176,090,189. During the same period the number of passengers carried on the steam railroads of the state was 107,271,842.

AN extensive scheme on the part of conductors to defraud the Cincinnati & Covington Street Railway Co.

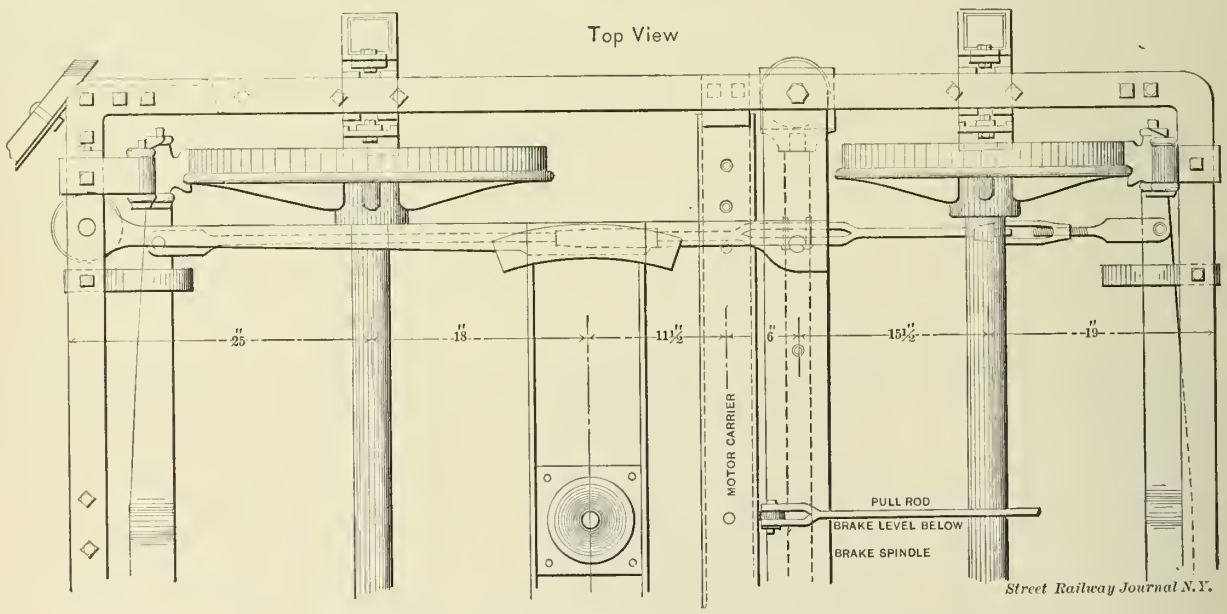


FIG. 2.—HALF PLAN—NEW MAXIMUM TRACTION TRUCK.

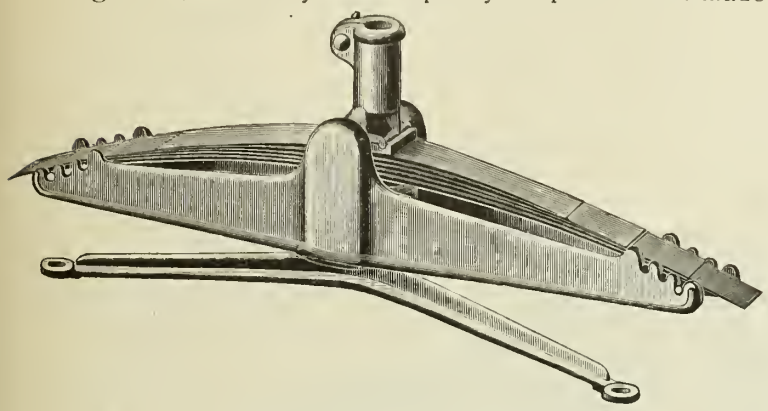
trussed, and being placed a good distance from the driving wheels. The side elevation of the truck shows its crowning feature—the placing of 75 per cent. of the weight of the car on the driving wheels. Practical tests have shown that this can be guaranteed. The brake work is simple but very effective, and is placed very low so as not to come in contact with any of the mechanical parts.

The truck may be run with either the driving wheels or the small wheels foremost, or so placed under the car that the driving wheels of the front truck are foremost and those of the rear truck trailing, or *vice versa*, and in

was discovered during the early part of last month. It was the custom of that road to burn in the furnace of the power station all the punched tickets turned in at the office of the company, and the plan of theft adopted was for the fireman of the furnace to rescue the bag containing the tickets before they were consumed, and to sell the tickets to the conductors for two cents each. The conductors would then turn in these tickets in place of cash fares received. The truth was discovered through the efforts of a detective in the employ of the company. It is stated that the amount lost by the company in this way was considerable.

The Philadelphia Trolley.

The trolley whose stand is shown below is manufactured by the Technic Electrical Works, Philadelphia, and embodies substantial mechanical design with lightness, durability and simplicity of parts. It is made



STAND OF PHILADELPHIA TROLLEY.

up of only nine pieces, can be dismantled in seven seconds and assembled in twenty-two seconds, all without a wrench. No nuts, bolts, screws or washers are used in its construction, and there are no chains, coil springs or small parts to rust or break. All parts are interlocking also and interchangeable.

The spring used, as will be seen, is of the leaf or wagon type, and is not liable to get out of order, while the design of the cam against the spring gives equal tension against the trolley wire, in all positions of the trolley pole from vertical to horizontal.

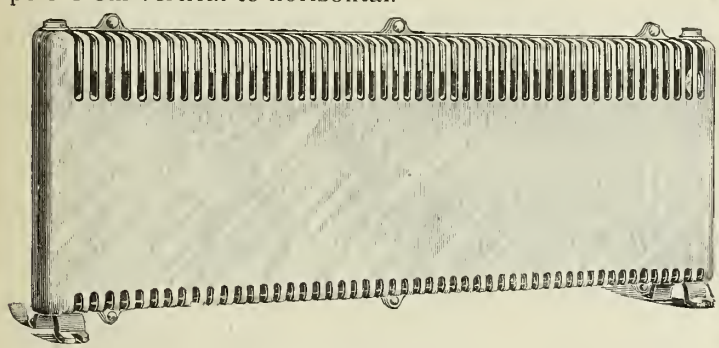


FIG 1.—ELECTRIC CAR HEATER.

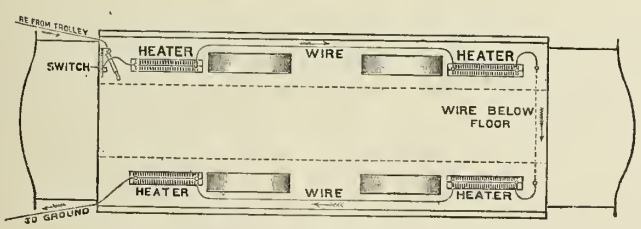


FIG. 2.—DIAGRAM SHOWING ARRANGEMENT OF ELECTRIC HEATERS.

The trolley has side motion, besides being pivoted and free to turn, and the degree of tension may be adjusted through a wide range.

According to the *Louisiana Planter*, molasses has been recently used for fuel in Cuba with seeming success. It is either poured or sprayed on to the bagasse as the latter enters the furnace, and in the judgment of those intreested, its efficiency as fuel when used in this way is considerable. The present price of molasses on the Louisiana plantations is at the rate of about $3.33 per ton, which is rather less per ton than current prices for coal delivered there.

Car Heating by Electricity.

For electric cars the electric heater possesses many advantages. It is light, durable and can be easily controlled. Moreover, it occupies no valuable space in the car, being generally carried under the seats, and can be turned on and off so easily by a switch that only a moment is required to throw the heater in and out of circuit. Electric heaters are perfectly safe, and as the electricity used is generated from cheap coal at the station, are also economical. Again, the heaters do not require close attention, thereby allowing conductors to attend to their other duties closely.

Electric heaters for an ordinary sized car are claimed to cost no more than a coal stove, and take but three amperes of current on a 500 volt circuit. One watt will heat nearly one cubic foot of air space in a car.

In the electric heater manufactured by the Dewey Electric Heating Co. of Syracuse, types of which are shown herewith, the entire surface of the heating conductor is exposed to the air. The conductor is supported and held firmly by non-combustible or fireproof material, and yet all except a very small percentage of its surface area is exposed to the air. There is no chance of getting a shock, as all current carrying parts are shielded and protected. The Dewey standard car heater is shown in Fig. 1. These heaters are located under the seats, and from four to eight are necessary to heat a car, depending upon the size of the latter. The heater case is of cast iron finished with a black japan, twenty-six inches long, two inches wide and less than eleven inches high, and can be secured firmly to the floor. The weight is about twenty-five pounds each. The heaters are generally connected in series on the car as shown in the diagram (Fig. 2). But

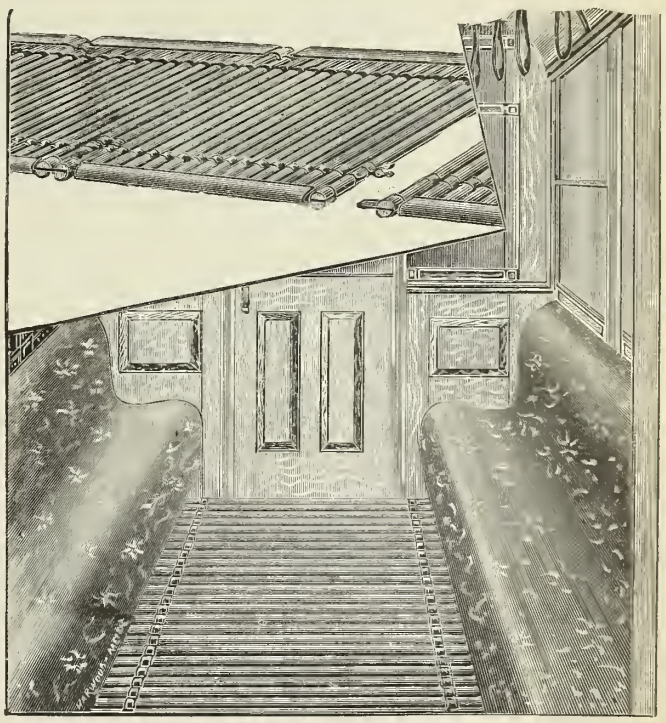


FIG. 3.—ELECTRIC MAT HEATER FOR STREET CARS.

one switch is in circuit to connect and disconnect the heaters, making their control simple and easy. At one end of the car the heaters are joined by passing the connection through and beneath the floor as indicated in Fig. 2. Should extremely cold weather appear, one of the heaters may be short circuited if necessary in order that a greater heat may be generated.

A mat or grating heater is shown in Fig. 3. This lies on the floor of the car and is composed of small gas pipes which inclose the conductor and form a large radiating surface. The grating is in sections so that it can easily be removed for cleaning purposes. As the temperature need not rise above 120 degs. to warm the car, there is no danger of rubber or leather being injured.

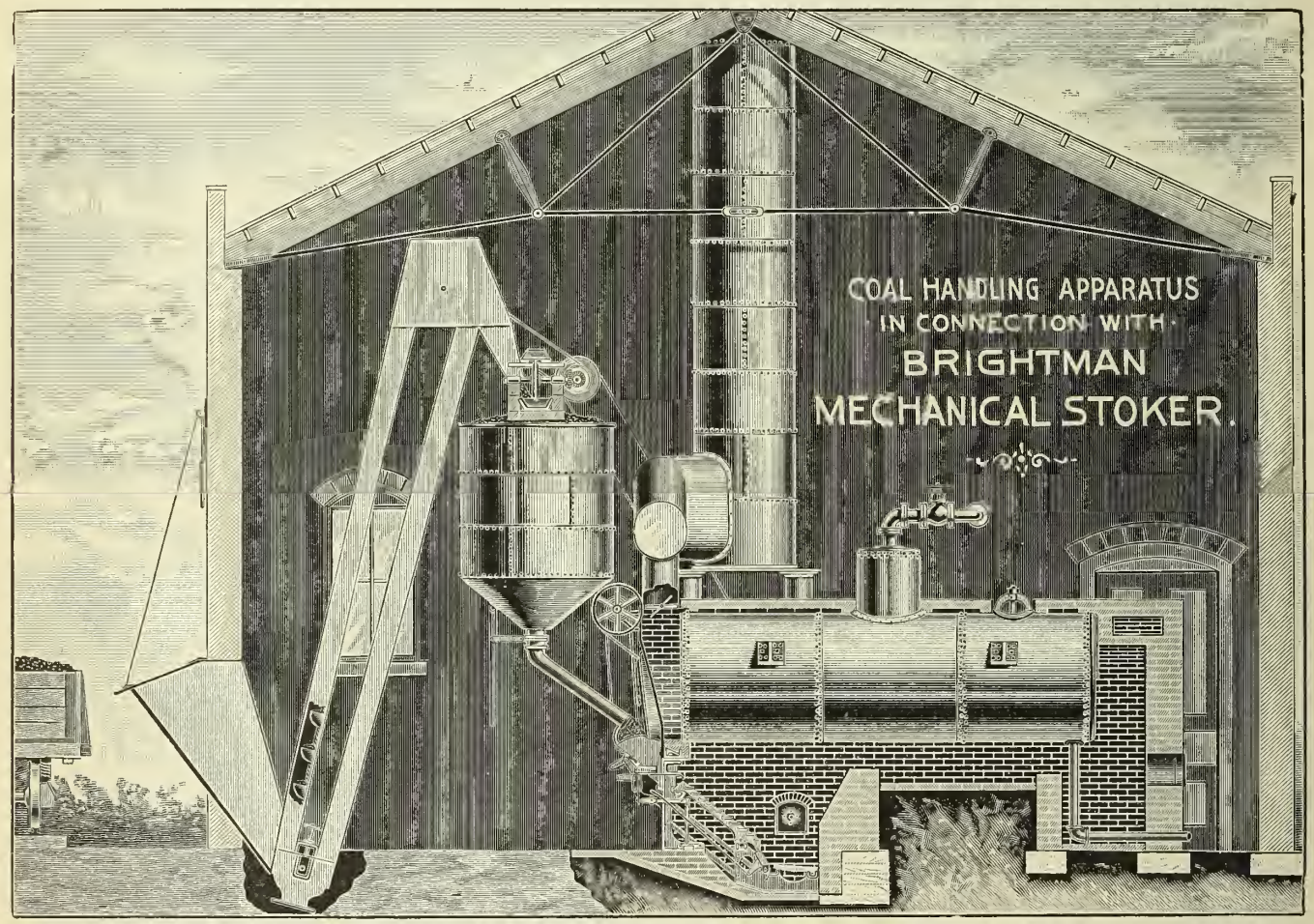
A Mechanical Stoker.

A boiler equipped with the Brightman mechanical stoker is illustrated in the accompanying engraving. It is noticed that a complete system of feeding fuel is represented. The special means adopted for conveying the fuel to the furnace is incidental, as other devices may be employed. Beginning with the furnace, it may be stated that the hopper in front of and below the flue cleaning doors is attached to the front and extends across it, its length being equal to the width of the grate surface. The bottom of the hopper is a cast iron feed table which extends into the furnace as far as the front ends of the grate bars. Sliding on the feed table is a "pusher" three inches in height having a horizontal reciprocatory motion. By its action the fuel is periodically crowded into the furnace, being delivered upon the forward ends of the grate bars. Motion is communicated to it by a heavy cast iron rocker, and the extent of the reciprocating movement, and consequently the feed of the fuel, may be controlled and varied by means of a rack and pinion feed adjuster. The rate of feed may also be altered by changing the belt on the cone pulleys. Provision is made so that the feed may instantly be stopped and started again. The power is ordinarily furnished by a small vertical engine, but it may be derived from a line shaft, or hand power may be the operating agency.

The arrangement of the grate bars is such that the great desideratum in a furnace is secured. The air supply is presented to the fuel in the most advantageous form, *i. e.*, in an extremely divided state. It enters through the grate bars, not in a score merely, but in a multitude of small apertures. This result is effected by the following construction: The grate bars are inclined at an angle of about thirty-four degrees from the horizontal, and are made with lateral projecting lugs overlapping each other. By this construction vertical openings through the grate are avoided, and the great waste often occurring by fine fuel falling through the bars is prevented. The overlapping lugs, however, are at a sufficient distance from each other to afford ample horizontal openings into the burning fuel, so that a plentiful supply of air is provided for combustion, and at the same time the bars are kept comparatively cool, and in consequence are not warped, melted or burned out.

Each alternate grate bar is stationary; the others have a reciprocatory and longitudinal motion communicated to them.

The fuel is delivered at the top of the grate, and the motion of the bars causes it to move regularly down the inclined surface toward the rear of the furnace. All fuel moves simultaneously, and this movement is positive and uniform, insuring a constant thickness of incandescent fuel. The motion of the grate bars may be varied from one fourth of an inch to an inch in accordance with the nature of the fuel, the draught and the character of the service. The adjustment is made quickly at any time without stopping the machine. This constant movement of the bars prevents the formation of clinkers. Nearly all the fuel is consumed on the inclined grate, and the feed is to be regulated accordingly; all clinkers and ashes and other incombustible matter and some unburned fuel pass from the principal grate to a *pit grate*, situated eight inches below the rear end of the principal grate, which is formed of ordinary bars, one-half inch thick by two inches wide with spaces of half an inch between them.



MECHANICAL STOKER AND COAL HANDLING APPARATUS.

The unburned coal is consumed on the pit grate; the ashes fall through to the ash pit below. The clinkers remain on the grate and their heat contributes to raise the temperature of the air entering the furnace.

One of the great advantages of the Brightman furnace lies in the fact that when it is used, little or no smoke is produced, because the combustible gases resulting from the decomposition of fuel are immediately and entirely consumed; in ordinary furnaces, as a consequence of incomplete combustion, these gases are more or less condensed and form smoke.

The tests that have been made with the Brightman

furnace seen to indicate a remarkable fuel economy. It has been demonstrated that it will supply from 15 to 30 per cent. more steam using slack than flat grade furnaces produce with the same weight of like fuel. The labor economy is still more marked. The labor required for boiler attendance is less than one-half that necessary in the case of a flat grate furnace.

Finally, it may be stated that the stoker is applicable to any style of steam boiler and to any of the patterns of fronts in common use. The stoker is manufactured by the Brightman Stoker Co. of Cleveland, O.

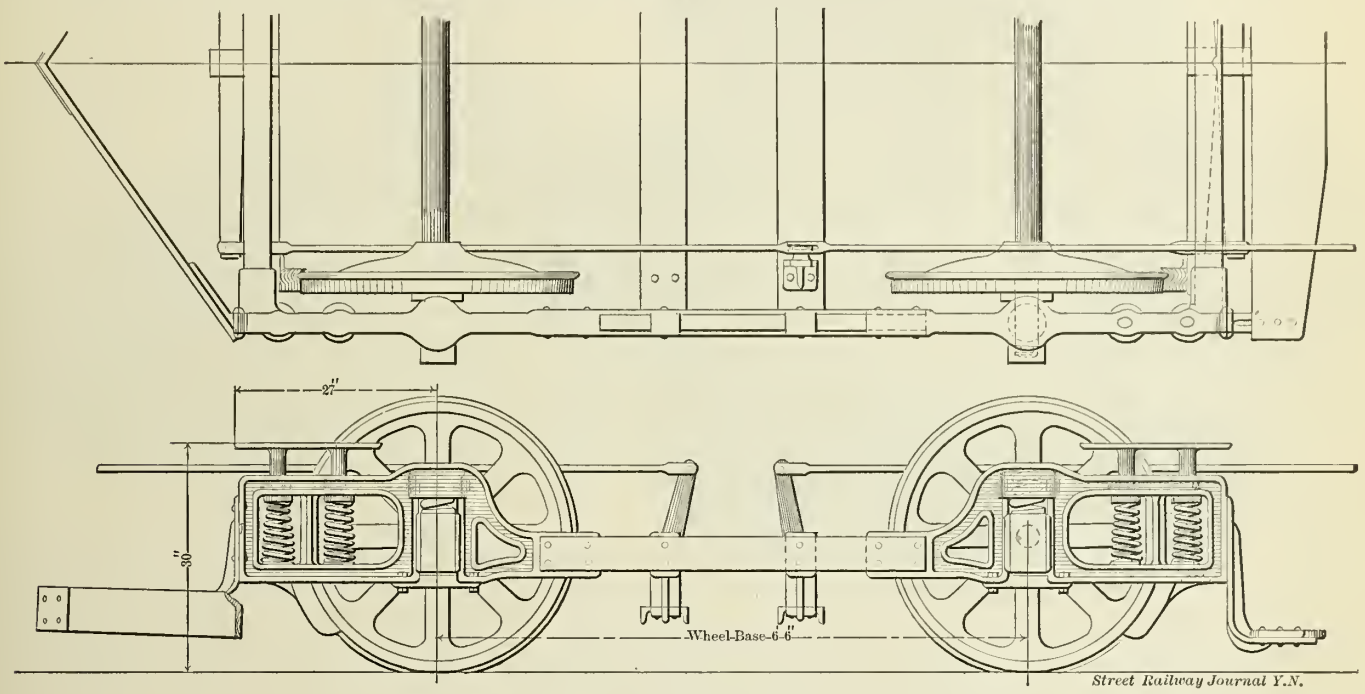
New Electric Motor Truck.

The accompanying cuts show the new extended spring base, electric motor truck to be put on the market by the St. Louis Car Co. The entire truck is an improvement on one of somewhat similar design turned out by the car company about six months ago.

It will be seen at a glance that simplicity of construction is one of the crowning features of the truck. There are but four steel castings, one of which is at each point of support of the car body, or, in other words, the frame occupying the region of the oil box, forming the extended spring base, and connecting with the bars which support the motor hangers. It will be seen that a heavy spiral spring is interposed between each oil box and its accompanying casting. These springs enable the entire truck to act as an equalizing bar. The great advantage of this feature is the minimum of noise and rattling caused by obstructions on the rails. The old truck above mentioned did not possess this advantageous feature. There are no bolts or nuts to work loose, and where any do exist they belong to working parts, such as in the brake mechanism. The wheels can be readily removed for motor repairs or other work by simply unscrewing the nuts which hold to the truck the plate beneath each oil box. The body pedestals, of which there are four, are attached to the car body, but are not intended to be removed every time the car body is lifted from the truck. They are released from the truck by loosening a nut at each upper spring cup, which can be seen in the side view. The advantage of this innovation is apparent from the fact that the continual screwing and unscrewing of bolts in the wood sills of a car body tend to wear away the threads, to increase the size of the holes, the consequences of which are well enough known, and to accumulate an account of rust. In the old truck there were four motor hangers, but in the present one there are only two, of flexible, hardened steel. The cut shows two styles of life guard. Both of these do not belong to the same truck, but simply exhibit the two most widely used styles, from which the purchaser can select.

The truck has been tested at the Washington University of St. Louis, by the Shickle, Harrison & Howard Iron Co., of the same city. It showed a tensile strength of 80,000 lbs. to the square inch. The weight of the truck is 3,000 lbs.

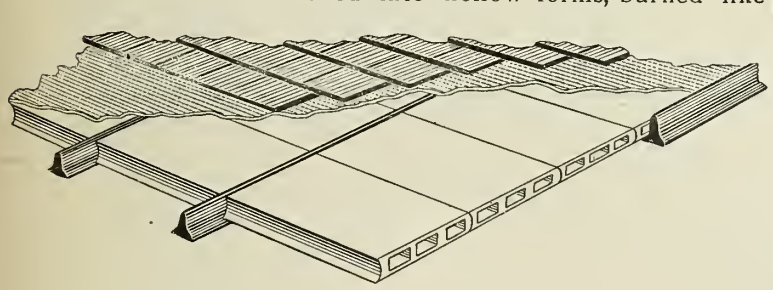
The company expects the truck to meet with great favor among street railroad men, as tests are now being made on the Union Depot and Bellefontaine railways of St. Louis, which give the most flattering results.



HALF PLAN AND ELEVATION OF NEW TRUCK—ST. LOUIS CAR CO.

Terra Cotta Lumber for Roofing.

The use of porous terra cotta, or terra cotta lumber as it is called, for building purposes where a fireproof material is required, seems to be growing rapidly among builders and architects. It has many advantages for this purpose, among which may be mentioned its non-conductivity of heat, cold or sound, its lightness and its ability to withstand a considerable load or continuous fire without breaking. Terra cotta lumber is a composition of clay and sawdust fashioned into hollow forms, burned like common brick in which process of burning the sawdust is consumed. One very successful application of the material and the one illustrated herewith, is that to roofing purposes.



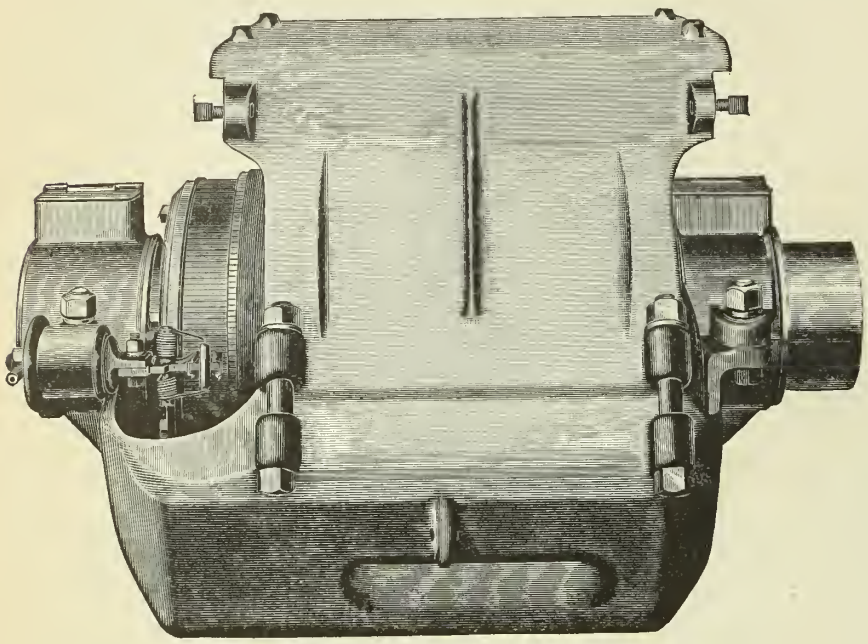
TERRA COTTA ROOF TILES.

The roofing tiles shown are from one and a half to three inches thick, twelve inches wide and twelve to twenty-four inches long, suitable to set between T iron purlins. The weight is from eight to fifteen pounds per square foot.

The Pittsburgh Terra Cotta Lumber Co., which supplies this material, operates under a license from the International Terra Cotta Lumber Co., by which it has the right to manufacture the composition under the Gilman patents.

A New Gearless Motor.

The gearless motor is a machine peculiarly identified with the Short Electric Railway Co. It is only a little over a year ago that the first machine of this type was introduced, and while it proved under the severe conditions of actual service to be of exceptional efficiency, the inventor saw a chance for development and improvement.



NEW GEARLESS MOTOR—END VIEW.

The machine and the subsequent slightly modified types that quickly followed the introduction of the machine attracted such widespread attention, and were so fully described, that a brief reference is essential in this connection only as prefatory to a description of a new gearless motor which was exhibited for the first time at the Cleveland convention. The original gearless was a four-pole machine flexibly mounted directly upon the car axle. The magnets were presented to the sides of the armature. As has been stated, this machine performed good work, but it was heavy and its construction was such that thirty-six inch wheels were necessary on the truck. The second type of machine was somewhat different in construction. The armature was mounted on a hollow shaft connected with the axle by means of a flexible driving device. The armature and magnets were practically the same as in the first machine, and as before, thirty-six inch wheels were necessary.

This machine was exhibited at the Pittsburgh convention of the American Street Railway Association a little more than a year ago, and was inspected with the greatest interest by railway men. In the next type the pole pieces were presented to the face of the armature instead of to the sides, and the armature was somewhat modified in form. Its face was wider, while the diameter was diminished so that thirty-three inch wheels could be used.

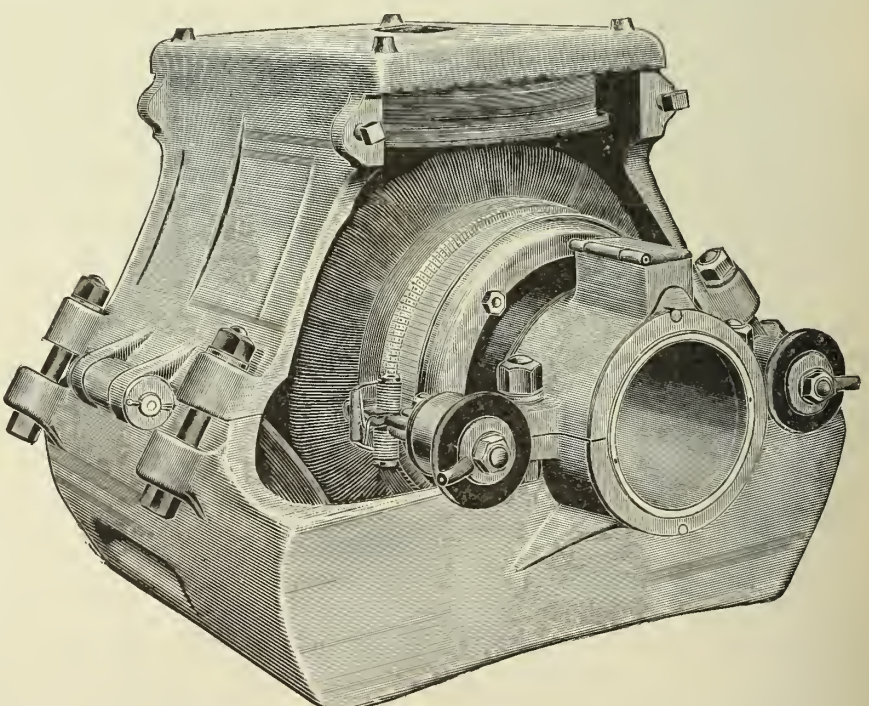
This brief description brings the development of the gearless up to the present latest type which is here illustrated. The motor is a six-pole machine weighing, complete, 2,300 lbs. The frame is cast from steel in two sections; the upper half is supported by the truck; the lower half is hinged to the upper, and may be swung down when a car is over a pit, so that inspection is rendered easy. The lower half of the frame is cast without any opening up to the level of the center of the axle, so that the motor may run through water and slush without any possibility of their penetrating inside the frame. Practically, therefore, the machine may be considered a waterproof motor.

The armature is twenty-one inches in diameter, and, as in previous types, is mounted on a six inch hollow shaft through which passes a four inch axle. To the end of the armature shaft is a flexible driving device for connection with the car axle.

The diameter of the armature is sufficiently decreased in the new type so that thirty inch wheels may be used with a clearance of three inches between the bottom of the motor frame and the track.

At already stated, the machine has six poles which are presented to the face of the armature. The latter is built with ninety-two bobbins, with sixteen turns of wire on each, which are connected to 184 commutator bars. The armature is designed to run at 120 revolutions per minute when developing twenty horse power.

Two of these motors will exert an horizontal effort of 1,500 lbs. in starting a car with eighty amperes, and with from eighteen to twenty amperes will propel an ordinary car at a speed of about twenty miles an hour.



NEW GEARLESS MOTOR—SIDE VIEW.

"A POOR track and imperfect roadbed mean decreased travel and consequent loss. The public are tenacious where their rights are concerned. The jumping of a track by a car and the consequent jolting occasioned thereby, tend to disgust shaken and demoralized travelers, and, with anathemas heaped on the company's head, they leap from the car and wend their way to business by their own private conveyances, namely, their legs. Hence the necessity of having good solid roadbeds, with rails equi-distant from each other, the whole length of the track."—*Chicago Street Railway Convention*, 1883.

PROF. ELISHA GRAY, has returned from an extensive European tour taken in the interest of the electrical congress which will be held in Chicago in connection with the World's Fair. He secured the promise of 200 electricians to attend the congress.

Rocker-Link Cantilever Truck.

Among the exhibits which attracted much attention at the Convention was a model of the above named truck, an illustration of which is given herewith. This is a type of six wheel truck so designed that the principal weight is carried upon the central wheels, while the front and rear wheels, which may be of the same diameter as the central wheels or smaller, perform the ordinary functions of a pony truck; and at the same time, owing to the

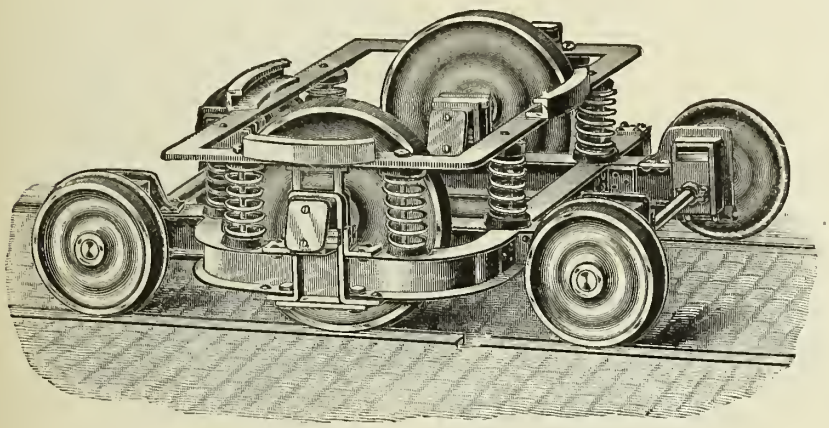


FIG. 1.—ROCKER-LINK CANTILEVER TRUCK.

presence of rocker links upon the axle boxes, take up or destroy the lateral shock that ordinary trucks experience when passing snaky track or entering curves. They also serve to keep the central wheels, which are ordinarily flangeless, upon the track. The front and rear axles are rigid vertically and longitudinally, but, owing to the rocker links, have a free lateral movement independent of each other or of the middle axle which is rigid to the truck frame in all directions. Fig. 2, shows the arrangement of the box with the link in the normal position. Fig. 3, shows the link by itself, and illustrates the principle through which, by means of the half round bearing surfaces of the link, the height of the truck above the rail is kept constant, independently of the position of the box.

The horizontal movement of the front and rear axles does not tend to raise the truck from its true horizontal

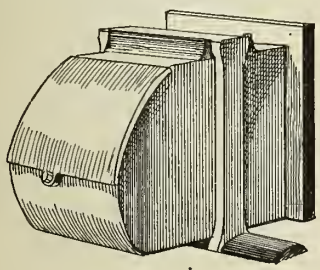


FIG. 2.—BOX.

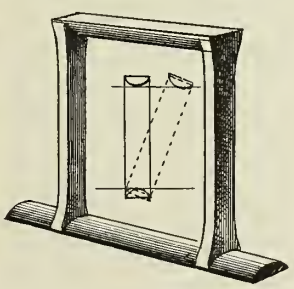


FIG. 3.—LINK AND DIAGRAM.

ROCKER-LINK CANTILEVER TRUCK.

line, however, as is the case with the ordinary swinging links, but the movement is against the gravity of their load, the same as if against a swinging link, so that the central wheels always remain in contact with the track, and their tractive force is not weakened.

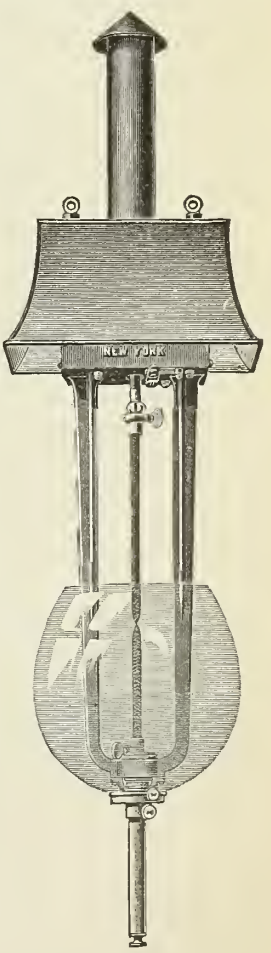
The frame being practically a cantilever balanced upon the central wheels and provided with springs, and having the spiral springs placed in the bottom of the of the frame and not, as ordinarily, between the axle box and truck beam, does not permit the front or rear wheels to drop into depressions or joints in the rail, and these wheels also in turn carry the central wheels over depressions in the same manner, which prevents pounding at joints. The central wheels can be mounted on the same axle, or preferably, as in the illustration, on independent axles with interior journal boxes, which facilitates their movements upon curves.

The truck is adapted to either steam, cable or electric traction, there being ample space within the frame for mounting the grip or the motors, which may be arranged to work independently on the separate axles, or upon a single main driving axle.

The device is the invention of E. R. Esmond, and is being manufactured by the Esmond Street Rail Co., 106 Broadway, New York.

Arc Lamps for Street Railway Circuits.

Most electric railway companies are in a position to operate electric lights from their circuits advantageously, and the number which supply current for arc lamps in this way is constantly on the increase. The accompanying engraving shows the improved Ward arc lamp designed for constant potential circuits, and which has already made a satisfactory record on circuits of 500 volts potential. Each lamp requires for its operation about ten amperes and forty-five volts, and on a 500 volt circuit ten lamps are used in series. Each lamp is provided with an automatic cut-out which, in case of accident to any individual lamp, will throw into the circuit a resistance equal to that of the lamp while burning, thus maintaining a constant resistance for the circuit and keeping the current constant. The resistance for this purpose is placed on the lamp or in the hood. Each group of ten lamps is also provided with a suitable resistance to adjust it to the voltage of the circuit, and this is placed either in one lamp or, if desired, exteriorly in some convenient location. The framework of the Ward arc lamp is of malleable iron, making it strong and durable, and the mechanical and electrical parts are duplicate and interchangeable. The carbon rod is a seamless drawn, rectangular, brass tube, and the pinions and bearings of the feed mechanism are of phosphor bronze. The lamp is manufactured by the Electrical Construction & Supply Co., of New York.



ARC LAMP FOR INCANDESCENT CIRCUITS.

The consumption of current can be measured by meter as easily with this as with an incandescent lamp.

"We should, therefore, recommend for a well ballasted roadbed good gravel that will bind; and if this cannot be procured, sand or any other ballasting material that will cause the least rot to the timbers by allowing the water to filter through. The paving well and properly laid on this bed cannot fail to give good satisfaction. Where the traffic is very heavy, we should recommend tram rail, from forty to forty-five pounds to the yard, and well spiked to stringers with good cast or wrought iron joint plates at the end of the rails."—*Chicago Street Railway Convention*, 1883.

A new material for paving is now being introduced in London. It is made of granulated cork and bitumen pressed into blocks. These blocks are afterward laid like bricks or wood paving. It is said that in this there is a special advantage in that it is exceedingly elastic, and when used for pavements gives a soft tread which is easy for the horses' feet, feels like a rubber carpet, and does away almost entirely with the noise which is such an unpleasant feature of the traffic of the streets of a great city.—*India Rubber World.*

A Cleft Rail System.

This is a type of continuous girder rail, which may be either center or side bearing. It is divided lengthwise vertically through the center of the head and the two members are rolled in the forms illustrated in Figs. 1 and 2. In either case the two parts are designed to be laid together with broken joints and bolted at frequent intervals. As shown in Fig. 1, the web of the inner member is represented as resting on a shoulder provided at the side of the leading member with a rib and groove as before, the former being virtually a continuous fishplate. Fig. 2 shows the rail mounted on a wooden substructure.

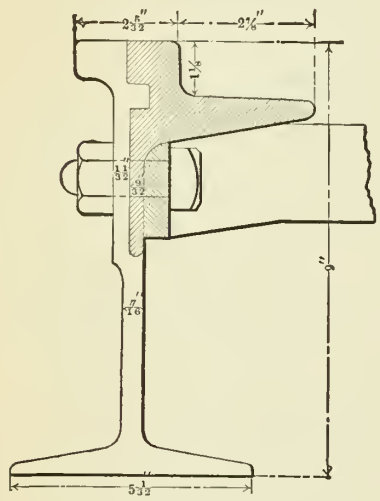


FIG. 1.—SECTION OF CLEFT RAIL.

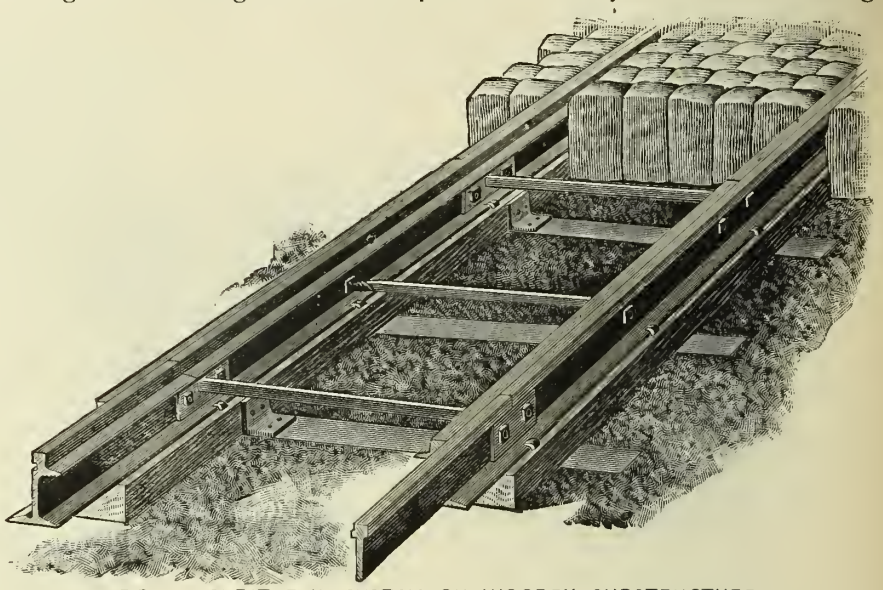


FIG. 2.—CLEFT RAIL SYSTEM ON WOODEN SUBSTRUCTURE.

The system is adapted to an entire metal construction, in which case, circular cast iron chairs having a broad base are employed, which may rest either on the soil or on prepared pedestals; or, it may be laid with the rail resting upon stringers or spiked directly to the ties.

The danger from water collecting and freezing between the members is obviated by making slight corrugations on the shoulder or seat on which the flange of the inner member rests which constitute drains and lead the moisture off before freezing can take place.

The claims made for it are, a smooth surface for the passage of cars, vertical stiffness with sufficient cushion to prevent jarring and pounding, good conductivity, the contact of the members being sufficient to conduct the current without the necessity of bonding; also good paving qualities.

The rail was designed by E. R. Esmond, and models were exhibited at the Cleveland Convention by the Esmond Street Rail Co., of New York, who are the promoters of the system.

Columbus Week Traffic in New York.

October 10, 11 and 12, were days which tested the capacities of the surface and elevated railways in New York City. The elevated railways, of course, carried more passengers than any other, the record for these three days on that road being as follows:

	No. of Passengers.
October 10	945,000
" 11	901,000
" 12	1,075,537
Total for the three days	2,921,537
Average per day	973,845

October 12, the traffic was thus divided between the roads of the elevated system:

Second avenue	114,502
Third avenue	440,442
Sixth avenue	447,634
Ninth avenue	71,852
Suburban	31,107
Total	1,075,537

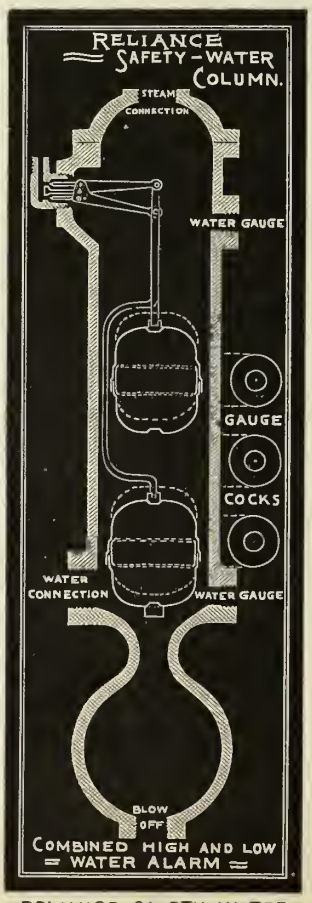
These were the greatest three days in the existence of the company. The average number carried per day was in excess, too, of the largest business done previously by the company on any one day. That was on the occasion of the Washington Centennial parade, when 867,000 passengers were transported in twenty-four hours. Among the surface railways the Third Avenue carried, probably, more than any other, the record of this road being

October 10	109,260
" 11	138,800
" 12	140,200
Total for three days	388,260

A statement of the traffic on the Brooklyn Bridge during Columbus Week will be found on another page.

The Reliance Safety Water Column.

Among the exhibits of auxiliary appliances at the Cleveland Convention, which attracted much attention, was the display of Reliance safety water columns by the Reliance Gauge Co., of Cleveland, the sole manufacturers of this apparatus. The exhibit included as well several iron columns with the various kinds of water gauges and gauge cocks with which they are equipped in accordance with the fancy of the buyer.



RELIANCE SAFETY WATER COLUMN.

But, perhaps, the part that attracted most attention was the aluminum models in section showing the working parts of the water column, as shown in the accompanying cut. As will be seen by a study of the connections, the water tender must keep the water right or be exposed by the whistle, which will sound if the water is too high or too low. The exhibit was in charge of A. J. Wright, president, and L. H. Elliott, secretary and treasurer of the company.

The West Chicago Street Railroad Co. have posted an order that police officers occupying seats in crowded cars must pay fare.

The Sperry Electric Railway System.

Nine cars equipped with the Sperry electric railway system have been in operation with most satisfactory results, during the past year, at Youngstown, O., where the conditions of road, grade, etc., are particularly severe. In view of the success attained by these cars, the Sperry Electric Railway Co. has been organized under the laws of Ohio with a paid up capital of $250,000 for the purpose of placing the equipments upon the market. Elmer A. Sperry, the inventor of the system and of the Sperry arc system of lighting, has been retained as electrical engineer of the company, and Harry P. Barr, who for the past three years has been connected with the railway department of the Thomson-Houston Electric Co., is secretary and general manager. The main office of the company is 29 Broadway, New York.

In the system a single forty horse power, single reduction, drum type armature, two pole motor is used on each car. These motors are elastically supported from the frame of the truck, and flexibly connected to both axles, beveled gears being used, and the axis of the armature being lengthwise of the car. The armature shaft is hollow, and its bearings form part of the motor frame. The weight of the motor, including the armature, which is about 2,000 lbs., rests upon two cross bars which are in turn supported on cushions from the truck frame. The only weight, therefore, not supported on springs is the weight of the driving gears, housings and pinion shaft, a total of 400 lbs., on each axle.

The flexible connection between the armature shaft and axles is a special feature of the equipment. This includes the use of a cushioned universal clutch consisting of a case having internal projections keyed to a hollow armature shaft and forming the driving element. A piece having radial arms keyed to the pinion shaft forms the driven element, and the two are connected by a floating piece which transmits the rotation from the one to the other through the medium of rubber cushions, allowing eccentric positions of the two while retaining the perfection of transmission.

It is self evident that by this device, while the effort of the motor is transmitted to the wheels, all concussion and vibration of the wheels and axles, with their destructive tendencies, are prevented entirely from being transmitted back to the motor. The yielding element in this drive is also found to greatly reduce the strain on gear teeth and to add materially to the life of both pinion and gear. This is exemplified by the fact that gears are running to-day in Youngstown which have been in continuous operation in actual service for the past year.

The method of control adopted embraces the series multiple combination of fields with variable resistance. On starting, two fields are in series with each other, and with the whole resistance. As the speed increases the resistance is gradually cut out, until when it is all cut out the fields are connected in parallel. The fields are particularly adapted to this method of control as they work far below magnetic saturation.

The controlling device is placed on the platform where it occupies the space afforded by the forward bulge of the dasher. From the fact that only small amounts of the resistance are cut out at a time, and from the method of making connections there is practically no sparking, and the arc formed on the last contact is mechanically blown out by an air blast formed by a small bellows operated directly by the contact lever. The reversing switch is within the controlling box, and is so arranged as to make it impossible to reverse while the current is on.

All the details of the system have been carefully worked out, and each part is especially strong and durable.

The contract for rebuilding the Newark & Orange Street Railway has been awarded to Wm. P. Craig, of East Orange. N. J., and is being pushed rapidly forward. The track will consist of nine-inch girder rails, spiked direct to the ties, which are laid two feet six inches between centers. Fish plates two feet long are used at the joints and fastened with eight one-inch bolts.

Some European and American Methods Compared.

By G. Herbert Condict.

It has been a source of great wonderment to the writer that American street railway managers should be so slow in adopting the double deck car. While the horse furnished the only motive power, this slowness could be accounted for by the fact that nothing in the shape of horseflesh could stand any increase in the burden already imposed upon it. On English and Continental tramways where the limit of load for a sixteen foot, double deck car is fixed at forty-six or forty-eight passengers, and that limit usually strictly adhered to, the power required to move the car is far below that necessary for a single deck car packed with weighty humanity to the very hand rails. Since the introduction of the almost unlimited power of the cable and of the electric motor, this reason for adhering to the old standard car does not exist. Certainly the patrons of the street car lines would be benefited by having the increased accommodations, and this plan of obtaining the same without occupying greater street surface, and also without increasing the number of cars, does seem most feasible. It would be most interesting to hear from the street railways in this country, which have tried the double decker, in regard to the advantages and disadvantages attendant on its use.

Now, as to the system of limiting the load to the available seating capacity of the car. This subject has often been discussed, not only by the foreigner who visits these shores, but by the native who has been brought up in the midst of the much decried American system of "there's always room for one more." Why do not the American municipal authorities compel the street railways to limit the number of passengers carried on their cars, is a question often asked. After some experience on both English and Continental street railways, the writer feels justified in saying that the average American public would not agree to any such restriction. That such a plan is the most comfortable for those who have seats, cannot be questioned an instant; but how about the poor unfortunate who, at a busy time, in inclement weather, is compelled to stand on a street corner for an indefinite period, watching car after car pass because all the seats are occupied? Isn't it better to stand in a car that is making progress toward the desired haven, than to stand on a wet, cold and exasperatingly stationary curbstone? It is not within the scope of this article to demonstrate that the oft repeated solution of the overcrowding question, namely, that "street railways should be compelled to run enough cars during 'rush' hours to carry the traffic," is no solution at all, in most cases.

The Paris plan has its advantages over the English, especially for the women, as it places them on an equal footing with the men, in regard to obtaining seats. Small offices are placed on the corners at points of heaviest traffic. By application at any one of these offices a prospective passenger may obtain a numbered ticket, entitling the holder, in regular turn, to board a passing conveyance of the company in which there may be a vacant seat. This is a decided improvement over the English system, as in the latter the women fare very badly when a heavy traffic is on, as the men jump on the vehicle before it has come to a stop and secure any vacant seats, leaving the fair sex to wait for a more favorable opportunity, which often means when there are no men desirous of obtaining seats. This, coupled with the fact that in the most crowded streets the busses and trams are not allowed to stop, either to take on or let off passengers, except at certain designated points, compels the English woman to be more active than her American cousin, and it is not at all unusual to see a woman getting on or off a conveyance while the same is moving at quite a lively pace.

The Chicago Street Railway Co. has placed an additional order for motors with the Westinghouse Electric & Manufacturing Co., making a total of sixty-one motor cars and four 200 H. P. generators ordered.

The Exhibits.

The exhibition of apparatus for street railways formed a notable feature of the Convention. At no previous meeting of the Association had there been shown such a varied and complete display of the devices and machinery designed for use by street railways, and the arrangements for exhibiting the apparatus were such as to facilitate a careful inspection. The exhibit demonstrated the variety of equipment which manufacturing companies are compelled to supply, and illustrated by its completeness the progress that has been made by these concerns within the last few years. The list of exhibitors is an extended one; for the number of inventors in this particular field is continually growing, and the multitude of specialties in certain lines is almost confusing. From the supply man's point of view the exhibit was entirely successful, for the greatest interest was shown in the varied display; and also from that of the street railway man, for none of them is so well informed that he could not extend his knowledge to advantage by inspecting the specialties and new machinery exhibited.

The main exhibit was located in the Army and Navy Hall almost directly opposite the Hollenden Hotel, and in a temporary building adjoining. Temporary stands were built for apparatus directly in the rear of the hotel, and cars were exhibited on a temporary tracks. The East Cleveland Railroad Co., made a liberal provision for all those requiring power. Current for the special cars and for all machinery in the exhibit halls was furnished from its power station. Following is a list of those who made exhibits:

C. S. Van Nuis, of New York, exhibited his Fulmen lightning arrester.

The Cleveland Frog & Crossing Co. showed frogs, crossovers, switches, etc.

D. H. Carpenter, of Toronto, exhibited a case containing automatic wrenches.

The Osborn Manufacturing Co., of Cleveland, exhibited several of its wire brushes.

John H. Graham & Co., of New York, showed two different styles of rotary alarm bells.

Koelher & Roskoph of Cleveland, exhibited their automatic street railway switches.

The Crescent Manufacturing Co., of Cleveland, exhibited a number of its specialties.

The Kuhlman Co., of Cleveland, showed to the visitors some of its interior street car work.

H. C. Burke, of Cleveland, exhibited a model of his patented underground trolley system.

The Reliable Manufacturing Co., of Boston, exhibited some of its street railway appliances.

The Foreman-Bassett-Hatch Co., of Cleveland, exhibited samples of street railway tickets.

The United Tramway Sprinkler Co., of Louisville, Ky, exhibited one of its tramway sprinklers.

John Kuehnle, of Detroit showed a line of trolley wheels for which special claims are made.

The Crossley Car Brake Co., exhibited a model of its friction brake which attracted no little interest.

The Partridge Carbon Co., of Sandusky, O., showed a line of brushes designed for electric railway motors.

Alfred G. Hathaway, of Cleveland, exhibited his transfer table, which is well known to all street railway men.

The Campbell & Zell Co., of Baltimore, exhibited a handsome model of the Zell improved water tube boiler.

The Hackney Hammer Co., of Cleveland, showed one of its lightest hammers operated by an electric motor.

The Hartford Woven Wire Mattress Co., of Hartford, Conn., exhibited samples of its woven wire car seats.

The Miller Chemical Engine Co., of Cleveland, made an exhibit comprising several Miller hand fire extinguishers.

The H. M. Loud Sons Lumber Co., of Au Sable, Mich., made an exhibit of poles designed for street railway purposes.

Horace A. Loomis, Hightstown, N. J., showed samples of the Jones adjustable metallic spring weather strip for street cars.

Pierce & Miller, of New York, were represented by Mr. Miller, who described the merits of the McIntosh & Seymour engines.

The Paige Car Wheel Co., of Cleveland, exhibited several of its steel tired wheels designed for use on electric and cable railways.

The Burrowes Car Shade Co., of Portland, Me., exhibited samples of car shades. C. M. Fuller was in charge of the exhibit.

The Charles Scott Spring Co., of Philadelphia, made a complete exhibit of its spiral and elliptic springs for horse, cable and electric cars.

Joseph Fischer exhibited models of two forms of brake which he had invented, and showed patents for a new underground trolley system.

The Siemens & Halske Co., of America, distributed to delegates photographs of its machinery designed for railway and lighting stations,

The International Register Co., of Chicago, showed several of its portable registers. The company was represented by A. H. Englund.

The Robinson Electric Truck & Supply Co. invited delegates to ride on the cars on the East Cleveland road, equipped with the Robinson truck.

The Mehling Car Co., of Cleveland, made no exhibit in the hall, but its summer and winter car, No. 288, on the East Cleveland line, attracted much attention.

The Automatic Cable Grip Release Co., of St. Louis, exhibited a model of its grip release which was examined with interest by all connected with cable roads.

The Chapman Valve Co., of Boston, exhibited a full line of valves, which are familiar to engineers of electric power stations. Special forms of valves were also shown.

The Toledo Electric Heating Co., of Toledo, O., exhibited car heaters. As they were connected to the railway circuit in the Hall, visitors were able to examine them in actual operation.

The American Electrical Works, of Providence, R. I., exhibited a line of samples of wire designed for street railway use. Their merits were explained by P. C. Ackerman and W. A. Hathaway.

The Eureka Tempered Copper Co., of North East, Pa., exhibited a number of its specialties. There were shown commutator segments, trolley wheels, brushes, etc., made of pure tempered copper.

R. A. Crawford, of Pittsburgh, gave a practical demonstration of the value of his guards for cars. The guard can be attached to any style of truck, and can be adjusted or taken off in a short space of time.

The Q. & C. Co., of Chicago, exhibited a rail saw which was examined with great interest. The saw was operated by hand power. Photographs of other apparatus sold by the company decorated the booth.

The Porter Tramway Switch Co., of Cleveland, made an extensive exhibit of its switches just outside of the exhibition hall and announced on a placard that these switches were used by all the Cleveland railroads.

The McIntosh-Huntington Co., of Cleveland, which furnished the wire for the Woodland Avenue & West Side Street Railroad Co., made a very complete exhibit showing wires, car trimmings and railway supplies.

The Aluminum Brass & Bronze Co., of Bridgeport, Conn., was represented by Gilbert M. Smith, of Chicago, who exhibited samples of silicon bronze trolley wire, for which many special advantages are claimed.

The Genett Air Brake Co., of Chicago, exhibited one of its air brakes which was attached to one of the Brill trucks. The brake was examined with great interest by many. The company was represented by D. Reid of Chicago.

The New Process Rawhide Co., of Syracuse, N. Y., displayed in its booth a line of rawhide pinions. One pinion shown had a record of 22,000 miles on the West Bay City Electric Railway, but scarcely any wear was perceptible.

The P. Wall Manufacturing Supply Co., Allegheny, Pa., exhibited a full line of steel gongs, and their interests were carefully looked after by Mr. J. P. Wall, who received substantial appreciation of his exhibit in the shape of orders.

The Bodifield Belting Co., of Cleveland, made an exhibit showing a variety of sizes up to a sixty inch dynamo belt. Among the new belts were two designed for use on motors. These are made of a combination of cotton and leather.

The Forest City Electrical Works, of Geneva, O., exhibited a line of switches and showed a slate switchboard completely equipped with devices of the Cleveland type. These consisted of ammeters, circuit breakers, fuse switches, etc.

The Cleveland Electrical Manufacturing Co., exhibited several of the American Watchman's time detectors, of which it is the sole manufacturer. The instrument is designed to keep an exact record of the doings of the night watchman.

The Billings & Spencer Co., of Hartford Conn., exhibited an assortment of Billings patent drop forged commutator bars, and a variety of tools made by the company. The bars and tools were neatly arranged on an exhibition board.

The W. H. H. Peck Co., of Cleveland, exhibited a line of samples of its electric railway and mill supplies. Among the articles exhibited were, waterproof trolley cord, tan cord for bells and registers, rubber goods, leatheroid, vulcanized fibre, etc.

The Wrought Iron Casting Co., of South Boston, Mass., exhibited specimens of their work in connection with the Hirt six wheel truck, the clamps, jaws and other wrought iron castings on the truck having been made by the Wrought Iron Casting Co.

The W. D. Graves Electrical & Manufacturing Co., of Cleveland, had an exhibit which was scattered, but was interesting to street railway men. The exhibition hall was lighted by Graves' arc lamps, which were operated on the 500 volt railway circuit.

The Shultz Belting Co., of St. Louis, was represented by J. A. Ferguson, who exhibited samples of the company's link belt and celebrated dynamo belt. He also showed the Shultz patent leather pulley covering which has been recommended by so many power users.

The Hill Clutch Works, of Cleveland, made an interesting exhibit of its specialties. These included one of the new Hill clutches, belt tighteners, couplings, shaft stands, etc, The machinery was set as if to be operated, so that it could be examined to the best advantage.

The Peckham Motor Truck & Wheel Co., of Kingston, N. Y., exhibited one of its No. 5 A trucks, constructed for electric railway service. Parts of the truck were shown in order they might be carefully inspected. Peckham's cushioned car wheels were also exhibited.

The Lodge & Shipley Machine Tool Co., of Cincinnati, exhibited one of its motor gear lathes, designed by William Lodge. It was constructed with a view of producing machine work of excellent quality, with great rapidity, and its operation was watched with equal interest.

The Pittsburgh Steel Hollow Ware Co., of Pittsburgh, Pa., showed a line of rolled steel gongs. The company has perfected a process by which a steel gong is rolled of uniform size, thickness and hardness. The company guarantees to replace all gongs broken or cracked.

The Stillman Light Railway Development Co., of Providence, R. I., exhibited a model of its track construction in which T rails and beveled stringers are employed. Economy and long life are claimed for the construction. Their new triple compound rail interested many delegates.

The Taylor Electric Truck Co., of Troy, N. Y., exhibited its truck designed for use on electric railways. It is claimed that it is non-teetering, noiseless, easy riding, durable, and that it may be quickly disconnected from the car body. A complete model was also exhibited.

Hooven, Owens & Rentschler Co., of Hamilton, O., had headquarters in which were shown photographs of the Hamilton-Corliss engines. What the company considered its real exhibit was to be found at the Cleveland Electric Light Co., where two Hamilton-Corliss engines are in operation.

The Supply Manufacturing Co., of Pittsburgh, Pa., exhibited a number of commutators, which the company makes in all sizes for railway and lighting machines. Their characteristics are beauty of finish, excellent material and accuracy in workmanship. The company also refills commutators.

The Robinson Machine Co., of Altoona, Pa., was ably represented by Mr. Albert Hay, president, who explained the special features of the Robinson all-steel truck and entertained many of the delegates with a ride on the car equipped with his truck and which showed excellent results.

Taylor, Goodhue & Ames, of Chicago, were represented by Mr. William Taylor. This firm has the Western agency of the Philadelphia trolley, Wagner motors for street railway circuits, the Columbia incandescent lamp and the Nutting arc lamp, both of which are for use on street railway circuits.

The Sheffield Car Co., of Three Rivers, Mich., exhibited the latest type of its truck. In this truck the equalizing of strains is effected by a side equalizing bar introduced upon one side of the truck, thus giving a three-point suspension to the car body, resulting in easy motion even over a heavy track.

The Edison Manufacturing Co., of New York, exhibited for the first time two electrostatic voltmeters, one intended for a 500 volt and the other for a 1,000 volt circuit. These devices are simple in construction and are not affected by magnetism. They are designed for use on both direct and alternating circuits.

The E. S. Greeley & Co., of New York, made a unique exhibit, which attracted no little attention. The special feature of popular interest was a miniature Statue of Liberty, whose torch was represented by a tiny incandescent lamp. The company showed resistance sets, lamps and general electrical supplies.

The Van Dorn Iron Works Co., of Cleveland, exhibited a number of its tubular steel poles. The joints of the poles are secured by Van Dorn locking steel keys, and are covered by a malleable iron ring shrunk on. The poles are painted inside and outside, and all wood insulating parts are boiled in paraffine.

The C. & B. Manufacturing Co., of Troy, N. Y., exhibited a simple trolley finder which has been in successful use on the Troy & Lansingburgh railway for several months. In connection with this exhibit was shown the Smith changeable signal light box in which the signal color can be changed as desired.

The Morton Safety Heating Co., of Baltimore, made an exhibit showing its method of car heating. The system consists in storing heat in earthenware tubes. It is claimed that the application of steam for five minutes stores sufficient heat to keep the cars comfortable for two hours in zero weather.

The Cushion Car Wheel Co., of Indianapolis, was represented by P. F. Leach, of Chicago, the vice-president. The exhibit comprised the wheels under the special car of the General Electric Co., which was mounted on a McGuire truck, and under a nickel-plated truck exhibited by the McGuire Manufacturing Co., of Chicago.

The Brownell Car Co., made an exhibit in addition to its Accelerator car. In a booth in the exhibit hall were shown a trolley bridge and a model of the Brownell truck. The booth was ornamented with photographs of Brownell cars. The company was represented by Mr. Brownell, B, F. Craw, C. W. Joslin, and F. A. Baier.

The Mitchell-Brant Copper Co., of Erie, Pa., showed an extensive line of pure tempered copper, designed for electrical purposes. A complete assortment of commutator bars which are made exactly to gauge, so that they are ready for immediate use. The company was represented by Thomas Brown and A. L. Daniels.

The Star Headlight Co. exhibited one of its new headlights, built with the idea of destinguishing cars. The device was constructed to carry out the idea advanced at the Saratoga convention of the New York State Street Railway Association, that the cars of different routes could be distinguished by headlights showing different colors.

The Pittsburgh Trolley Co. made an exhibit which street railway men found of marked interest. A. P. Manning, the representative of the company, explained the merits of the Duncan compression spring trolley, for which special claims are made. The self-oiling trolley wheel introduced by this company was a feature of the exhibit.

The Stirling Boiler Co., of Chicago, was represented by T. E, Bruce at the headquarters in the exhibit hall. Mr. Degan of the Chicago office, was present at the Convention. In the way of an exhibit the Stirling Co. had much to show. In Cleveland the new boiler house of the Otis Steel Co. contains one of these boilers.

The Bradley General Electric Co., of Chicago, exhibited a full sized model of its electric railway conduit. The construction of the conduit is somewhat similar to that built for cable service, but is less expensive. The construction is such that dirt, mud and water cannot enter into the section of the conduit in which the trolley wire is run.

The John Stephenson Co., Limited, of New York, was represented by Messrs. D. W. Pugh and J. A. Tackaberry. Mr. Pugh distributed among his friends a very nice leather bound memorandum book. On the back was printed a Stephenson electric car, and on the front the seal of the Association, making a handsome vest pocket souvenir.

The Standard Railway Supply Co., of Chicago, exhibited two of its car stoves, which may be applied to any style of car without cutting the seats. These points were particularly emphasized by Garson Myers, the manager of the company. The exhibit was so arranged that it was easy to demonstrate that no injury would be caused to cushions.

The Washburn & Moen Manufacturing Co., of Worcester, Mass., exhibited some of the wires made by that company. Specimens were shown of sizes ranging from a magnet wire to the heaviest railway feeder cable ever made. There was also exhibited striking evidence of the fireproof qualities of the company's new wire, known as "Salamander."

The Pennsylvania Steel Co., exhibited sections of its T rails ranging in sizes from 40 to 100 lbs. Girder rails were exhibited, varying in height from 4½ to 10 ins. Switch pieces for T and girder rails were shown, as well as samples of special work. The representative of the company was John F. Ostrom. Ralph Lee Crump was in charge of the exhibit.

The Esmond Street Rail Co., of New York, made an extensive exhibit showing the different styles of its novel and effective track construction. Visitors were especially interested in the statement that the rails were practically jointless requiring no fishplates and no bonding when used for electrieal service. The novel Esmond rocker link truck was exhibited by a model.

The Jewell Belting Co., of Hartford, Conn,, made an exhibit of several belts, the largest of which, forty-eight inches in width, is to be used by the General Electric Co., in New York City. The regular dynamo belting and the railway dynamo belting were shown. The company was represented by Charles E. Newton, Secretary, C. L. Tolles and George W. Bancroft.

The R. D. Nuttall Co., of Pittsburgh, made an extensive display of its street railway supplies. Particularly noticeable was the Nuttall trolley, which is giving such general satisfaction on electric roads. A full line of the well known Groetzinger Dermaglutine pinions was displayed. Among the other specialties were overhead switches, gears for all systems, commutators, drills, etc.

Mark & Sterling, of Cleveland, made an exhibit of their special devices for track equipment. They were arranged in a prominent position and attracted no little attention. The special joint devised by Mr. Mark was examined with special interest. The firm uses malleable iron in the production of its specialties, as it has been found to give the most satisfactory service under all conditions.

Dorner & Dutton, of Cleveland, made their exhibit on an extensive platform directly in the rear of the hotel. In all the firm exhibited five of its solid forged trucks, several of which were equipped with elliptical springs. Short motors were mounted on two of the trucks, and a third carried Westinghouse motors. The firm showed a full line of track cleaners, gears, journal boxes, wheels and transfer tables.

The Walker Manufacturing Co., of Cleveland, had a booth at the entrance of the convention hall. Photographs of the several departments of the works and of some of the ponderous machinery constructed there were shown. Models of gear drive and rope drive cable machinery and block patterns for machine moulded gears were exhibited. In a booth in the exhibit hall a second display somewhat similar in character was made.

The National Fare Box Manufacturing Co., of Chicago, exhibited its new aluminum fare box. F. H. Roeschlaub, the manager,

explained its working, and showed the impossibility of abstracting fares once deposited. The lightness and manifest advantages of the new box interested many attendants. Mr. Roeschlaub also exhibited a new device for repairing bell cords, that will soon be put on the marked.

The Lima Register Co., of Lima, O., exhibited one of its stationary registers, which is now used by seventy street railroad companies. It is giving satisfaction, as it is durable, not likely to get out of order, and is safe from the manipulation of dishonest conductors. The company's business has increased so rapidly of late that it has been obliged to equip a brass foundry which will turn out work entirely for the registers.

The H. W. Johns Manufacturing Co., of New York, made a complete exhibit, showing insulators of every form used by street railway companies. The goods made of Vulcabeston and moulded mica cover all requirements for electrical insulation. They are made under enormous pressure and are very dense. Street railway men who appreciate the value of good insulating material found the booth of great interest.

The Electrical Supply Co., of Chicago, showed samples of its new overhead line material. Some of the new devices are novel in construction, and show that the company has a proper appreciation of what is needed by the railway companies. The new pull-over brackets, the strain insulators and hangers were examined with especial interest. The company showed me one of the Carpenter electric heaters which it is introducing.

The Barnes Brake Co., of Cleveland, showed a model of its friction brake for cable and electric roads. The brake is simple, consisting of only twelve parts, none of which is complex or delicate in mechanism. It is durable, as the only wearing part is a leather washer that will last six months, it is stated, and can be replaced in a few moments at trifling cost. The brake is exceedingly effective and by its use the car is kept at all times under control.

Charles A. Schieren & Co., of New York, made an exhibition which attracted general attention. Its most prominent feature was a three ply belt, 116 ft. in length, seventy-two inches wide and weighing 2,200 lbs. The belt was made for the Brooklyn City Railroad Co., and will transmit 1,600 H. P. from engine to generator. The firm showed several smaller belts, and photographs of its belts now used in electric railway power stations.

Edward C. White, of New York, intended to make an exhibit of the West End radial and West End short trucks manufactured by him and adopted on the West End Street Railway of Boston. The trucks forwarded did not arrive in time for the Convention owing to some delay in transit, causing much disappointment to Mr. White as well as to a number of delegates who had become interested in this new design of truck from descriptions given of it.

The Meaker Manufacturing Co., of Chicago, exhibited samples of its street car registers in both the portable and stationary form. These registers are so well known to street railway men throughout the country that no description of them is required here. They have been adopted by 150 companies. One of the new combination registers was shown, which combines an additional check on the collection of fares with less labor than under the old system.

The Reliance Gauge Co., of Cleveland showed in its exhibit a large number of the Reliance safety water columns, including several finished in brass with heavy trimmings. A number of floats was exhibited, ranging in size from twelve inches in diameter to two and a half inches in diameter. The booth was decorated with photographs, the most interesting of which was one of the boiler room of the East Cleveland Railroad Co., where fourteen Reliance water columns are used.

The Dewey Electric Heating Co., of Syracuse, N. Y., made an exceedingly interesting exhibit of heaters intended for street cars and for office use. The car heater is 26 ins. long, 2 ins. wide and 10½ ins. in height. It is made of cast iron, japan finished and weighs about 15 lbs. On an ordinary car a heater takes three amperes on a 500 volt circuit. Four heaters are ordinarily used for heating a car. They are placed under the seats, and distribute the heat equally throughout the car.

The Brightman Stoker Co., of Cleveland, made an exhibit of one of its mechanical stokers which was examined critically by those interested in power stations. Motive power was supplied by an electric motor. The advantages attending the application of the stoker were manifest. Economy in fuel is one of the important considerations of the power user, and this stoker is found to contribute greatly to this end. The device is simple in construction, and can be applied to any boiler.

J. M. Jones' Sons, of West Troy, made no exhibit of street cars, for the reason that a number are in operation and giving great satisfaction in Cleveland, so that all delegates had an opportunity to inspect them under working conditions. Two novelties were shown by the company. The most interesting was the auger feed sand box, the operation of which is simple and effective. It was regarded by visitors as a great improvement. A new style of platform alarm was also exhibited, and photographs of Jones cars were distributed.

The Fulton Foundry Co., of Cleveland, exhibited two trucks of its latest type. These were equipped with double tread wheels, elliptic springs and were connected by Robison draw bars. Attached to the frames were Lyons brush holders. The Haycox patent brake shoes with interchangeable slippers formed part of the equipment. The Haycox door fastener was shown, and the firm exhibited samples of its switches, turnouts and crossovers. An interesting model in the exhibit was that of the Robison patent wrecking truck.

The Technic Electric Works, of Philadelphia, exhibited the Philadelphia trolley which has been designed to meet the requirements of the electrical railway superintendent. It is simple, being made of nine parts, and it is stated that it can be dismantled in seven seconds and assembled in twenty-two seconds without a wrench. There is no nut, bolt, screw or washer in its construction, and no chains, coil springs or similar parts. No oil or grease is required. The design is substantial but still light. The parts are interlocking and interchangeable. It is pivoted and free to turn, besides having a side motion.

William Wharton, Jr., & Co., of Philadelphia, made an extensive exhibit of rails, general track construction and special work. Girder rails were exhibited spiked to ties with brace plates and tie plates. The construction of composite and integral styles of switches were shown, and the process of making this special work was illustrated by castings brought from the foundry. Saussy's spring tongue switch was shown, and many of the well known specialties of the firm, and sections of the various sizes of T and girder rails were exhibited.

The Massachussetts Car Co., of Boston, made an exhibit which illustrated the principle of its new combination car. The section of a car was transformed speedily from an open to a closed car. The car is equipped with a balanced roller blind, which can be raised or lowered, if desired. A person when riding in the car when it is open can lower the shade if it rains slightly. Protection is afforded and the air is not excluded. As an additional protection, one half the opening may be closed by a window and if that is not sufficient the window can be entirely closed.

The W. Bingham Co., of Cleveland, exhibited a line of tools, car trimmings and railway supplies. In charge of the exhibit was C. E. M. Young. In connection with the exhibit was that of the Cleveland Motor Lift Co., which showed one of its hydraulic jacks. This appliance has been in use in a number of street railway repair shops and has been found extremely useful in lifting street railway cars. It is in use in the shops of the East Cleveland Railroad Co.; in fact the machine was designed to supply the need which that company found for a device of this kind. In the exhibit hall the jack was employed for lifting a heavy load of lead.

The Carpenter Enamel Rheostat Co., of Bridgeport, Conn., made an exhibit of its specialties. The principle of the new rheostat consists in the conduction and dissipation of heat by holding a resistance wire in close relation to a metal plate so that the heat generated in it by the passage of a current is rapidly conducted to the plate which becomes the radiating surface. This is accomplished by the use of an enamel which permanently attaches the wire to, but insulates it from, the radiating surface plate and which also completely surrounds and protects the wire from chemical action.

The St. Louis Register Co. showed a number of its new registers, which have just been placed on the market. The manager of the company, E. F. Wickham, explained the merits of the new register. It is simple in construction, and has few parts, and is not liable to get out of order. The mechanism is all worked by the movement of one shaft. The totalizer bell and indicator are all geared together, and one movement works them all. It totalizes 99,999, and is furnished either with or without a hood for the totalizer. It has a detent attachment on the ringing device, which makes it impossible for a conductor to snap the rope without ringing the bell.

The Ford-Washburn Storelectro Co., of Cleveland, interested visitors in its storage battery car which was run over the different street railway lines of the city. Visitors were afforded every facility for examining the car and its batteries on the several trips, and beyond all question they were both pleased and surprised to note the speed, and the ease with which the car was controlled. Many of those attending the Convention regarded the car as the feature of chief interest. In the exhibition hall the company showed several of its stationary motors adopted for use on street railway circuits. An exhibit of unusual interest was a test of the storage batteries, which was frequently made. The test comprised a direct short circuiting of the cells.

The Duplex Street Railway Co., made a complete exhibit which illustrated very thoroughly the general and special construction of the company. The exhibit consisted mainly of two 30 ft. sections of track one of 66 lb. center bearing rail and the other of 75 lb. 5 in. head rail. There was shown a tongue switch and mate, frog, section of curve, and sections of the several styles of rail. The frog was examined with particular interest, owing to the fact that it is exceedingly well supported and that the point may be replaced and practically a new frog produced at the cost of 10 ft. of rail and the machine work necessary for cutting it. The company showed a series of photographs illustrating the Duplex track work in different stages of construction.

The Johnson Co., of Johnstown, made an extensive exhibit illustrating the various styles and weights of rails, and some samples of special work. Among the latter was a railroad crossing electrically welded; a welded three-way curve weighing 3,200 lbs., tongue switch and mate. A rail built up of four sections electrically welded was a noticeable feature of the exhibit. Samples of special devices including the standard suspended girder joint were shown. The temporary track on Bond Street, on which the special cars were run to the Convention headquarters was properly a part of the Johnson Co.'s exhibit. The following representatives were present: Daniel Coolidge, Johnstown; Major H. C. Evans, New York; W. E. Boughton, Philadelphia; W. B. Kingston, Atlanta, Ga., and O. C. Evans, Cincinnati.

The New York Car Wheel Works, of Buffalo, N. Y., exhibited their "machined" car wheels. The system of comparative tests used by this company fixes positively the conditions of chill and strength in each wheel. The machining process which the wheels undergo after leaving the foundry consists of boring out, grinding true to center, and balancing. The result of this thorough system is shown

by the average mileage of the machined wheels far exceeding that of the ordinary wheels, which are put in service in the same condition in which they come from the foundry. Being made mechanically perfect, less power is required to operate a car equipped with them, and the wear and tear on track and equipment is reduced to a minimum. The company was represented by Robert J. Mercur, Buffalo, and J. R. Ellicott New York.

The McGuire Manufacturing Co., of Chicago, exhibited several trucks, most of which were in use, and the exhibit was the more desirable on this account. In the exhibit of the General Electric Co. was placed a nickeled truck of the 19 F type. In the Sperry Electric Railway Co.'s exhibit was shown a second truck of the same type. The General Electric Co.'s special car, which was built by the Newburyport Car Co., was mounted on two McGuire maximum traction trucks, and equipped with Thomson-Houston motors. The Thomson-Houston special vestibule car, built by the Gilbert Co., was mounted on a McGuire truck of the latest design. The Sperry Electric Railway Co.'s car, built by the Pullman Co., for use at Youngstown, O., was also carried by a McGuire truck. The company was represented by J. A. Hanna, M. P. Hubbard and D. B. Dean.

The Johnson Electric Co., of Cleveland, made a very extensive exhibit of the electric material made in its shops. The exhibit included iron and steel gears designed for all systems, rawhide pinions, the Harris trolley wheel, which has a wonderful record for length of service, and trolley poles. The company does an extensive repair work, and to illustrate this department several refilled commutators were shown, which were in all respects as good as new. The company showed a line of fixtures which was examined with great interest. The company is managed by A. L. Johnson and Samuel Harris, of the Brooklyn Street Railroad Co., two practical street railway men, and the results of their extended experience in the details of electric railways are embodied in the apparatus manufactured by the company. Jilson J. Coleman was in charge of the exhibit.

The Rochester Car Wheel Works made a handsome exhibit of wheels and axles. They sent six motor axles of various diameters, from 3¼ ins. to 3¾ ins., turned for different oil boxes, and filled with different patterns of wheels. Also eleven loose wheels, mounted on stands, and ranging in weight from 130 lbs. up to 500 lbs., and in diameter from 22 ins. to 36 ins., which included "Wharton" wheels, reverse dish for narrow gauge roads, and illustrated other details of size, weight, pattern, tread and flange. A Barr contracting chill was also shown, and there were several fractures from various wheels, displaying the chill. Another feature of the exhibit, and one entirely novel, was a 30 in. motor wheel broken in pieces at and between the spokes, and secured to a disk of wood in such a way as to show the metal in the spokes and the depth and regularity of chill all around the rim—a point in which the user of wheels is materially interested.

The Sperry Electric Railway Co., of New York, exhibited for the first time its railway system. The practical workings of the motor were shown to the attendants who gathered in numbers about this exhibit. The motor is a forty horse power, single reduction machine, and is geared to both axles, so that the best tractive effects, it is claimed, are secured. The machine is flexibly connected and is elastically supported. Those interested had a chance to make a careful inspection of the machine, as all parts were visible, and were also given an opportunity to see the motor in actual service. A Pullman car, mounted on a McGuire truck, and equipped with a Sperry motor, was operated on the street car system, starting from the special track on Bond Street. The car carried large numbers of passengers, who were highly pleased with the system. The car is to go to Youngstown, O., where the Sperry system has been in successful operation for a considerable time. The company was represented by H. P. Barr, of New York, and C. A. Pratt, of Chicago.

The Railway Equipment Co., of Chicago, made an exhibit which was located in one of the most prominent points in the hall. The display of its specialties attracted general attention. The most prominent feature was the Ahearn electric heater, which the company is introducing. The heater was used last winter in Ottawa and proved highly successful. The device was connected on the circuit, and raised the temperature very decidedly in the vicinity of the booth. The company exhibited its new line material which has been received with such favor by street railroad companies. Special material made for the Atlantic Avenue Railway, Brooklyn, N. Y., was shown. The devices were neat, and attracted no little attention. A line of carbon motor brushes was shown. The headquarters of the company, on the parlor floor at the Hollenden, were attractively decorated by flowers and potted plants. A handsome ornament in the room was a cluster of colored lamps arranged to form the letters "R. W. E." W. R. Mason, the president, and W. L. Adams, the secretary, were present. The exhibit was in charge of J. F. Macartney, the Buffalo agent, and Mr. Rowe, the Boston representative.

The J. G. Brill Co., of Philadelphia, had an exhibit of peculiar interest to visitors, The cars to be used on the Woodland Avenue & West Side Street Railroad were shown for the first time. In front of the exhibit hall was located one of these new cars which are twenty-one feet long, and thirty feet over all. It was mounted on a No. 21 truck of the latest pattern. Near by was shown the solid frame of one of the trucks of this type. There was also exhibited a Eureka maximum traction truck with solid frame. In the exhibit of the General Electric Co. was a Brill No. 21 truck, equipped with two waterproof motors. In a booth in the upper hall were shown handsome models of the several styles of Brill trucks. Ten of the forty Brill cars built for the Woodland Avenue & West Side Street Railroad Co. were operated on the lines of the company for the first time. The cars are exceedingly handsome, and made a splendid showing. They were equipped with Westinghouse motors, and were operated as successfully as if they had been in use for weeks. The headquarters of the company were located in one of the parlors, and were elaborately decorated with flowers and plants. The company was represented by G. M. Brill, president; W. H. Heulings, Payson A. Andrews, Chicago; Samuel Curven and F. C. Randall.

The Westinghouse Electric & Manufacturing Co., of Pittsburgh, obtained a large floor space at the entrance of the Army and Navy Hall, and its exhibit, while it immediately attracted the attention of every visitor who came, was in a position to show off to an excellent advantage. Alexander J. Wurts, the well known electrical engineer of lightning arrester fame and the discoverer of non-arcing metals, divided the honor of entertaining the visitors with Mr. A. Franz. Immediately upon the left on entering the hall, a Dorner & Dutton truck, equipped with two Westinghouse single reduction motors, was noticed. The equipment was complete in all its details. It afforded an excellent opportunity for inspecting the construction of the motor, and it showed at the same time the facility with which the apparatus can be handled when on the truck, as well as the accessibility of the different parts, commutator, brushes, armature, etc. At one end of the truck a platform had been erected upon which the new series multiple controlling device was noticeable, This exhibit attracted a great deal of attention. However, one of the most interesting exhibits of the Westinghouse company, and perhaps the one which attracted the most general attention, was the 150 H. P. railroad generator. This generator had all the attachments of wires just as if installed in a power house in actual operation. It was connected with the current line of the East Cleveland Railroad Co., and was operated as a motor. The smoothness of its running, the absence of sparking at the brushes, and the general appearance of the apparatus, in design and thorough workmanship, were the subjects of general remark. The Westinghouse exhibit also included a switchboard with voltmeters, ammeters, resistance box, automatic cut-outs, circuit breakers, and lightning arresters. In addition to the switchboard, there was shown a single reduction motor elevated on a special platform. This motor was taken apart in order to give the visitors an idea of all the details of this apparatus. On two large tables were spread out all the details connected with the Westinghouse system of electric railways, and they claimed a great deal of attention. The company also afforded a good opportunity to the guests of the Convention of seeing its system in practical operation. This was on the Woodland Avenue & West Side Railway Co.'s cars, which have only recently been equipped. The cars were built by the J. G. Brill Co., and are painted in a handsome green color. As many of the cars as were ready were taken out and were kept busy in carrying the guests over the city. In spite of the fact that cars and equipments were quite new, their operation was generally pronounced to be perfect. The motors ran smoothly, noiselessly, and they responded to the guiding hands of the motormen as if they had been running for a week at least. The Westinghouse company was well represented at the Convention by the following gentlemen: Lemuel Bannister, vice-president and general manager; W. C. Clark, general agent and assistant treasurer; Albert Schmidt, superintendent; E. H. Heinrichs, advertising agent; A. J. Wurts, electrical engineer; H. McL. Harding, W. F. Zimmermann, New York; A. C. Bragg, Philadelphia; R. S. Brown, Boston; S. A. Stewart, Chicago; A. T. McCarthy, J. A. Rutherford, T. W. F. Gray, J. L. Ludwig, Pittsburgh; W. J. Lingmore, assistant purchasing agent; E. F. Lamme, R. J. Davis, Pittsburgh.

The General Electric Co. made an exhibit which was superior to those which were made in the old days of the Edison and Thomson-Houston companies. The General Electric Co. is now enabled to show what is considered best in modern systems by the combined talent of the two former rivals. The exhibit, which was in every way worthy of the company, was arranged in such a manner that an excellent idea of the entire railway system could be gained without any effort on the part of the visitor to locate the various devices. On a Brill truck two W. P., single reduction motors were mounted, and the visitor was struck with the lightness, compactness and ease of adaptation of the machines. A W. P. 50 motor was exhibited, with the hollow field and field coil thrown back, so that the interior parts could be readily inspected. The S. R. F. 30 motor and the familiar standard S. R. G. were also shown. An Edison No. 14 was exhibited in the center of the exhibit. Street railway men were particularly interested in a new gear press for applying and removing the gear wheels from motors. This device is adapted for use with all styles of motors. The new series parallel car controller was a noticeable feature, as its use greatly increases the economy of operating cars.

Arranged on a long, sloping board was a full line of new overhead parts. They had been carefully plated and polished, and made a splendid showing. Near by was shown a collection of the ancient appliances of six years ago. The contrast illustrated in a very striking manner the rapid development of electric railway apparatus. Another interesting exhibit was a station switchboard, equipped with automatic circuit breaker and current indicator of the latest type. Near by were several Thomson wattmeters shown in operation, so that their action and method of recording could be seen.

Small electric lamps outlined the name of the company in different points about the exhibit, and in the center was an American eagle perched on a shield formed of small incandescent lamps of the national colors. A new railway lamp was also exhibited in which the filament was coiled in the form of a spiral.

The General Electric Co. operated two handsome cars over the lines of the East Cleveland Railroad Co. One was a special vestibuled car upholstered in brown plush and provided with easy chairs. The car was equipped with two W. P. 30 motors. The second car was forty feet in length, mounted on a double truck, and equipped with two W. P. 50 motors. The floor was removable so that passengers could watch the operation of the motors. Measuring instruments of the

Weston type were placed on each car so that it was possible to note at all times the amount of power required by the motors.

The headquarters of the company at the Hollenden Hotel were most tastefully decorated with ferns, potted plants and flowers, and the walls were hung with photographs of various installations of the General Electric Co. Mr. W. J. Clarke, the general agent of the railway department, in whose hands the entire management of the General Electric Co.'s exhibit was placed, acted as host, and his geniality and cordial greeting won for him the good will of every visitor. Mr. Clarke was ably seconded in his efforts by Mr. Elmer P. Morris of the railway supply department, Mr. G. K. Wheeler, assistant manager of the Chicago railway department; Mr. F. J. Clarke, manager at Washington; Mr. H. H. Harrison, Mr. C. S. Rusling, Mr. I. Silverman, Mr. W. A. Stern, and a thoroughly competent staff of General Electric Co. men. The representatives of the company at the Convention were: O. T. Crosby, general manager railway department, Boston, Mass.; W. J. Clarke general agent railway department, New York; G. K. Wheeler, assistant manager railway department, Chicago, Ill.; Paul T. Brady, general manager Central Thomson-Houston company, Cincinnati, O.; F. H. Clarke, district manager General Electric Co., Washington, D.C.; C. S. Rusling, general manager railway department, Cincinnati, O.; W. H. Knight, chief engineer railway department, Boston, Mass.; E. W. Rice, superintendent, Lynn, Mass.; Theo. Stebbins, superintendent construction, railway department, Boston, Mass.; Arthur W. Jones, assistant manager Thomson-Houston International company, New York; A. A. Glasier, manager Industrial Improvement Co., Boston; Caryl D. Haskins, manager meter department, Boston, Mass.; John McGhie. manager advertising department, New York; Geo. W. Mansfield, special agent, Boston, Mass.; E. G. Waters, general manager, Pittsburgh, Pa.; W. A. Stern, manager railway department. Philadelphia, Pa.; H. H. Harrison, supply agent, New York; C. E. Hart, supply agent, Cincinnati, O.; A. H. Lewis, special agent railway department, New York; T. H. Feary, state agent, Syracuse, N.Y.; R. J. Randolph, special agent, Cincinnati, O., F. H. Strieby, superintendent construction, Cincinnati, O.; C. T. Hamilton, special agent, Pittsburgh, Pa.; F. E. Jackson, representative lamp department, Harrison, N. J.; F. E. Allen, agent, St. Louis, Mo.; S. P. Wells, agent, St. Paul, Minn.; C. R. Stearn, superintendent construction; Percy Hodges, manager shipping department, Boston, Mass.; T. F. Mullaney, electrical engineer, Boston, Mass.; M. H. Hamilton, private secretary, New York; J. A. Kimball, electrical engineer, Boston, Mass.; W. S. Elliott, agent railway department, Boston, Mass.; Mr. Ewing, agent snow sweeper department, Boston, Mass.; F. H. Bostwick, agent, Cleveland, O.; B. M. Barr, agent, Cleveland, O.; F. Houghton, agent, Cleveland, O.; G. H. Stout, agent, Cincinnati, O.; E. P. Sharp, electrical engineer, Boston, Mass.; W. P. Potter, electrical engineer, Boston, Mass.; G. H. Alton, superintendent meter department, Boston, Mass.; Mr. Woolsey, electrical engineer, Boston, Mass.; R. E. Hood, electrical engineer, Boston, Mass.; Geo. M. Haskell, electrical engineer, Boston, Mass.; F. J. Reynolds, railway expert, Cincinnati, O.

The Short Electric Railway Co., had made every preparation for the entertainment, reception and even instruction of delegates and attendants at the Convention. The company felt that an especial obligation rested upon it as a local corporation. It certainly discharged its obligations in the most liberal manner. The company dispensed a most lavish hospitality and every attendant at the Convention is indebted to it for its untiring efforts to promote the success of the meeting. To summarize what the company exhibited is contemplated here, and only a comparatively brief reference can be made. Wherever he went the delegate found Short apparatus of one kind or another. The company decided that a special track on Bond Street which adjoins the Hollenden Hotel on the west would afford unusually good facilities for exhibiting electric cars. The Johnson Co. agreed to furnish rails leading to the tracks of the East Cleveland Railroad Co., which expressed its willingness to supply the power necessary for operating the cars. Permission was obtained from the City Council for laying the track, but the franchise did not permit the Short company to begin the track laying until seven o'clock on the evening on which the Association convened. Promptly at that hour work was commenced. The rails, which are of the Johnson Co.'s latest pattern, with electrically welded chairs, were laid on ties resting on the granite blocks. The work was prosecuted in spite of a drenching rain, and cars were operated on the following day. The Short company equipped with motors five cars which made trips, starting from the hotel doors. These were, first, the private car, built by the Gilbert company, mounted on an Anger truck; Accelerator car, constructed by the Brownell Car Co., mounted on a Brownell truck; East Cleveland car, mounted on a Fulton Foundry truck; Lamokin car, mounted on a Robinson all-steel truck. These were equipped with two single reduction motors, with the exception of the Lamokin car, which is operated by a twenty horse power, single reduction motor. The fifth car was built by the St. Louis Car Co. especially for the Short company. It is mounted on a truck designed by Professor Short. Each pair of wheels is contained in a separate channel bar frame supporting the boxes and springs. The frames are connected by a single spring steel bar in the center. The bar allows the two axles to spring to a curve, and thus prevents the grinding of the wheel flanges. The result is practically the same as if the truck were radial. The car is equipped with two of the new Short gearless, six pole motors, which have just been introduced, and are controlled by the new series multiple switches of the Short company. These cars were inspected continually by street railway men who accompanied the cars on their periodic trips.

Short apparatus was to be seen in several different parts of the exhibit department. In the temporary building was installed a 175 K. W., railway generator, which was operated as a motor. It was belted to an incandescent and an arc machine. The former dynamo furnished the current for all the incandescent lamps used throughout the exhibition hall. In the main exhibition hall the Short Electric company occupied the space on the stage, and immediately in front of it. Very pretty electric effects were produced by lamps furnished by the Swan Lamp Co. Over the stage the words "Short Electric Railway Co." were spelled out in incandescent lamps. At the back of the stage was the word "Gearless." in huge letters formed by incandescent lamps. The exhibit was arranged particularly to illustrate the development of the gearless motor. On the left of the stage was the first machine of this kind constructed by Professor Short. It was not a commercial machine, and was not designed as such, but was constructed to prove that a machine could be built in which the armature speed was not too great to be communicated to the car axles. The next machine was the familiar type of 1891, which was exhibited at the Pittsburgh Convention. This machine, as well as its predecessor, required 36 in. wheels. The next machine, with a 23 in. armature, was shown. With this motor a 33 in. wheel could be used. The last in the series was the six-pole gearless motor which has just been introduced, and with which 30 in. wheels can be employed. This machine embodies in its construction all the experience which the inventor has gained in the previous motors, and was the chief electrical feature of the exhibit. In every respect, including the matter of appearance, it is far superior to its predecessors. Tests made in the presence of street railway men at the Convention proved beyond all question that the great trouble with a gearless motor—taking an excessive amount of current on starting—had been overcome. It operates fully as well as the single reduction machine. On the wall were two curves, drawn on a large scale, representing graphically the tests made of the former type and the present gearless. The latter has an efficiency of 85 per cent., this figure falling to 75 per cent. as a minimum with the decrease of the load. Curves were also shown of tests of the twenty horse power and thirty horse power single reduction motors. The method of winding the gearless motor was illustrated by an actual exhibition of the work. On the stage were placed single reduction and gearless motors, with the frames opened to facilitate inspection. On tables were arranged such parts of the machines as could not readily be seen. The stage was ornamented by flowers and aquaria in which floated tiny swans carrying miniature incandescent lamps. The exhibit was planned and under the supervision of C. F. Uebelacker, of the Short company, assisted by Messrs. Culver and Nicholson.

The headquarters of the Short company at the Hollenden were located in one of the largest parlors which was handsomely decorated with flowers. The walls were hung with photographs of Short apparatus, and of railways on which Short motors are operated. On tables about the room were bound volumes containing prints and photographs of apparatus. One of the ornaments in the room was a large swan significant of the Swan Lamp Co., carrying a large incandescent lamp. One interesting novelty was a huge block of ice in the center of which three incandescent lamps were burning. The representatives of the Short company present at the Convention were J. Potter, president; Prof. S. H. Short; William Hazelton, 3d., assistant general manager; Frank A. Rogers and C. C. Curtiss, special representatives; John E. Ridall, Pittsburgh; W. S. Atchinson, Atlanta; E. J. Wessels, New York; F. R. Ford, Chicago; F. A. Scheffler, superintendent of the works.

The Car Exhibit.

The car manufacturers exhibited cars on the special track on Bond Street as follows: The St. Louis Car Co. built the car equipped with Short gearless motors. It was handsomely fitted up in all respects. It was mounted on a Short truck constructed by Dorner & Dutton, of Cleveland. Weston direct reading voltmeters and ammeters were located on a shelf on the platform. The Gilbert Car Manufacturing Co. constructed the Short company's private car, which was handsomely decorated and provided with easy chairs for passengers. It is mounted on an Anger truck. Pullman's Palace Car Co. constructed the car, which was operated by a Sperry forty horse power motor, and which will be sent to Youngstown, O. The McGuire pressed steel truck was used. The General Electric Co.'s exhibition car was built by the Newburyport Car Co., and was mounted on a McGuire truck. Weston measuring instruments were located inside the car. The General Electric Co.'s special car was built by the Gilbert Car Manufacturing Co., and was mounted on McGuire trucks. It was handsomely furnished, and easy chairs handsomely upholstered were provided for passengers. The Lamokin Car Co.'s car was mounted on a Robinson all-steel truck, and was equipped with Short motors. The car is to be sent to Oskaloosa, Ia. The Brownell Car Co., of St. Louis, exhibited one of its famous Accelerator cars, which was inspected with great interest. The car was mounted on a Brownell truck, and was equipped with Short motors.

THE Lewis & Fowler Manufacturing Co., and the Lewis & Fowler Girder Rail Co., were represented by Messrs. L. E. Robert, Geo. S. Whipp and Frank A. Morrell. It is needless to say that there were many inquiries for the Lewis & Fowler special train which had become a popular feature of the Convention.

Souvenirs.

A large number of souvenirs were distributed by exhibitors. Among these were noticed the following: Jewell Belting Co., leather cigar case; Short Electric Railway Co., card case with handbook of electrical data; Ansonia Brass & Bronze Co., alumimun lizard; Charles Scott Spring Co., pocket book and card case; Reliance Gauge Co., match safe; Swan Lamp Co., fancy glass vase; Railway Equipment Co., novel leadpencils; Hartford Woven Wire Co., memorandum book.

At The Convention.

Angier, G. M., Mather Electric Co., Boston, Mass.
Andrews, Payson K., J. G. Brill Co., Chicago, Ill.
Andrews, R. L., Brush Electric Co., Cleveland, O.
Ackerman, P. C., American Electrical Works, Providence, R. I.
Aldrich, H. L., *Electrical Industries*, Chicago, Ill.
Adams, W. L., Railway Equipment, Co., Chicago, Ill.
Aitken, John W., Carbondale Traction Co., Carbondale, Pa.
Atkinson, E. P., Charles A. Schieren & Co., New York.
Allen, J. H., *Dixie*, Atlanta, Ga.
Alton, Geo. H., General Electric Co., Lynn, Mass.
Anderson, A. A., Citizens' Street Railroad Co., Indianapolis, Ind.
Bancroft, Geo. W., Jewell Belting Co., Boston, Mass.
Bailey. Theo. P., General Electric Co., Chicago, Ill.
Brown, F. Wayland, Youngstown St. Ry. Co., Youngstown, O.
Bostwick, F. H., General Electric Co., Pittsburgh, Pa.
Bowman, W. P., J. A. Roebling's Sons Co., Trenton, N. J.
Baumhoff, George W., Lindell Railway Co., St. Louis, Mo.
Baker, R. F., Columbia Railroad Co., Washington, D. C.
Bean, W. Worth, St. Joseph & Benton Harbor Electric Railway Co., St. Joseph, Mich.
Bartlett, A., Syracuse Consolidated St. Ry. Co., Syracuse, N. Y.
Barr, Harry P., Sperry Electric Railway Co., New York.
Bunch, George H., East End Railway Co., Memphis, Tenn.
Bone, W. H., Walker Manufacturing Co., Cleveland, O.
Bronsdon, M. H., Providence Cable Tr'way Co., Providence, R. I.
Blackwell, J. H., Trenton Passenger Railroad Co., Trenton, N. J.
Browning, G. Genge, Camden Horse Railroad Co., Camden, N. J.
Baker, Clifford C., Topeka Railway Co., Topeka, Kan.
Barclay, J. L., Chicago, Ill.
Bradford, H. P., City Electric St. Ry. Co., Little Rock, Ark.
Bole, Geo. M., Westinghouse, Church, Kerr & Co., Pittsburgh, Pa.
Break, Sam. R., Toronto Railway Co., Toronto, Ont.
Bullock, Geo., Cincinnati Street Railway Co., Cincinnati, O.
Baldwin, B. H,. United Tramway Sprinkler Co., Louisville, Ky.
Brayton, Robt., Riverpoint Supply Co., Riverpoint, R. I.
Beckley. John N., Rochester Railway Co., Rochester. N. Y.
Brennan, M. F., Lowell & Suburban Railway Co., Lowell, Mass.
Bragg, C. A.. Westinghouse Elec. & Mfg. Co., Philadelphia, Pa.
Bolton, Lyman B., Combination Car Co.. Boston, Mass.
Billings, Frederic C., Billings & Spencer Co., Hartford, Conn.
Broadhead, A. N., Jamestown Street Ry. Co., Jamestown, N. Y.
Butler, A. E., Merrimac Valley Street Ry. Co., Lawrence, Mass.
Barnes, C. E., Plymouth & Kingston Ry. Co., Plymouth, Mass.
Boughton, W. E., Johnson Co., Philadelphia., Pa,
Benedict, Washington, G., Boston & Revere Electric Railway Co., Boston, Mass.
Babcock E. L., Falls Rivet & Machine Co., Cuyahoga Falls, O.
Barnard, George A., Buckeye Engine Co., Salem, O.
Bergholtz, H., Ithaca Street Railway Co., Ithaca, N. Y.
Bruce, H. P., General Electric Co., Boston, Mass.
Benton, C. A., Sprague Elevator Co., New York.
Bidwell, C. S., Ashtabula Rapid Transit Co., Ashtabula, O.
Belden, D. A., Aurora Street Railway Co., Aurora, Ill.
Brill, G. M., J. G. Brill Co., Philadelphia, Pa.
Baird, M. E., Eddy Electric Motor & Mfg. Co., Windsor, Conn.
Bannister, Lemuel, Westinghouse Elec. & Mfg. Co., Pittsburgh.
Carey, P. H., R. D. Nuttall Co., Chicago. Ill.
Collins. L. W., *Electrical Engineer*, New York.
Carthy, Louis M., N. T. C. Macallan Co., Boston, Mass.
Coffman, John R., Eureka Tempered Copper Co., Detroit, Mich.
Corey, R. B., Electric Construction & Supply Co., New York.
Clarke, W. J., General Electric Co., New York.
Candee, W. L., Okonite Co., New York.
Cicott, Frank X., *Railway World*, London, Eng.
Cochran, Henry, Lamokin Car Works, Chester, Pa.
Curtiss, C. C., Short Electric Railway Co., New York.
Connett, A. N., Baltimore City Passenger Ry. Co., Baltimore, Md.
Chapman, Jas. R., Consolidated St. Ry. Co., Grand Rapids, Mich.
Coolidge, Daniel, Johnson Co., Johnstown, Pa.
Colvin, F. R., *Electrical Engineer*, New York.
Chamberlain, James, Ford-Washburn Storelectro Co., Cleveland.
Cummins, M., Central Railway Co., Peoria, Ill.
Caldwell, Edward, *Electrical World*, New York.
Crane, W. F. D, H. W. Johns Manufacturing Co., New York.
Crawley, H. J., General Electric Co., Atlanta, Ga.
Carr, W. Frank, Roanoke Street Railway Co., Roanoke, Va.
Coleman, Jilson J., Johnson Electric Co., Cleveland, O.
Crump, Ralph Lee, Pennsylvania Steel Co., Merchantsville, Pa.
Carleton, W. F., U. S. Street Ry. Advertising Co., Boston, Mass.
Coles, Stephen L., *Electrical Review*, New York.
Condict, G. Herbert, Philadelphia, Pa.
Coolbaugh, F. W., Coolbaugh & Pomeroy, New York.
Crossman, T. E., Brooklyn, N. Y.
Crouse, J. B., Standard Carbon Co., Cleveland, O.
Clark, F. H., General Electric Co., Washington, D. C.
Clark, James M., Windsor, Sandwich & Amherstburg Railway Co., Windsor, Ont.
Carter, E. J., Fremont Street Railway Co., Fremont. O.
Crider, J. S., Washington Carbon Co., Pittsburgh, Pa.
Chamberlain, J. C., J. C. Chamberlain & Co. New York.
Cogswell, G. P., Norwich Street Railway Co., Norwich, Conn.
Dickerson, J. W., STREET RAILWAY JOURNAL, Chicago, Ill.
Davies, H. J., Brooklyn Street Railroad Co., Cleveland, O.
Dean, D. B., McGuire Manufacturing Co., Chicago, Ill.
Dewey, M. W., Dewey Electric Heating Co., Syracuse, N. Y.
Delany, W. H., Royaline Manufacturing Co., New York.
Dyer, D. B., Augusta Railway Co., Augusta, Ga.
Dutton, A. W., Short Electric Railway Co , St. Louis, Mo.
Dickerman, Alton L., Seattle, Wash.
DeBevoise, Alfred, North Hudson Co. Ry. Co., Hoboken. N. J.
Dickinson, Wallace D., Gr't Falls St. Ry. Co., Great Falls, Mont.
Denman, C. A., Consolidated Street Railway Co., Toledo, O.
Dodge, S. D., Mehling Car Co., Cleveland, O.
Derr, C. A., Rochester Electric Railway Co., Charlotte, N. Y.
Dean, William W., Hamilton Street Railway Co., Hamilton, Ont.
Durbin, C. K., Denver Tramway Co., Denver, Colo.
Dewar, D. C., Ottawa Electric Street Railway Co., Ottawa, Ont.
Dixon, A., City Electric Railway Co., Port Huron, Mich.
Dorner, H. A., Dorner & Dutton, Cleveland, O.
Dutton, W. A., Dorner & Dutton, Cleveland, O.
Evans, H. C , Johnson Co., New York.
Eppley, F. M., Orange Crosstown & Bloomfield Street Railway Co., Orange, N. J.
Elwell, John D., Duplex Street Railway Track Co., New York.
Elkins, Wm. L., Pittsburgh and Duquesne Trac. Co's.
Esmond, E. R., Esmond Street Rail Co., New York.
Eindolph, Allen, Citizens' Street Railway Co., Vincennes, Ind.
Esty, William, Lynn, Mass.
Everett, H. A., Toronto Railway Co., Toronto, Ont.
Englund, A. H., International Register Co., Chicago, Ill.
Everts, D. T., Simplex Electrical Co., Boston, Mass.
Eno, W. G., Wilkes-Barre & Wyoming Valley Traction Co., Wilkes-Barre, Pa.
Ely, Alfred, Alfred Ely & Co., Baltimore, Md.
Ellis, George, Ellis Car Co., Amesbury, Mass.
Everett, A., East Cleveland Railroad Co., Cleveland, O.
Fairchild, C. B., STREET RAILWAY JOURNAL, New York.
Flesh, F. M., Piqua Street Railway Co., Piqua, O.
Fortenbaugh, S. B., Short Electric Railway Co., Cleveland, O.
Ferguson, J. A., Shultz Belting Co., St. Louis, Mo.
Ford, Geo. A., Ford-Washburn Storelectro Co., Cleveland, O.
Field, C. J., Field Engineering Co., New York.
Frenyear, T. C., Cayadutta Elec. R. R. Co., Gloversville, N. Y.
Flood, J. F., Steubenville Street Railway Co., Steubenville, O.
Field, Arthur W., Peckham Motor Truck & Wheel Co., N. Y.
Ford, F. R., Short Electric Railway Co., Chicago, Ill.
Fuchs, W. C., Cicero & Proviso Street Railroad Co , Chicago, Ill.
French, Hollis, Massachusetts Electrical Engineering Co., Boston,
Frederick, C. R., Davenport & Rock Is. R. R. Co., Davenport, Ia.
Foote, C. W., Nicholson Electric Hoist Co., Cleveland, O.
Gordon, W. H., W. H. Gordon Co.. New York.
Geriken, H. J., A. French Spring Co., New York.
Groetzinger, W. C., A. Groetzinger & Sons, Allegheny City, Pa.
Griffith, T. B., Hamilton Street Railway Co., Hamilton, Ont.
Gathright, J. R., United Tramway Sprinkler Co , Louisville, Ky.
Gates, J. Holt, Siemens & Halske Elec. Co., of America, Chicago.
Gates, C. A., Massillon Electric Railway Co , Massillon, O.
Good, Brent, U. S. Street Railway Advertising Co., Boston, Mass.
Grubner, A. J., Mintz, Grubner & Co., Baltimore. Md.
Graham, J. H., Consolidated Railway Supply Co., Boston, Mass.
Geise, Frank, York Street Railway Co , York, Pa.
Graham, John, Wilkes-Barre & Wyoming Valley Traction Co., Wilkes-Barre, Pa.
Green, Alfred, Rochester Railway Co., Rochester, N. Y.
Gheghan, John J., J. H. Bunnell & Co., New York.
Greene, B. E., *Electricity*, New York.
Groves, Samuel, Walker Manufacturing Co., Cleveland, O.
Graham. G. H., Chicago, Ill.
Graves, W. D., W. D. Graves Electrical & M'f'g Co., Cleveland, O
Godfrey, J. W., New York Insulated Wire Co., New York:
Holmes, John G., Citizens' Traction Co., Pittsburgh, Pa.
Harrison, H. H., General Electric Co., New York.
Hanna, J. A., McGuire Manufacturing Co., Chicago, Ill.
Hathaway, W. A., American Electrical Works, Providence, R. I.
Hart, Charles E., Central Thomson-Houston Co., Cincinnati, O.
Hunt, W. T., *Street Railway News*, New York.
Heinrichs, Earnest H., Westinghouse Elec. & Mfg. Pittsburgh.
Hazelton, William, 3d, Short Electric Railway Co., Cleveland, O.
Hay, Albert E., Robinson Machine Co., Altoona, Pa.
Hassan, K. D., Short Electric Railway Co., Cleveland, O.
Hanna, J. B., Woodland Ave. & West Side St. R. R. Co., Cleveland.
Hartman, H. C., Bradley Electric Conduit Co., Chicago, Ill.
Hamilton, Campbell T., General Electric Co., Pittsburgh, Pa.
Hayward, H. T., Jersey City & Bergen H. R. R. Co., Jersey City.
Hutcheson, J. E., Ottawa Electric St. Ry. Co., Ottawa, Ont.
Hauss, D. J., Cincinnati, O.
Hoopes, Maurice, Lynn & Boston Railroad Co., Lynn, Mass.
Hannum, L. K., Pottsville & Orwigsburg El. Ry. Co., Pottsville, Pa.
Hough, A. H., Brush Electric Co., Cleveland, O.
Hatch, A. S., Windsor, Ont.
Hathaway Alfred G., Cleveland, O.
Heald, E. W., Wilmington, Del.
Haynes, George D., Newark, N. J.
Holmes F. S., with C. H. Davis, New York.
Hall, John D., Fort Clark Street Railway Co., Peoria, Ill.
Hoover. P. H., Standard Paint Co., New York.
Hubbell, Z. S., Walker Manufacturing Co., Cleveland, O.
Haycox, C. E. Fulton Foundry Co., Cleveland, O.
Hurley, P. E., Trenton Passenger Railway Co., Trenton, N. J.
Hight, C. B., Baxter Electric Motor Co., Baltimore, Md.
Hills, C. I., Perkins Electric Lamp Co., Manchester, Conn,
Herenden, G. B., Brightman Stoker Co., Cleveland, O.
Hayward. A. H., Allent'n & Bethlehem Rap. Tran. Co., All't'n, Pa.

Hathaway Charles, Cleveland, O.
Hand, S. Ashton, Detroit Electrical Works, Detroit, Mich.
Hoadley, Geo. M,, Bemis Car Box Co., Springfield, Mass.
Hall, J. H., Fort Clark Street Railway Co., Peoria, Ill.
Heulings Wm. H. Jr., J. G. Brill Co., Philadelphia, Pa.
Hamilton, M. H., General Electric Co., New York.
Hazelbrigg, S. F., Citizens' St. R.R. Co., Indianapolis. Ind.
Hawks, J. D., Citizens' Street Railway Co., Detroit, Mich.
Hill, H. W., Hill Clutch Works, Cleveland, O.
Irish, W. E., Cleveland, O.
Issertel Henry G., Alexander, Barney & Chapin, New York.
Johnston, W. J., *Electrical World*, New York.
Johnston H. C., Charles Scott Spring Co., Philadelphia, Pa.
Janney, W, H., Fifth & Sixth Streets R.R. Co., Philadelphia, Pa.
Jacobs, F. B., Johnston Safe Automatic Elec. Co., Richmond, Pa.
Jewell, W. S., Citizens' Street Railroad Co., Indianapolis, Ind.
Johnson, Tom L., Brooklyn Street Railroad Co., Cleveland, O.
Johnson, A. L., Brooklyn Street Railroad Co., Cleveland, O.
Jones, J. H., J. M. Jones' Sons, West Troy. N. Y.
Kenfield, H. J.,*Street Railway Review*, Chicago.
Klock, G. F., Murphy Varnish Co., Cleveland, O.
Knight, M. L., Shenango Falls St. R. Co., Beaver Falls, Pa.
Kenfield, F. L., *Street Railway Review*, Chicago.
Kendall, A. C., Connellsville, New Haven & Leisenring Street Railroad Co., Connellsville, Pa.
Kingston, Wm. W., Johnson Co., Atlanta, Ga.
Keyes, O. J., Cleveland Electric Manufacturing Co., Cleveland, O.
Keating, G. H., H.M. Loud & Sons Lumber Co., Au Sable, Mich.
Kissam, George, Carleton & Kissam, New York.
Kilgour, John, Cincinnati Street Railway Co., Cincinnati, O.
Kilgour, Charles H.,Cincinnati Street Railway Co., Cincinnati, O.
Kilgour, B. L., Cincinnati Street Railway Co., Cincinnati, O.
Kerr, Walter, Westinghouse, Church, Kerr & Co., Philadelphia,
Koch, John, Cleveland City Cable Railway Co., Cleveland, O.
Kelsey, Israel A., New Haven & West Haven Horse Railroad Co., New Haven, Conn.
Kohler, G. A. E., Kohler Bros., Chicago, Ill.
Knight, M. L , Shenango Valley St. R. Co., Beaver Falls, Pa.
Kelley, W. J., Columbus Street Railway Co., Columbus, O.
Lynn, A. W., Milwaukee Street Railway Co., Milwaukee, Wis.
Langdon, C. J., Fulton Foundry, Cleveland, O.
Laughlin, F. M., Solar Carbon Co., Pittsburgh, Pa.
Leidenger, P., Dayton Manufacturing Co., Dayton, O.
Leidenger, Jos., Dayton Manufacturing Co., Dayton, O.
Lockwood, Joseph E., Detroit Electrical Works, Detroit, Mich.
Long, Wm. B., Valentine & Co., New York.
Luther, H. R., Barbour, Stockwell & Co., Cambridgeport, Mass.
Lincoln, F. H., Consolidated Street Railway Co., Toledo, O.
Luther, C. F., Pawtucket Street Roilway, Pawtucket, R. I.
Lanius, W. H., York Street Railway Co., York, Pa.
Le Vake, L. B., Brush Electric Co., Cleveland, O.
Low, F. R., *Power*, New York.
Lesley, H., Electro-Dynamic Co., Philadelphia, Pa.
Louttit, W S., Pullman's Palace Car Co., Chicago, Ill.
Littell, H. M., Cincinnati Inclined Plane R. Co., Cincinnati, O,
Littell, H. H., Buffalo Railway Co., Buffalo, N. Y.
Leach, P. F., Cushion Car Wheel Co., Chicago, Ill.
Luhn, Max, Helios Electric Co., Cologne, Germany.
Longstreet, D. F., Denver, Colo.
Lang, Albion E., Toledo Street Railway Co., Toledo, O.
Littlefield, A. S., O. W. Meysenburg & Co., Chicago, Ill.
Ludwig, J. L., Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.
Leonard, H. Ward, H. Ward Leonard & Co., New York.
Leonard, S. S., Hill Cluch Works, Cleveland, O.
Lewis, Frank J., Johnson Electric Co., Cleveland, O.
Lufkin, H. L., C. & C. Electric Motor Co., New York.
Mark, C. E., Mark & Sterling, Cleveland, O.
McGraw, J. H., STREET RAILWAY JOURNAL, New York.
Morris, Elmer P., General Electric Co., Boston, Mass.
Mason, W. R., Railway Equipment Co., Chicago, Ill.
Morris, Dwight, General Electric Co., Boston, Mass.
Manning, A. P., Pittsburgh Trolley Co., Pittsbugh, Pa.
Myers, Garson, Standard Railway Supply Co., Chicago, Ill.
Magee, Frank A., E. S. Greeley & Co., New York.
Macartney, J. F., Railway Equipment Co., Chicago, Ill.
Macartney, Rutherford, Railway Equipment Co., Buffalo, N. Y.
Mailloux, C. O., New York.
McTighe, T. J., Barry & McTighe, New York.
Milbank, L. A., Holmes, Booth & Haydens, New York.
McQuaide, James, P., National Conduit Manufacturing Co.
McCulloch, Robert, Citizens' Railway Co., St. Louis, Mo.
McGhie, J., General Electric Co , New York.
Mercur, Robt. J., New York Car Wheel Works, Buffalo, N. Y.
Morrison, William H., Brooklyn City R. R. Co., Brooklyn, N.Y.
McClure, J. H. Short Electric Railway Co., Cleveland, O.
McNairy, A. B., Cleveland, O.
McDonald, D., Pleasant Valley St. Ry. Co., Allegheny City, Pa.
McLean, Thos. H., Houston, West St. & Pavonia Ferry RR Co., N.Y.
Mayer, Charles J., R. D. Nuttall Co., Pittsburgh, Pa.
McClary, J. B., Birmingham Ry. & Elec. Co., Birmingham, Ala.
McKenzie, Wm., Toronto Railway Co., Toronto, Ont.
Marker, W. C., Cleveland Electric Mfg, Co., Cleveland, O.
McRae, J. W., Ottawa Electric Street Railway Co., Ottawa, O.
Madison, G. L., Oshkosh, Wis.
Myers, L. E., Detroit Electrical Works, Chicago, Ill.
McElroy, J. Y., Consolidated Car Heating Co., Albany, N. Y.
Martin, T. C., *Electrical Engineer*, New York.
Mowatt, J. H., Mowatt Detective Service, Cleveland, O.
Mechem, A. M., New Process Rawhide Co., Syracuse, N. Y.
MacQuesten, W. J., New York.
Mason, J. H., Simplex Electrical Co., Boston, Mass.
Morse, Geo. C., Taunton Street Railway Co., Taunton, Mass.
Mears, James F., Ohio Auxiliary Fire Alarm Co., Cleveland, O.
Mintz, Jacob, Mintz, Grubner & Co., Baltimore, Md.
Morrell, Frank A., Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Minary, T. J., Louisville Railway Co., Louisville, Ky.
Morton, N. E., Merrimac Valley St. Ry. Co., Lawrence, Mass.
McLaughlin, Chas., Paterson Central Elec. Ry.Co., Paterson, N.J.
McLaughlin, Wm., Paterson Central Elec. Ry. Co., Paterson, N.J.
Maltby, Geo. E., Jamestown Street Railway Co., Jamestown, N.Y.
Melms, G. J., Milwaukee Electric Railway Co., Milwaukee, Wis.
McNamara, John W., Albany Railway Co., Albany, N. Y.
Newton, Charles E., Jewell Belting Co., Hartford. Conn.
Nicholson, L. W., Short Electric Railway Co., Cleveland, O.
Nuttall, R. D., R. D. Nuttall Co., Allegheny City, Pa.
Neftel, Knight, Neftel & Marsh Co., New York.
Nold, L. S., E. Liverpool & Wellsville St. Ry. Co., E. Liverpool, O.
O'Hara, J. B., *Western Electrician*, Chicago, Ill.
Orr, A. M., Piqua Street Railway Co., Piqua, O.
Osgood, C. B., Chicago, Ill.
Oswald, E. H., Benedict & Burnham Mfg Co., New York.
Odell, Chas., Newburyport & Amesbury Ry.Co., Newb'yp't, Mass.
Ostrom, J. F., Pennsylvania Steel Co., Philadelphia, Pa.
Owen, B. F., Reading City Passenger Railway Co., Reading, Pa.
Ogden, D. H., *Western Electrician*, Chicago, Ill.
Olds, E. W., Denver Tramway Co., Denver, Colo.
Partridge, Arthur S., St. Louis, Mo.
Potter, W. B. General Electric Co., New York.
Packer, E., Rochester Car Wheel Works, New York.
Peckham, E., Peckham Motor Truck & Wheel Co., Kingston, N.Y.
Pugh, D. W., John Stephenson Co. Ltd., New York.
Phipps, C. W., Brush Electric Co., Cleveland; O.
Pratt, G. E., Lamokin Car Works, Philadelphia, Pa.
Perrine, Lewis, Jr., Trenton Passenger Railway Co., Trenton, N.J.
Pugh, J. S., Baltimore Car Wheel Works, Baltimore.
Paiste, H. T., Philadelphia, Pa.
Parker, L. H., Trenton Passenger Railway Co., Trenton, N. J.
Patterson, N. H., Bloomington City Ry. Co., Bloomington, Ill.
Powers, E. L. *Electrical Industries*, Chicago, Ill.
Pfetch, J. F. Erie Electric Motor Co., Erie, Pa.
Possons, N. S., Eureka Tempered Copper Co., North East Pa.
Pfingst, L., Boston, Mass.
Pullen, C. L.. Globe Iron Works, New York.
Parmelee, G. F., Cuyahoga Falls & Akron Railway & Passenger Co., Cuyahoga Falls, O.
Pool, H. W.. STREET RAILWAY JOURNAL, New York.
Pond, A. E., New Haven & W. Haven H.R.Co..New Haven, Conn.
Price, W. F., Rapid Transit Co., New Brunswick, N. J.
Payne, H. C., Milwaukee Street Railway Co., Milwaukee, Wis.
Peckham, M. D., New York.
Pratt, Mason D., Pennsylvania Steel Co., Steelton, Pa.
Reid, D., Genett Air Brake Co., Chicago, Ill.
Rutherford, J. A., Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.
Robison, Frank De H., Cleveland City Cable Ry. Co., Cleveland, O.
Randall, F. C., J. G. Brill Co., Philadelphia, Pa.
Russell, F. D., Rochester Car Wheel Works, Rochester, N. Y.
Rowe, Charles E., Railway Equipment Co., Boston, Mass.
Richardson, William, Atlantic Ave. R. R. Co., Brooklyn, N. Y.
Richardson, Wm. J., Atlantic Ave. R. R. Co., Brooklyn, N. Y.
Ridall, John E., Short Electric Railway Co., Pittsburgh, Pa.
Rogers, Frank A., Short Electric Railway Co., Cleveland, O.
Ruff, D. A., York Street Railway Co., York, Pa,
Ross, Edward L., Chapman Valve Mfg. Co., Indian Orchard, Mass.
Reynolds, Edward C., *Street Railway Gazette*, New York.
Robinson, Wm., Robinson Elec. Truck & Supply Co., Boston, Mass.
Rice, Walter P., Cleveland, O.
Rugg, J. E., Citizens' Traction Co., Pittsburgh, Pa.
Ramsey, Wm. M., Federal Street & Pleasant Valley Passenger Railway Co., Allegheny City, Pa.
Rusling, C. S., Central Thomson-Houston Co., Cincinnati, O.
Rand, C. F., Everett Washington Ry. & Elec. Co., Cleveland, O.
Randolph, R. J., Central Thomson-Houston Co., Cincinnati, O.
Rae, Frank B., Detroit, Mich.
Roeschlaub, F. H., National Fare Box Mfg. Co., Chicago, Ill.
Radel, Andrew, Newark & South Orange Street Railway Co., Newark, N. J.
Register, A. L., Pepper & Register, Philadelphia, Pa.
Rice, E. W.. General Electric Co., Lynn, Mass.
Richards, H. T., *Electrical Review*, New York.
Rhoads, H. R., Williamsport Pass. Ry. Co., Williamsport, Pa.
Rusling, F. O., West Bay City St. Ry. Co., West Bay City, Mich.
Robinson, E. I., La Clede Car Co., St. Louis, Mo.
Robert, Louis E., Lewis & Fowler Mfg .Co., Brooklyn, N. Y.
Ring, Wm., Paterson Central Elec. Ry. Co., Paterson, N. J.
Roberts, E. P., Swan Lamp Co., Cleveland, O.
Reynolds, John N., *National Car & Locomotive Builder Supplement.*
Runser. Frank D., Shenango Valley St. Ry. Co., Sharon, Pa.
Rommel, W. B., Pittsburgh & Birmingham Trac. Co., Pittsburgh.
Smith, Gilbert M., Aluminum Brass & Bronze Co., Chicago, Ill.
Sharp, E. P., American Mica Co., Boston, Mass.
Smith, Frank B., Metropolitan Elec. Ry. Co., Springfield, Mo.
Stanley, Henry D., Okonite Co., New York.
Scott, Charles Jr., Charles Scott Spring Co., Philadelphia, Pa.
Shinn, Luthur E., Esmond Street Rail Co.. New York.

Stephenson, Wm., Columbia Railroad Co., Washington, D. C.
Smith, W. A., Omaha Street Railway Co., Omaha, Neb.
Shay, J. H.. Munson Belting Co., Chicago, Ill.
Sawyer, E. C., Steam Gauge & Lantern Co., Syracuse, N. Y.
Seguine, W. P., Frost Veneer Seating Co.
Smith, Charles G., Cleveland, O.
Silver, Wm. S., William S. Silver & Co., New York.
Shaffer W. H., Richmond City St. Ry. Co., Richmond, Ind.
Stark, E. C., Peckham Motor Truck & Wheel Co., Kingston, N. Y.
Sterling, Willis B., Mark & Sterling Cleveland, O.
Soper, Warren, T., Ottawa City Pass. Ry. Co., Ottawa, Ont.
Scull, Wm. S., Camden Horse Railroad Co., Camden, N. J.
Sperry, Elmer A., Chicago, Ill.
Scheffler, Frederick A., Brush Electric Co., Cleveland, O.
Stearns, Charles G., Bemis Car Box Co., New York.
Smith, John A., Cincinnati Inclined Plane Railway Cincinnati, O.
Suckow, Gus, Richard Vose Car Spring Co., New York.
Scheerer, W , Newark & South Orange St. Ry. Co., Newark, N. J.
Silverman, S. H..General Electric Co., Philadelphia Pa.
Smiles, E. N., Edison Manufacturing Co., New York.
Smith, F. W., Automatic Cable Grip Release Co., St. Louis, Mo.
Schieren, Chas. A. Jr., Charles A. Schieren & Co., New York.
Stump, C. E., STREET RAILWAY JOURNAL, New York.
Sturges, Wm. M., Utica Belt Line Railroad Co., Utica, N. Y.
Smith, H. W., Smith Closed Conduit Co., Newark, N. J.
Stillman H. L., Stillman Lt.Ry Development Co., Providence, R.I.
Smith, J. T., Citizens' Electric Railway Co., Fishkill, N. Y.
Schermerhorn, G. L., General Electric Co., Pittsburgh, Pa.
Stearns, C. K., Northwest General Electric Co., St. Paul, Minn.
Stevens, E. H., Johnson City & Carnegie Street Railway Co. Johnson City, Tenn.
Stewart, John A., Central Thomson-Houston Co., Cincinnati, O.
Sporling, Fred. H., John A. Roebling's Sons Co., Trenton, N. J.
Strieby, F. H., Central Thomson-Houston Co., Cincinnati, O.
Saunders, C. L., Cleveland Engineering Co., Clevelahd, O.
Stanley, John J., Broadway & Newburgh Street Railroad Co., Cleveland, O.
Shipherd, John J., Cleveland City Cable Railway Co.
Tolles, Charles L.. Jewell Belting Co., Hartford, Conn.
Traggardh, J. G., Pittsburgh Traction Co., Pittsburgh, Pa.
Taylor, Wm., Taylor, Goodhue & Ames, Chicago, Ill.
Ticknor, J. S., West End Street Railway Co. Rockford, Ill.
Turk J. C., King Bridge Co., Cleveland, O.
Tucke, E. M., Lowell & Suburban Railway Co., Lowell, Mass.
Taft. J. A., Babcock & Wilcox Co., Cincinnati, O.
Uebelacker, C. F., Short Electric Railway Co., Cleveland, O.
Van Dorn, W. T., Fitzgerald-Van Dorn Co., Lincoln, Neb.
Van Nuis, C. S., New York.
Valentine, J. W., Short Electric Railway Co., Cleveland, O.
Wheeler, Howard, New York.
Woolsey, C. A., General Electric Co., Boston, Mass.
Wyman, Edward B., Dewey Electric Heating Co., Syracuse, N. Y.
Webb, H. E., Solar Carbon Co., Pittsburgh, Pa.
Wallace, Edward J., Smith & Wallace. Boston, Mass.
Wheeler, G. A., General Electric Co., Chicago, Ill.
Windsor, H. H., *Street Railway Review*, Chicago, Ill.
Wills. Joseph, Short Electric Railway Co., Cleveland, O.
Wessels, Edward J., Short Electric Railway Co., New York.
Wheelhouse, S. H., Star Headlight Co., Rochester, N. Y.
Wharton, Wm., Jr.. Wm. Wharton, Jr., & Co., Philadelphia, Pa.
Whittemore, W. F., N. Hudson County Ry. Co., Hoboken, N. J.
Webster, E., Stillwell & Bierce Manufacturing Co., Chicago, Ill.
Whitney, Louis B., A. Whitney & Sons, Philadelphia, Pa.
Wardwell, Fred., Duluth Street Railway Co., Duluth, Minn.
Woodruff, R. S., Trenton Passenger Railroad Co.. Trenton, N. J.
Wright, Aug. W., Siemens & Halske Electric Co. of America, Chicago, Ill.
Weaver, W. D., *Electrical World*, New York.
Wickham, E. F., St. Louis Register Co., St. Louis, Mo.
Wood, E. E., *Electrical Industries*, New York.
Washburn, Geo. A., Ford-Washburn Storelectro Co., Cleveland, O.
Wason, Charles, W., East Cleveland Railroad Co., Cleveland, O.
Whittlesey, J. E., Gilbert Car Manufacturing Co., New York.
Wheildon, Louis B., Massachussetts Car Co., Boston.
White, Edward C., Globe Iron Works, New York.
Walker, John, Walker Manufacturing Co., Cleveland, O.
Whitla, J. C., Beaver Valley St. R. R. Co., Beaver Falls, Pa.
Williams, Chas. A., Rochester Railway Co., Rochester, N. Y.
Wurts, Alexander J., Westinghouse Elec. & M'f'g. Co., Pitts. Pa.
Whipp, George S., Lewis & Fowler M'f'g. Co., Brooklyn, N. Y.
Wackerman, L. A., Walker Manufacturing Co., Cleveland, O.
Wheeler, K., P., A. & M. Traction Co., Pittsburgh, Pa.
Wilkes, Gilbert, Detroit Electrical Works, Detroit, Mich.
Wells, S. P. Jr., North West General Electric Co., St. Paul, Minn.
Wrightman, Merle J., Scranton Pa.
Waterman, F. N., Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.
Wright, A. J., Reliance Gauge Co., Cleveland, O.
Willson, Fred. J. Battle Creek Elec. Ry. Co., Battle Creek, Mich.
White, J. G., J. G. White & Co., New York.
Young, C. E. M., W. Bingham Co., Cleveland, O.
Young, A. M., Waterbury Horse R. R. Co., Waterbury, Conn.
Zerbey, J. H., Scuylkill Electric Railway Co., Pottsville, Pa.

THE Whiting, Hammond & East Chicago Railway Co. has asked for a number of franchises in East Chicago, and for an electric line connecting at the Robey race track in Whiting with one from South Chicago.

Street Railway News.

New Roads.

Allegheny, Pa.—A charter has been issued to the Allegheny & South Side Railway Co, capital $50,000. The road will be constructed from a point in the city of Allegheny to Pittsburgh.

Atchison, Kan.—The Atchison Electric Motor & Street Railway Co. has applied for a charter. The incorporators are: W. F. Dolan, J. C. Fox, A. J. Harwi, J. T. Hersey and A. W. Simpson. The capital stock of the company is $500,000.

Atlanta, Ga.—The Atlanta City Street Railway Co. is a new railway company which has been granted a charter to build a road from Atlanta to Decatur. W. 1. Zachry, Aaron Haas, Clyde L. Brooks and others are interested. The capital stock is $25,000.

Beaver Falls, Pa.—A company composed of J. C. Whitla, M. L. Knight, Harry Reeves and others, was organized lately, and has purchased the franchise of the Sharon & Sharpsville electric road, a new line four miles long, connecting the towns of Sharon and Sharpsville. J. C. Whitla has been elected president, F. G. Barker treasurer, and W. L. Knight, secretary. Work of building the road will be begun at once.

Boone, Ia.—The Boone Electric Street Railway & Light Co., with a capital of $200,000, has filed articles of incorporation.

Bowling Green, O.—The Fostoria & Bowling Green Street Railway Co. has asked permission of the Council here to construct a street railway within the corporate limits on certain streets. The road will be continued to Fostoria by way of Portage, and will be operated by electricity.

Chicago, Ill.—The Jefferson Street Railway Co. has secured a license to incorporate, with a capital stock of $500,000. The intention is to build an electric line on Elston Avenue and connect with the West and North Chicago street railway lines on Milwaukee and Clybourn Avenues—seven miles in all. The incorporators are George H. Parker, Joseph B. Bickerdike, Fred E. Eldred and four others.

Cripple Creek, Colo.—Articles of incorporation of the Cripple Creek Street Railway Co., with the principal office in Fremont, were recently filed, the incorporators being A. C. Hickman, Albert B. Calaway, George Jordan and W. S. Montgomery. The company propose building a line through the towns of Cripple Creek and Fremont, and connecting with the towns of Barry and Mound City. The capital stock is placed at $100,000. The proposed line will be about five miles in length.

Dayton, O.—Albert M. Crisler and Robert Appleby of Eaton, have filed with the board of county commissioners an application for permission to erect poles and string wires for a single track electric railroad from the county line to Dayton.

Dravosburg, Pa.—Homer H. Swaney, of McKeesport, has formed a company of Pittsburgh capitalists and has bought the stock and charter of a company that was formed some years ago to operate an electric line between Dravosburg and Elizabeth, and he will put the project through.

Elizabeth, N. J.—Articles of incorporation were filed last month by the Elizabeth & Plainfield Street Railway Co. The road will run through Linden and Cranford townships, and will first be constructed to Westfield. The capital of the company is $100,000 in stock of 1,000 shares. The incorporators are James B. McGiffert, William A, Peddle, J. H. Vail, Westfield; Luther M. Whittaker, Westfield; Dwight F. Burritt, James Garwood and Foster M. Voorhees. The line will start from the Union Depot, Elizabeth, and run through what is known as the old road to Westfield, will be seven miles long and operated by electricity.

Galesburg, Ill.—A new company, entitled the Galesburg West Side Street Railway Co., has been incorporated, with capital stock, $75,000. The incorporators are Sol Frohlick, N. P. Glann and others.

Grand Forks, Minn.—The Grand Forks Electric Street Railway Co. has been incorporated by Charles F. Arrol, Wilford G. De Celle and Frederick C. Stevens, all of St. Paul. The capital stock is $100,000.

Green Bay, Wis.—A franchise has been granted Jackson J. Case and Charles H. Holmes, of Racine, for an electrical railway, to be commenced by May 15, 1893, and finished within one year from that date.

Hammond, Ill.—The Whiting, Hammond & East Chicago Street Railway Co. has been incorporated; capital $100,000. A. R. Shroyer, A. Bloch, M. Joel and C. F. Griffin are the incorporators. The principal office will be at Hammond.

Hanover, Pa.—The Hanover & McSherrystown Street Railway Co. has been organized, with a capital of $30,000. John C. Tanger, of Hanover, is president. Others interested are A. H. Melhover, Aaron Hostetter and Thos. Ehrehart, all of Hanover.

Houston, Tex.—The Houston City Street Railway Co. has been organized with a capital of $400,000. The incorporators are H. F. McGregor, T. W. House, C. A. McKinney, George C. Adams and O. M. Carter.

Lockport, N. Y.—Goodwin & Swift, of 2 Nassau Street, New York, and Reed & McKibbin, of 2 Wall Street, New York, with Ashley & Hodge, of this place, will commence construction soon on the proposed Lockport and Olcutt road.

THOS. H. FEARY, of Syracuse has asked the aldermen whether they would consider a petition for a franchise in the city.

Mauch Chunk, Pa.—The Council has voted to grant the right of way petitioned for by the Carbon County Electric Railway Co. Fred. Bertolette is attorney of the company.

McKeesport, Pa.—The Citizens' Passenger Railway Co. has been incorporated here. The capital stock is $30,000, and the president is James S. Kuhn, of McKeesport. Others interested are W. A. Dunshee, W. E. Harrison and Horace Crosby, all of this place.

Meadville, Pa.—The Select Council lately received a petition from George D. Trawin and thirty-seven citizens, asking the privilege to construct an electric railway on certain streets.

Medford, Mass.—The city has granted a franchise for the Middlesex Fells electric road, and its completion is assured. The road is backed by Ex-Governor Ames, F. L. Ames and others.

Montgomery, Ala.—The West End & Riverside Electric Street Railway Co. has filed articles of incorporation. The incorporators are Dr. S. D. Seelye, M. E. Satchwell and J. M. Garrett, Jr. The capital stock is $100,000.

Nanticoke, Pa.—People's Street Railway Co., of Nanticoke and Newport, has been chartered; capital, $60,000.

New Glasgow, N. J.—The New Glasgow Electric Co. has asked the Council to approve of a route for their proposed electric street railway.

Oakland, Cal.—The Twenty-third Avenue Electric Railway Co. has been incorporated, with $300,000 capital stock. The directors are W. J. Landers, H. W. Meek, C. E. Palmer, B. C. Hawes and A. C. Hammond, Jr.

Passaic, N. J.—The Passaic, Rutherford & Carlstadt Railway Co. has been organized by James A. Morrisse, of Paterson.

Pottstown, Pa.—The Citizens' Passenger Railway has received a charter; capital, $75,000. The road will be twelve and a half miles in length, beginning at Douglassville, and extending to Pottstown. The directors are John P. Dunn, John A. Weber, Pottstown; Samuel M. Zacharias, W. Wilkins Car, Philadelphia; James C. Herlig, Reading.

Quakertown, Pa.—It is contemplated to build an electric railway from here to Richlandtown.

Reynoldstown, Pa.—The Reynoldstown & Port Vue Traction Co. has been organized with a capital stock of $18,000 to build an electric railway. Horace Crosby, of Pittsburgh, is president. A. Chandon, W. A. Dunshee, James S. Kuhn and James Simpson, all of McKeesport, are interested.

Richfield Springs, N. Y.—The Trustees of Richfield Springs have granted a franchise for a street railroad. The road will extend from the Spring House corners to the Lake House.

Sacramento, Cal.—H. P. and Charles E. Livermore, Albert Gallatin, A. J. Ralston, J. D. Fry and R. D. Fry, all of San Francisco and owners of the Folsom Water Power Co., have applied to the City Trustees for a franchise for a system of electric railways covering a number of streets in this city.

Salt Lake City, Utah.—A franchise has been granted to the Great Salt Lake & Hot Springs Railway Co.

Sioux City, Ia.—Articles of incorporation of the Morning Side Street Railway Co. were filed last month. The capital stock is fixed at $100,000. The incorporators include James A. Jackson, William L. Joy, E. C. Peters and J. H. Quick.

Tampa, Fla.—Articles of incorporation have been filed of the Consumers' Electric Light & Street Railroad Co. Among those interested are E. S. Douglass, W. H. Kendrick, A. C. Wuerpel, H. H. Kinyon and W. B. Henderson.

Tamaqua, Pa.—The Tamaqua Board of Trade has passed a resolution urging the construction of the electric railway between that town and Lansford.

Toronto, Ont.—At a recent meeting of the shareholders of the Toronto & Scarboro' Electric Railway, Light & Power Co., at the offices of John Stark & Co., 28 Toronto Street, it was voted to push the work of construction without delay. The intention of the company is to connect Scarboro' Heights and the city, and overrun that part of Toronto east of Don with a system of electric cars. The officers of the company are: President, W. G. Stephenson; vice-president, John Hallam; secretary, treasurer and managing director, A. W. Dingman.

Washington, Ind.—This place is to have an electric street car line. The City Council has granted a franchise for fifty years to Graham & Cox, and released them from taxation for ten years.

Extensions and Improvements.

Andover, Mass.—A petition by residents has been presented to the Merrimack Valley Street Railway Co., asking for an extension of the tracks from North Andover centre to Andover.

Ashland, Wis.—Work on the electrical equipment of the street railway line here has been commenced.

Baton Rouge, La.—The Capitol Railway & Lighting Co. has purchased the Baton Rouge Street Railway, and will operate it by electricity.

Buffalo, N. Y.—The directors of the Buffalo & Williamsville Electric Railway Co. have let contracts for the construction and equipment of an electric railway from Buffalo to and through the village of Williamsville, N. Y. The road will be four and a half miles long, and will be a continuation of the Main Street line of this city. The contract for the construction has been awarded to J. D. Murray, of New York City, who also furnishes the electrical equipment and rolling stock. The former is of the Thomson-Houston type. The contract for a 150 H. P., compound condensing engine has been awarded to the John T. Noye Manufacturing Co., of this city.

THE Buffalo Railway Co. has been granted by the Board of Aldermen the right to substitute electricity for horse power on all its lines except the Elmwood Avenue Line.

Chattanooga, Tenn.—The street railway company contemplates the early completion of the proposed line out Fourth Street to Sherman Heights. The survey has been made and the poles erected for part of the distance. The extension of the Ridgedale line one mile further, to East Lake, is also being talked of. Some important improvements are also in progress on the St. Elmo road.

Chicago, Ill.—By an action of the City Council last month the extreme southern electric street railway systems of the Calumet Electric Street Railway Co. are connected with the system of the Chicago City Railway Co. by way of Stony Island Avenue. The importance of this lies in the fact that it gives transportation to the World's Fair by electric railway (overhead wire system) from Grand Crossing and southern points, and perfects the connection with the present cable system. A license fee of $50 for each car is fixed.

APPLICATION for a permit to build from Ashland to Western Avenue has been made by the Lake Street Elevated Railway Co.

Cincinnati, O.—The Cincinnati Street Railway Co. has become the owner of the franchise for what is known as Route 23, granted some time ago to Simeon M. Johnson.

THE Board of Aldermen have been petitioned by the Consolidated Street Railway Co. for permission to change the Eighth Street line to electricity; also to build a new inclined plane at a point 100 ft. north of the present one. The road is to be finished in a year from the time of getting the grant. Route 21, on top of Price Hill, is to be made electric also, and thus the rapid transit will be continuous to the west corporation line. The company has also received permission to equip the Sedamsville line with electric power.

Danville, Va.—At a recent meeting of the directors of the Danville Street Car Co. it was voted to begin at once the work of extending the line towards the reservoir.

Denver, Colo.—An ordinance has been passed granting the franchise to the Tramway company to construct a line connecting with the Agate Avenue line.

Detroit, Mich.—The street railway company has received permission to equip its Woodward Avenue line.

Duluth, Minn.—A contract has been let by the Duluth Street Railway Co. to W. C. Doherty to build an extension to Lakeside. It is to be completed before November 15.

Everett, Mass.—The Lynn & Boston Railroad Co. has petitioned the selectmen for a location for a second track in the city.

Lancaster, Pa.—The West End Railway Co. has been granted rights by the Council to make several important extensions.

Lansing, Mich.—Real estate dealers in the northwest portion of the city are agitating the matter of extending the street line west on Franklin Street to the Blind School, north on Pine to Willow Street, and thence west to West Street, and from this point to the fair grounds, thus forming a complete belt line.

Malden, Mass.—The Stoneham & Boston Street Railway Co. has petitioned for right to construct a single electric track over Highland Avenue, Pleasant and Sumner Streets.

New Bedford, Mass.—The Union Street Railway Co. has petitioned the town of Fairhaven for permission to extend its track from its present terminus to the Howland Road, or East Coggeshall Street.

New Haven, Conn.—The State Street Horse Railway Co. has received permission to double track its entire line.

THE Board of Public Works has given permission to the Winchester Avenue Street Railroad to extend its tracks from the present terminus, corner of College and Chapel Streets, through College, George and Commerce Streets, to connect with the New Haven & West Haven railroad's tracks.

AN extension to the Morris Cove electric road has been laid up Farren Avenue and along Meadow Street to the east end of the Quinnipiac drawbridge.

New Rochelle, N. Y.—The Board of Village Trustees has granted a franchise to the Union Railroad Co. to lay tracks and operate a trolley railroad in connection with their New York system.

New York, N. Y.—On October 5 the board of directors of the Houston, West & Pavonia Ferry Railroad Co. which operates all but two of the lines controlled by the Metropolitan Traction Co. in New York City, voted to cable the extensions on Ninth and Lexington Avenues, which they petitioned for. The petition has been granted. Previous to this vote it was generally understood that the trolley system would be installed on the first of these extensions. The directors state in their resolutions that "whatever may be the merits of other systems of traction, it is not open to this company to consider the same for these extensions after having invested millions of dollars in the present cable system."

Newton, Mass.—The Newton & Waltham Street Railway Co. will commence work at once on the construction of the connecting line of tracks between Waltham and Watertown.

Norristown, Pa.—The Citizens' Passenger Railway Co. has received permission to operate its road by electric power. The usual conditions and restrictions are made.

Providence, R. I.—The Union Street Railway Co. has been granted a twenty year franchise over certain streets in East Providence.

St. Paul, Minn.—Thos. Lowry, president of the Twin City Rapid Transit Co., has been granted permission to build a line to Como Park.

Scranton, Pa.—The new managers of the People's Railway Co. will probably double track a considerable portion of the line which has now only one track, and will introduce other improvements.

Springfield, Ill.—The City Railway Co. has been granted the right to extend its line on Monroe Street, Capitol Avenue and East Grand Avenue.

Springfield, Mass.—The Springfield Street Railway Co. has petitioned for right to make a number of extensions.

Springfield, O.—The street railroad company has been granted the right to construct its line over Sycamore and Warder Streets.

Vancouver, Wash.—The Columbia Land & Improvement Co., of this city has sold its street railway franchise, horses, cars, etc., to the Washington Street Railway Co. This latter company will extend the line and will install a new engine and boiler.

Washington, Pa.—The electric railway company has made a liberal proposition to parties interested in the extension of the line. They propose to make it on condition that all unpaid stock subscriptions in the vicinity be paid in full, and a subscription be made in cash sufficient to justify the extensions, with consequent additional expenses of operation. A rebate of 10 per cent. on tickets is also offered.

Wellesley, Mass.—The Natick & Cochituate Street Railway Co. proposes to ask for a franchise to extend its tracks from Natick through Wellesley.

Williamsbridge, N. Y.—The Board of Trustees of Williamsbridge, have granted a franchise to the Union Railroad Co. to extend its system through the streets of the village.

Personal.

Mr. Frank C. Randall, formerly superintendent of the Tripp Manufacturing Co., has accepted a position with the J. G. Brill Co.

Mr. Henry D. Stanley, formerly connected with the Bridgeport Brass & Copper Co., has accepted a position with the Okonite Co., of New York.

Mr. John A. Brill was unable to attend the Convention on account of serious illness, which has confined him to his home for about six weeks. Mr. Brill has been a constant attendant at the conventions, and it is needless to say that his absence was generally noted. The interests of the Brill company, however, were well cared for by the president, Mr. G. M. Brill, and Mr. W. H. Henlings.

The Ammonia Motor.

The Railway Ammonia Motor Co., whose motor car was described in the last issue of the STREET RAILWAY JOURNAL is building in Brooklyn an improved ammonia motor car which will be completed shortly, and will then be put in operation on one of the street railway lines in New York City.

This motor is the invention of P. J. McMahon, an ex-naval engineer, who has operated a car on the World's Fair grounds in Chicago, and has also introduced the system in England, where a car is in successful operation. The motor carries no coal or fire, and there is no escape in the atmosphere. The anhydrous ammonia used is prepared at a stationary plant, and the cost of producing the power is claimed by the manufacturers to be less than one cent per car mile run. The motor is easy to operate, and can be worked by any ordinary conductor, stopping and starting much more quickly than a horse car. On a level road and with a free track a speed of twenty miles an hour can be maintained. The cars are considerably lighter than electric cars of the same size, and as each car is operated independently and carries its own motive power, the manufacturers claim it to be more desirable than the electric system. This company has moved its offices from 280 Broadway to Drexel Building, Wall Street, New York.

The Origin of Feed Water Purifiers.

A novel illustration, showing the principle upon which the feed water purifier is based, has been issued by the Hoppes Manufacturing Co., of Springfield, O. This illustration, which appears in our advertising pages, shows in the center a Hoppes purifier complete, and the view of a purifier pan after use. The latter exhibits a considerable deposit of solid matter which was formerly held in the feed water, but which has been caught by the pan. The rest of the picture shows the interior of a cave in which many stalactites are hanging from the roof, left there by the solid matter of water dripping through the roof, while on the floor of the cave are a number of stalagmites. As stalactites are found longer and greater in number than stalagmites, so this manufacturing company has found in its heater that in actual practice about three-fourths of the solid matter caught by the purifier is found clinging to the under side or bottom of the pan; while the inside shows a deposit usually amounting to one-fourth of the total scale.

Profit Sharing.

The subject of co-operation and profit sharing is a theme that has engaged the thoughts and attention of persons well versed in the art of governing or managing great and productive enterprises requiring a large number of operatives. While this has been a thoughtful subject with limited experiments during the past years, it is now a subject which occupies the attention of those in every walk or class of life. Centralization of capital has strengthened its power; this is evident, as revealed in the many successful attempts by financiers to consolidate capital. During this time labor has not been idle, but has exemplified its power in its efforts to organize or unionize with a view to restrict or defeat any infringement of capital on labor. The inhabitants of a state or government co-operate for the purpose of strength and prosperous gain. If these are governmental facts in a large way, why is not the subject of co-operation more thoroughly studied and adopted by those controlling and managing enterprises which represent a government within themselves?

Railway lines are merged into one system in order to become a unit which, with skillful management and co-operation, are enabled to attain results impossible of consummation in any other way. These are not rare instances. Street railway companies consolidate for the fulfillment of centralized strength, that desirable results may be attained. The whole drift and tendency of capital engaged in operating systems of traffic for the benefit of the people is to consolidate, and few are ready to deny that such consolidation and co-operation is not wise and beneficial.

Then, if this principle of unity will bring to aggregate wealth salutary results, why is it that men whose capital is their labor cannot in a measure attain similar results. There is no reason why an organization of men whose capital is their labor may not produce for themselves the same ratio of profit. Neither large nor comfortable fortunes have ever been accumulated from the savings or profits of one man's labor, who did not either employ others or acquire land or other property bearing interest, increase in value or return large rents. It is this apparent fundamental wrong or inequitable condition which the labor movement is striving to correct at the present time. Profit sharing produces an individual, or self interest, which is natural to man. Little or no respect is shown to the individual who does not, in this age, look out for self. Attempts to foster a system of gain or profit may be so strained as to breed selfishness, and may be impregnated with such tyrannical shortsightedness as to fail of its purposes, while a wise self interest can look beyond the present day advantage.

"The employer who pays starvation wages," says Geo. Chace, of Mass., "and expects to get the measure of work by sweating and grinding, who is bothered by frequent shifts, poor production and occasional strikes, is as short sighted as a poor teamster, who half starves his horses and hopes by blows to force the stint of work from his thin ribbed beasts, and perhaps more so, inasmuch as the capability and sensibility of human beings are greater than those of dumb creatures." As a matter of business, it pays to trust human nature and anticipate adequate returns for your confidence. The lack of good faith and fidelity are, as a rule, cause for the treachery and fraud that are often apparent and complained of. The underlying principle of profit sharing relies for its success upon the natural appreciation of a good turn by reciprocal parties.

Low and inadequate wages, viewed from the standpoint of an employer, whether the manager of a street railway system or any other kind of work, if made so low as to hinder the employes from doing the full measure of work, or injures the quality of the service, is not productive service. It is not difficult to correctly estimate the difference in value between the labor of an eager and commensurately paid workman and a reluctant, half paid servant, between one who works for your interest and one who works against it, and one whose chief aim is only to accomplish enough to secure his pay and retain his place.

Will profit sharing supply a sufficient impulse to so advance the whole interest of employer and employe? It is claimed to offer the safest practicable solution of the labor problem. In such event, it is claimed that the affairs and business would be kept in the hands of men of brains, skill and gumption, and at the same time preserve every incentive of self interest intact, proffering employes an appreciable share which may from time to time be distributed, and ultimately increased when results are sufficient to justify such increase.

If it has been and can be demonstrated that profit sharing pays a manufacturer, is it a sensible thing to recommend to a street railway management? If such a scheme pays the employer, it also pays the employe; hence, can it not be presumed to pay the community in general and the customer or patron who in turn increases the receipts correspondingly? Would not the adoption of such a system give a better quality of service, and thereby make thrifty citizens of a class heretofore unsteady as to habits and permanency? If profit sharing teaches employes thrift, and gives them steady employment where prudence, skill and interest mean profit, and profit means forehandedness, there can be little doubt about the betterment of his citizenship.

Profit sharing is the oil that cools the friction of interests. If a servant is given to know that a fair chance is open to him he is not indulging in inflammatory advocacy of strikes. He cannot well afford to strike against his own interests, but rather finds it to his interest to attend strictly to business. When an employer or management takes his employes into quasi-partnership, he thinks more highly of them, and by a word of encouragement and appreciation obtains more and better service than could have been accomplished under the "low wages, non-interest" system with harsh and commanding usages. There is much in favor of profit sharing, and but little against it. The strongest side considered herein is that of self interest. The question is, after considering all its social and economical relations, can it be successfully adopted by street railroad management. The proof of this does not

depend so much upon argument as upon experience. A simple plan would of necessity first be adopted which would enable the management to keep within their own knowledge the true state of affairs, earnings, etc. The workmen should share with the stockholders.

It would be difficult to determine the influence such an experiment would have upon street railway management. It would, doubtless, work admirably when business was good and profits ample, but when business was slow and there were no profits to divide, a discontent, even greater than that produced by low wages, might be expected. Such an experiment might be made for a given time—six months or a year—with no promise beyond that time. Would it not be a surprise to some managements that are not paying any dividends now to experiment with profit sharing, and thus to be able to pay a healthy dividend? It is evident that a generous business policy counts for something, and the interested co-operation of few or many employes cannot be well overlooked as an insignificant factor in the successful operation of any enterprise. Profit sharing is entitled to a fair trial in this age, and a wise self interest on the part of both employer and employed in the management of street railway systems affords an average opportunity for mutual success. R. D. F.

New Station of the Metropolitan Street Railway Co., Washington.

Within a short time ground will be broken for an electric power plant, to be built by the Metropolitan Street Railway Co., at the intersection of O, P and Four-and-a-half Streets and Delaware Avenue, Southwest, for the Four-and-a-half and Ninth Street lines. A storage battery building, machinery building, boiler house and car house will be put up, and they will occupy a frontage of 252 ft. and a depth of 512 ft.

The feature of this structure will be the corner tower, with a base twenty-six feet square and an elevation of eighty feet above the sidewalk. The storage battery building will be on the corner.

Adjoining this building on the east and fronting O Street will be located the car house, 90 × 268 ft., the roof of which will be carried upon eighteen iron trusses (ninety feet span), making one of the largest street car houses in the country. South of the storage battery building will be the machinery building, 85×69 ft., with an elevation of thirty feet to the eaves, and inclosed with a steep trussed roof. In this building will be placed the machinery.

Adjoining the latter building, and extending to P Street, will be placed the boiler house, 58×65 ft., and corresponding in elevation with the machinery building. This will contain four large boilers, two large water tanks, steam pumps, heaters, etc. A one story fuel house, fronting P Street, will be annexed to the boiler house. The feature of the boiler house building will be the smokestack, skirting with base twelve feet square up to the roof lines, and from this point the section will be made octagonal, and topped with a terra cotta capital coped with stone at an elevation of 107 ft. above the surface. The interiors of the buildings will be finished in a plain but substantial manner. All floors will be laid with granolite, and Georgia dressed pine lumber used in roof construction, and iron beams, girders, columns and corrugated iron arches enter largely into the construction.

Report of the Melbourne Tramway & Omnibus Co.

The annual meeting of the Melbourne (Australia) Tramway & Omnibus Co. was held August 9. The report of the directors showed during the year ending June 30, 1892, a profit (including £13,043 13s. 7d., brought forward from last year) of £95,715 4s. 1d. From this three quarterly dividends of 5 per cent. each had been paid, amounting to £72,000, leaving a sum of £23,715 4s. 1d. to be carried forward. The receipts had been largely interfered with by the depression which had existed throughout the year in every class of business, and until some revival took place the directors stated they could not anticipate any marked improvement, but they had no misgivings as to the real prosperity of the company when matters resumed their normal condition. To meet the lessened receipts, besides considerable savings in other accounts, large reductions had been made under the heads of directors' fees, salaries and wages, and further reductions were arranged for.

The traffic receipts for the year were £511,914 12s. 3d., a decrease of £50,626 7s. 3d. on the preceding year. The amount was made up thus: Omnibuses, £9,541 14s. 5d., being £2,082 12s. 8d. less than last year: tramways, £502,372 17s. 10d., being £48,543 14s. 7d. less than last year. During the year sixteen cable lines and three horse lines have been operated.

Passengers carried were: 43,825,439, a decrease of 4,056,125; miles run, 8,892,077, a decrease of 576,950; miles operated, 41⅝ double track, cable; and 4½ double track, horse.

Power Hack Saws.

Although the power hack saws manufactured by the Millers Falls Co., of 93 Reade Street, New York, have been on the market only a short time, they have already achieved a remarkable success. They are designed to run with a belt, and are adapted to various lengths of the Star hack saw. The manufacturers state that with one twelve inch blade they have cut off a four inch steel shaft ten times, and have run the saw steadily on cast iron for a week. Further particulars in regard to this saw can be found in the January issue of the STREET RAILWAY JOURNAL for this year. Among the users of this saw are numbered many street railway companies and other companies and individuals who have occasion to use this apparatus.

Professor Thomson on the Electric Railway.

In the following extract on the "Future of Electricity" is given Prof. Elihu Thomson's idea of the modern electric railway. He refers also briefly to developments which may be expected in the field. The article appeared in a recent number of the *New England Magazine*.

In our day we cannot, even with effort, realize how great a change was wrought in means and methods of transportation by the introduction of the steam locomotive. To do so we must make a journey through a country where the railroads have not yet gone. How vast has been their influence on the development and prosperity of a country! Even with no other means of propulsion than horses, the strips of iron or steel called rails have had an incalculable influence on the growth of cities. The horse car system, the introduction of which is within the memory of persons of middle age, is however, being rapidly revolutionized. To realize this fully, one has only to stand in or near Boston Common and to notice that on Tremont Street, which at one time was covered with poor horses struggling with their heavily loaded cars, there is now a lively procession of "electrics," or, as Dr. Holmes has quaintly called them in his charming poem, "broomstick trains." What witchery is here! Simply a great exhibition of transmission of power by electricity as applied to moving vehicles. But it is certainly more. It is a grand example of organized human effort in the solution of difficult problems. In one of its aspects it signalizes a victory even over prejudice and conservatism. It is a living testimonial of the wisdom and energy of the men who have stood back of the work and have been able in a sense to move mountains. From the engineering standpoint it has shown that even under conditions the most exacting, the electric motor has proven its merit. But those who are not familiar with such work can not realize how much of strenuous battling with obstacles and difficulties is involved in effecting such a revolution. Back of the visible expenditure of mechanical energy in moving the cars, we shall find for generating and supplying the current a gigantic power station, with its ponderous engines, dynamos, regulators, switches, together with a huge steam boiler plant, the whole constituting the largest electrical generating station in the world to-day and aggregating over 20,000 H. P. when in full work. All of this energy is put into the lines leading from the station in the form of electric current under a moderate pressure. The revolution thus exemplified in Boston is going on extensively in other places, and will constitute, without doubt, one of the most active of enterprises for a considerable time to come.

In a modified form railways in factories and mines are already being run by electricity. In such cases electric trucks or electric locomotives do the haulage work. The time is probably not far distant when there will exist electrically operated railways connecting different cities and towns wherever the traffic is considerable. The steam locomotive itself will on some roads be replaced by the electric locomotive, where the conditions are such as to warrant it. Water powers may thus be rendered available for the operation of the railways, and new water powers may be created for the operation of roads such as skirt along rivers having a sufficient fall. But it is not at all likely that the lines of road which have but a very few lines per day passing over them will be operated electrically by generating current at a station and conveying it to the moving trains. In such cases the problem is like that of the steamship, which will become an electrical ship when means are found for cheaply generating electricity from fuel carried on board. Or perhaps this and many other such problems may receive another solution. Could we, for example, consume our fuel efficiently in setting free from combination two chemical elements or substances which could afterwards be combined in a compact battery and give out an equivalent electrical energy, and were it also possible to again use fuel in decomposing for a second time, and so on, the two substances, the result would be attained indirectly. Were the processes required simple and unattended with great wastes, our much-to-be-desired cheap supply of electricity, either in a station or in a moving vessel or vehicle, might become a realization. We shall suggest this solution of the problem, without daring to prophesy that it will come to pass.

Proposed High Speed Electric Railway.

The plan for a boulevard and electric road between Baltimore and Washington has been enlarged to include Philadelphia. The company has been incorporated in Maryland as the Washington & Baltimore Boulevard & Electric Railroad Co., The incorporative act requires that work on the road shall begin within six months, and be completed within twenty-four months after the passage of the act. It is expected to run trains at the rate of sixty miles an hour.

A House Warming.

The Electrical Engineer entertained its many friends on Wednesday afternoon, October 26, in its handsome new offices in the *Mail and Express* Building, 203 Broadway, New York. An elaborate luncheon was served to the several hundred gentlemen present, who thoroughly enjoyed the hospitality of the popular staff of our esteemed contemporary whose marked success in the field of electrical journalism is so pronounced and so deservedly earned.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co ...	50	1,250,000	Q.—J.	1½	.....	124	.....
Brooklyn City R. R. Co.....	10	6,000,000	Q.—J.	2	.....	212	.....
Coney Island & Brooklyn R. R. Co.....	100	500,000	Oct. 1.	4	.....	150	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.....	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	104
Broadway R. R. Co.....	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds.....	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates.....	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st.....	.....	125,000	F. & A.	7	Aug. 1897	106	.....
South Brooklyn Central R. R. Co., 2d.....	.....	150,000	F. & A.	6	July, 1941	102	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	109	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.....	100	750,000	Q Feb.	1½	1890	121	127
Watervleit Turnpike & R. R. Co.....	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort...	1865	40,000	J. & J.	5	1905	105	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	102½	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	102	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	102	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	102½	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	105	.....
" " " Debenture..	1891	200,000	M. & N.	6	1901	113	.....
Watervliet Turnpike & R. R., 1st Mort.....	1889	350,000	M. & N.	6	1919	115	118
Watervliet Turnpike & R. R., 2d Mort.....	1889	150,000	M. & N.	6	1919	109	113

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	.....	150
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	138
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.. ..	120	.....
42d & Grand St. Ferry.....	100	748,000	Q.—F.	3	.....	295	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	54	56
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	113	116
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	195	200
Third Avenue.....	100	2,000,000	M. & N.	4	.....	203	210
23d St.....	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue.....	100	800,000	Q —J.	1½	.....	132	135

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	112	115
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	102	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	5	July, 1924	104	.....
Additional.....	.....	1,000,000	J. & J.	5	July, 1905	92	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	115	118
Central Crosstown.....	.....	250,000	M. & N.	6	Nov., 1922	115	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	101	103
Scrip.....	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry.....	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.....	.....	1,200,000	J. & J.	6	1915	63	65
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston. W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	112	115
Second Avenue.....	.....	1,600,000	M. & N.	5	Nov., 1909	99	101
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	110	112
23d St.....	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. Oct. 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.....	50	$6,406,000	J. & J.	4	1887	87½	... .
West End Com'n.....	50	9,085,000	J. & J.	5	1890-1892	72⅝	72¾

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Oct. 19.

Company	Par.	Capital.	Period	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co.....	100	$270,000	New.	...	Oct., 1887	92½	97
Union R. R. Co., Prov.....	100	2,000,000	Q.—J.	2	1862-1863	204	210
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co....	100	1,000,000	J. & J.	4	.....	210	225
Holyoke Street R. R.....	100	200,000	J. & J.	4	.....	212	225
Northampton Street R. R.....	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.....	50	$100,000	J. & J.	3	.....	.....	65
Enterprise Ry. Co.....	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.....	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	800,000	Quart.	1½	1867	132	135
Crescent City R. Co.....	100	1,150,000	"	1¼	.866	100	101½
Canal & Claiborne R. R. Co..	40	240,000	.....	...	1888	27	31
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	140½	144
Orleans R. R. Co.....	50	185,000	"	2	1868	67	68
St. Charles Street R. R. Co ..	50	600,000	"	2	1866	94	95½

Bonds.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	.....	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93-'99	.....	.....
do do new	1886	40.000	M & N	6	1896	... .	.....
N. O. City R. R. Co.....	1879	495,200	J & D	6	1903	120	.....
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92-'06	.....	.....
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89-'01	.....	.....

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	37	.....
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	. .....	.....	...	.....	26	.....
New Haven & Centville H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	....
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1899	104	.....
Bridgeport Horse R. R. Co....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	...
Hartford & Wethersfield Horse R. R Co., Deb. Series C. (Not yet issued).....	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	245	246

BONDS.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	90	91
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	34	35

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	99	99½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	115	.....
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	115	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City.....	100	$7,000,000	Q.—J.	3	.....	470	480
Chicago Passenger.....	100	1,000,000	A. & O.	2½	.....	99½	.....
North Chicago City.....	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street.....	100	5,000,000	J. & J.	4	.....	270	275
West Division City.....	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street.....	100	10,000,000	Q.—F.	1½	.....	215	218

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City.....	.....	4,619,500	J. & J.	4½	.....	98⅝	98¾
Chicago Passenger.....	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	101½	102
" " "	.....	1,850,000	M. & N.	4½	1927	96½	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100⅝	.....
West Chicago Street.....	.....	4,160,000	M. & N.	5	.....	101½	.....
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	96¼

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 421 Wood Street, Pittsburgh, Pa., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co ...	50	1,500,000	.....	...	.....	...	29¼
Citizens' Traction R. R. Co ..	50	3,000,000	J. & J.	3	.....	62½	63
Pitts. & Birmingham R. R. Co	25	3,000,000	.....	...	.....	25	25¼
Pittsburgh Traction R. R. Co.	25	2,500,000	.....	3	.....	58	59
Federal St. & Pleasant Valley	50	1,400,000	J. & J.	3	.....	25⅛	25⅝
Pittsburgh, Allegheny & Man	50	3,000,000	....	1¼	.....	44½	45
West End R. R. Co.....	50	200,000	J. & J.	...	.....	...	.....
Second Avenue R. R. Co.....	50	300,000	J. & J.	3	.....	...	.....
Penn Incline Plane Co.....	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.....	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.....	50	3,000,000	.....	...	.....	28½	28⅝

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co ..	...	1,250,000	A. & O	5	1927	106	107
Pitts. & Birmingham Traction Co.....	1890	1,500,000	M. & N.	5	1929	102½	103
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	104	.....
Pleasant Valley Ry.....	1892	1,250,000	J. & J.	5	1919	102¼	.....
P., A. & M. R. R. Co.....	1891	1,500 000	J. & J.	5	1931	102½	102¾
Duquesne Traction Co.....	1890	1,500,000	J. & J.	5	1930	101½	101⅝
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.....	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.....	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.....	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.....	1883	125,000	.....	6	1903	....	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	....	.....
Monongahela Incl'e Plane Co.	1887	50,600	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.....	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.....	100	1,000,000	Monthly	5	.....	114½	115
Central R R. Co.....	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R.R.Co	100	1,000,000	.....	1	.....	95	110
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	68	72½
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	30	35
Omnibus Cable Co.....	100	2,000 000	Monthly	4	.....	48¾	50¾
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	28	29¼

Bonds.	Date of Issue	Am't Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House.....	.....	650,000	M. & S.	6	1914	101½	105
Market Street R. R.....	.....	3,000,000	J. & J.	6	913	123	.....
Omnibus R. R.....	.....	2,000,000	A. & O.	6	1918	114	.....
Powell Street R. R.....	.....	700.000	M. & S.	6	1912	110	.....
Park & Ocean R. R.....	.....	250,000	J. & J.	6	1914	.....	115¼
Park & Cliff House R. R.....	.....	350,000	J. & J.	6	.....	96	.....
Cal. St. Cable R R.....	.....	.....	.....	...	.....	105½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.....	100	$324,000	.....	3	1864	110	150
Cass Ave. & Fair Grounds.....	100	2,500,000	.....	...	1876	46	47
Citizens'	100	1,500,000	Oct. '91	4	1887	90	95
Jefferson Avenue.....	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	76	80
Missouri.....	100	2,000,000	Oct. '92	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
People's.....	50	1,000,000	M. & S.	6	1889	45	50
St. Louis.....	100	2,000,000	July '92	6	1890	150	160
4th Street & Arsenal.....	50	150,000	Jan.	.50	1872	10	12
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban.....	100	2,500,000	.....	...	1891	48	50

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine.....	1891	$500,000	F. & A.	6	1911	102	102½
Cass Avenue & Fair Ground...	1892	1,800,000	J. & J.	5	1912	97	98
Citizens' Cable.....	1887	1,500.000	J. & J.	6	1907	106	107
Lindell	1890	1,500.000	J. & J.	5	1895-1910	99	100
Mound City.....	1890	525,000	A. & O.	6	1900-1910	105	106
Missouri Cable.....	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort.....	1882	125,000	J. & D.	6	1902	102	105
" 2d mort.....	1886	75,000	M. & N.	7	1902	104	105
People's Cable.....	1889	800.000	J. & J.	6	1889-1914	97	100
St. Louis Cable.....	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union Depot.....	1890	1,600,000	A. & O.	6	1900-1910	105	106

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'.....	50	$500,000	Q.—J.	4	1858	260	265
Continental.....	50	1,000,000	J.—J.	6	1873	120	124
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	220	223
Germantown.....	50	1,500,000	Q.—J.	2¼	1858	105	107
Green & Coates.....	50	500,000	Q.—J.	3	1858	120	122
Hestonville.....	50	2,050,000	.....	...	1859	34	35
Lombard & South.....	25	500,000	A.—O.	8	1861	58	60
People's Common.....	25	1,500,000	M.—S.	2½	1873	52	54
" Preferred.....	25	750,000	M.—S.	2½	.....	52	55
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	151	152
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	70	72
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	92	93
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	225	227
Second & Third.....	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	206½	208
Union.....	50	1,250,000	J.—J.	9½	1864	191	192
West Philadelphia.....	50	750,000	J.—J.	10	1857	202	204
Metropol tan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	118	119
Baltimore Traction.....	25	5,000,000	.....	1	1889	27½	28
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	44	45
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	28	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	26	27

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1.250,000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	106	107
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	103	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.....	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.....	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati.....	50	$6,000,000	Q.—J.	5	.....	109¾	110
Mt. Adams & Eden Park....	50	1,400,000	Q.—J.	5	.....	108⅝	108¾
S. Covington & Cincinnati..	50	275,000	J. & D.	6	.....	125	135
Mt. Auburn Cable.....	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry.....	100	500,000	.....	...	.....	92	95
" " " Pref.	100	100,000	.....	6	.....	99½	100
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street.....	.....	50,000	J. & J.	7	July, 1892	.....	.....
" "	.....	50,000	J. & J.	7	July, 1893	102¾	.....
" "	.....	50,000	J. & J.	7	July, 1894	107	.....
" "	.....	50,000	J. & J.	7	July, 1895	108½	109
" "	.....	50,000	J. & J.	7	July, 1896	110½	111½
" " extended	.....	100,000	J. & J.	4	July, 1896	99¾	100¾
	.....	50,000	J. & J.	5	July, '96	102	103½
Mt. Adams & Eden Park....	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	106
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je.'94-1924	105½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104½	105¼
Cin. Inclined Plane Ry.....	.....	125,000	J. & J.	7	July, 1899	116	.....
" " " "	.....	300,000	J. & J.	6	Jan. 1914	107¾	108¼
Mt. Auburn Cable.....	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap.'93-1908	.....	111¼
S. Covington & Cincinnati..	.....	250,000	M. & S.	6	Mar. 1912	115	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Oct. 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.....	25	1,000,000	Quart.	3	... .	78	85
Union Pass. Ry. Co.....	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)..	25	5,000,000	Quart.	1	.....	27	27½
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry.....	1882	250,000	J. & J.	6	1912	108	109
" " " cons. mort..	1892	500,000	.....	5	.....	105	106
Union Ry. Co. 1st mort.....	.....	50,000	M. & N.	6	.....	105	110
" " gen. mort.....	.....	1,500,000	.....	5	.....	105	105½
Balto. Traction Co. (Cable)..	1889	1,500,000	M. & N.	5	1929	110	110¾
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	106	106½
" " "	1891	1,250,000	M. & S.	6	1901	105½	106
City Pass. R. R. Co.....	1891	2,000,000	"	5	1911	112	112½

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	320	.....
Metropolitan R. R.....	50	750,000	Q. J.	2	1864	96	100
Columbia R. R.....	50	400,000	Q. M.	1	1870	57	65
Capitol & North O St. R. R...	50	500,000	Q. J.	...	1875	33	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	25	31
Georgetown & Tenallytown..	50	200,000	.....	...	.....	.....	50
Rock Creek R. R.....	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.....	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown..	1883	500,000	J. & J.	6	1893-1923	102	.....
do. do. convert.	'83-'91	3,000,000	J. & J.	6	1899-1929	140	150
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	100	.....
Capitol & North O St. R. R...	1921	240,000	J. & J.	5	1921	103½	104½
Metropolitan R. R. convert...	1901	200,000	J. & J.	6	1901	108	.....
Anacostia R. R..... ..	.....	200,000	A. & O.	6	1901-1931	.....	.....

ROCHESTER, BUFFALO, PATERSON, NEWARK AND COLUMBUS STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.....	100	5,000,000	.....	...	1890	50	55
Buffalo (N.Y.) Ry.....	100	6,000,000	.....	...	1891	63	65
Paterson (N. J.) Ry.....	100	1,250,000	.....	...	1891	.....	25
Newark (N J.) Pass. Ry ...	100	6,000,000	.....	...	1890	28¾	29
Columbus (O.) St. Ry.....	100	3,000,000	.....	...	1892	55	.....
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.....	1890	3,000,000	A & O	5	1930	94	96
Buffalo (N.Y.) Ry.....	1891	5,000.000	F & A	5	1931	91½	.....
Paterson (N. J.) Ry.....	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry ...	1890	6,000 000	J & J	5	1930	90	92
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	94	97½

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R..	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.....	100	310,000	.....	2	.....	176	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd ..	100		.....	....	.....	95	105
East Cleveland R. R.....	100	2,000,000	Quart.	2	.....	166½	170
Woodlawn Ave. & West Side.	100	1,100,000	Quart.	1½	.....	136	140

Financial.

THE Columbus (O.) Street Railway Co. makes the following report for September, 1892 :

	1892.	1891.		
Gross earnings.....	$52,143.54	$43,199.12	Inc.	$8,944.42
Operating expenses.....	23,552.64	24,900.61	Dec.	1,347.97
Net earnings.....	$28,590.90	$18,298.51	Inc.	$10.292.39

$ $ $

THE Newark (N. J.) Passenger Railway Co. gives the following comparative statement of its operations for the month of September :

	1892.	1891.		
Gross earnings.....	$107,924.15	$97,472.24	Inc.	$10,451.91
Operating expenses.....	70,887.91	77,738.35	Dec.	6,850.44
Net earnings.....	$37,036.24	$19,733.89	Inc.	$17,302.35

$ $ $

THE Louisville (Ky.) Railway Co. reports for August :

	1892.	1891.		
Gross earnings.....	$111,778.51	$104,949.65	Inc.,	$6,828.86
Operating expenses....	76,047,91	68,404.80	Inc.,	9,643.11
Net earnings.....	$35,730.60	$36,544.85	Dec.,	$ 814.25

$ $ $

THE Buffalo (N. Y.) Railway Co., for the month of September, 1892, shows :

	1892.	1891.		
Gross earnings.....	$114,471.48	$87,633.65	Inc.,	$26,837.83
Operating expenses....	64,328.55	53,749.51	Inc.,	10,534.04
Net earnings.....	$ 50,142.93	$33,839.14	Inc.,	$ 6,303.79

$ $ $

THE capital stock of the Citizens' Street Railway Co., of Fishkill N. Y., has been increased to $75,000.

$ $ $

THE directors of the Brockton (Mass.) Street Railway Co. have declared a dividend of 1½ per cent.

$ $ $

THE Citizens' Passenger Railway Co., of Steelton, Pa., proposes increasing its capital stock from $100,000 to 200,000.

$ $ $

AT the annual meeting of the Plymouth (Mass.) & Kingston Street Railway Co., a dividend of 7 per cent. was declared.

$ $ $

THE Northwest General Electric Co. have declared a quarterly dividend of 2 per cent. on the common stock of October 7, payable October 15.

$ $ $

THE Columbus (O.) Street Railway Co. report receipts for September, 1892, $52,143. The receipts for the same period last year were $43,060.

$ $ $

THE Newton (Mass.) Street Railway Co. has voted to petition

the railway commissioners for an increase of capital, the amount not to exceed $100,000.

$ $ $

THE Rochester (N. Y.) Street Railway Co. report receipts during September, 1892, $66,213. For the same period last year the receipts amounted to $56,043.

$ $ $

THE gross earnings of the West End Street Railway Co., of Boston, for September were $606,000, or $67,141 more than for September, 1891. This shows an average daily taking of $20,200, repreenting over 400,000 fares.

$ $ $

THE Worcester, (Mass.) Leicester & Spencer Railway Co.'s directors have voted to pay a dividend of $4 a share on the earnings of the month of September, payable November 15 to all stockholders of record November 5.

$ $ $

AT a meeting of the board of directors of the Northwestern Street Railway Co., of Chicago, held September 19, at their office, 79 Clark Street, it was decided to increase the capital stock of the corporation from $25,000 to $100,000.

$ $ $

KOUNTZE BROS. and Clark Dodge & Co., of New York, and Lee, Higginson & Co., of Boston, offer for sale $1,000,000 of 5 per cent. cable consolidated bonds of the St. Paul Street Railway Co. at 95 per cent. and accrued interest.

$ $ $

ON September 29, at a meeting of the Norwalk (Conn.) Tramway Co., the capital stock was raised from $30,000 to $70,000. The road is under contract, that at least one and a half miles are to be constructed and in operation before January 1, 1893, and the remainder on or before June 1, 1893.

$ $ $

THE Philadelphia Traction Co. are showing an increase in gross receipts over last year of about $1,000 a day. The gain during September was $29,003.00; in August, $32,944.00. The gross receipts during September, 1892, were $399,670.90. The day of greatest traffic was September 17, when $15,838.00 was taken in.

$ $ $

THE gross receipts of the Baltimore Traction Co. during September 1892, were $81,648.00; during September, 1891, the receipts were $58,086.00. The gross gain from January 1, to September 30, was $150,710.00. The day of greatest traffic during September was September 17, when the receipts amounted to $3,844.00.

$ $ $

THE stockholders of the Pittsburgh (Pa.) & Birmingham Traction Co. met October 11. The secretary's report for the year ending on July 1, showed the gross earnings for three months past to be $89,132.71; expenses $39,585.20, leaving the net earnings at $49,451.51. It was decided by the meeting to issue bonds on the Knoxville branch of the road.

$ $ $

THE *Worcester* (Mass.) *Telegram* says the Worcester Consolidated Street Railway Co.'s stock is considered to be practically sold to a syndicate representing Philadelphia and New York capitalists, through the banking houses of E. W. Clark & Co., of Philadelphia, and H. B. Hollins & Co., of New York. The latter concern is supposed to be a Vanderbilt house.

$ $ $

THE annual report of the Springfield (Mass.) Street Railway Co. is as follows: Increase of capital stock, $650,000 to $1,000,000; increase in number of miles run, 758,608 to 1,088,965; increase in number of passengers carried, 4,391,251 to 6,395,519; increase in amount of track operated, 21⅝ to 32½ miles; total earnings, $333,550; expenses, $251,001; interest, $3,473; 8 per cent. dividend, $44,000; surplus, $34,476.

$ $ $

THE Interstate Bridge & Street Railway Co., of Omaha, Neb., which was organized by the East Omaha Co. several years ago, has changed its name to the Omaha Bridge & Terminal Co., and increased its capital to $7,500,000. A loan for $5,000,000 has been already placed. it is said, with Drexel & Co., of Philadelphia, and a mortgage for that amount has been placed upon the plant, the money to be furnished as required in the progress of the work.

Lamp Decision.

A decision was rendered October 4 in the United States Circuit Court of Appeals, by Judge Lacombe, in the case of the Edison Electric Light Co. *vs.* the United States Electric Lighting Co. This case has been before the courts for about five years, and the decision rendered was in favor of Edison and awarded him the right to be considered as the inventor of the incandescent electric lamp as used to-day. The case was brought up on appeal from the United States Circuit Court, where a decision by Judge Wallace had been rendered, July 14, 1891, in favor of the complainant.

In the decision the various defenses based upon the phraseology of the patent in suit, and upon the termination of the Edison Canadian patent, and certain technical defenses in reference to the title of the complainant were carefully considered by the court and overruled. The conclusion of the court is that the defendant's lamps are plainly infringements of the second claim of the patent and that the facts do not make out "a case that the injunction should be refused on any theory of laches or equitable estoppel by reason of undue delay in bringing suit, or acquiescence in known infringements."

The patent thus upheld was No. 223,898, and was granted to Thomas A. Edison, November 4, 1879. Its four claims are:

1. An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires, as set forth.

2. The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted for the purposes set forth.

3. A carbon filament or strip coiled and connected to electric conductors so that only a portion of the surface of such carbon conductors shall be exposed for radiating light, as set forth.

4. The method herein described of securing the platina contact wires to the carbon filaments, and carbonizing of the whole in a closed chamber, substantially as set forth.

Storage Battery Decisions.

On October 4 the United States Circuit Court of Appeals for the Second District, handed down two important decisions effecting storage battery interests. The first was in the case between the Brush-Swan Electric Light Co., of New England, and The Brush Electric Co., and was decided in favor of the latter company, reversing the decision of the lower court. The action was brought to enforce a contract by which the Brush-Swan Electric Light Co. acted as exclusive agents of the Brush Electric Lighting Co. in certain territory.

The contract was made May 23, 1878. The Brush-Swan company's

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business was to furnish electrical machinery bought by it from the Brush Eelectric Co. at a discount of about 20 per cent. The agreement made in 1878 was to continue in force for seventeen years, unless sooner abrogated by mutual consent or by the decision of arbitrators. It was agreed that if at any time the pecuniary responsibility of the Brush-Swan company became so impaired as to be insufficient to enable the Brush Electric Co. safely to transact the business in the specified territory through them the contract should be dissolved. On October 27, 1887, the Brush Electric Co. declared the contract annulled and refused to deliver any more goods. To compel a specific performance of the contract, suit was begun by the Brush-Swan people.

When the case was brought for trial before the Circuit Court, the only question in doubt was whether the Brush-Swan company had violated the contract so as to justify the Brush Electric Co. in declaring the contract annulled. The Circuit Court held that there had been no breach of contract on the part of the Brush-Swan company. The Court of Appeals, however, reverses that decision with this remark:

"In our view, the complainant is asking a court of equity to compel the specific performance of a contract which it has not kept, which it cannot truthfully assert that it will keep, and which apparently it cannot help violating, and desires to compel the defendant to furnish it with merchandise which it cannot pay for and the ultimate payment for which it cannot attempt to secure."

The second decision was in the case of the Electrical Accumulator

SPECIAL NOTICES.

FOR SALE.

FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

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WANTED.—Position as Superintendent of a Street Railway. Fully competent to take charge, having had ten years' experience on both horse and electric lines. Address, "SUPERINTENDENT." care STREET RAILWAY JOURNAL, World Building, New York. 1t

WANTED.—Position wanted by thorough practical and theoretical electrician of 10 years' experience in the different departments of the electric business. Considerable experience in railway work. Address S. H., care STREET RAILWAY JOURNAL, New York. 2t

WANTED.—By a Practical Man, position with Street Railway Company as Superintendent or Manager. Have had experience with Electric Steam Motor and Horse Lines. Satisfactory references as to ability and character in the construction, operation of Street Railways and Surburban Lines. Address, "STREET RAILWAY," 6,608 Evans Ave., Chicago, Ill.

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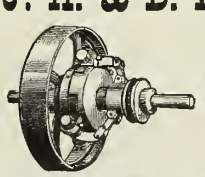
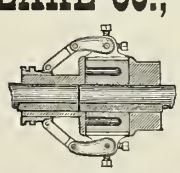
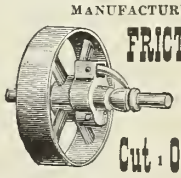
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THE GLASGOW CORPORATION TRAMWAYS COMMITTEE invites parties desirous of Submitting Estimates to Equip certain of their Tramway Routes for working on the Overhead-wire System to Communicate with their General Manager,

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A. O. SCHOONMAKER,
158 WILLIAM STREET, **NEW YORK.**

Co., *et al.*, appellee and defendant, *vs.* the Brush Electric Co., appellee and complainant.

The question before the court was an appeal from a decree of the Circuit Court for the Southern District of New York which enjoined the Electrical Accumulator Co. against the infringement of the 7th and 14th claims of the Brush patent No. 266,090, October 17, 1882, and the 1st, 2d, 3d, 6th, 7th and 12th claims of the Brush patent No. 337,299, dated March 2, 1886, for improvements in secondary batteries.

In discussing the latter patent the court first referred to the question of the novelty of the invention, taking into account the claims to priority of Camille A. Faure. This was disposed of by reference to Judge Coxe's recent decision which limited Faure's claims to the application of active material in the form of "paste, paint or cement." The inventions of Percival and Leclanché are disposed of as follows by the court. "These do not affect Brush's patent. Not only the invention, as described in the 1st, 2d and 3d claims, belongs to him, but he was the first who rammed or pressed the dry powder, the form in which his absorptive substance was used, into grooves or receptacles in the plates, as described in the 6th and 7th claims."

The court then discusses the validity of the various claims, which were solely the subject of appeal, in view of other patents to Mr. Brush of a prior or of the same date, including the Italian patent. On these points the court paraphrases Judge Coxe's previous decision which mantains the full scope of the claims, 1, 2, 3, 6, 7 and 12. In respect to the patent No. 266,090 the court holds that the broadening of the scope of the patent by the insertion of new matter while the patent was pending in the Patent Office should not have been allowed by the latter, and hence it takes a narrower view than that held by Judge Coxe who found an infringement by the defendants of two claims only. As construed by this court there is no infringement of patent No. 266,090.

The decree of the lower court is modified to the extent indicated above, with costs to the appellants. In other respects the decree of the lower court is affirmed.

Coverings for Steam Pipes.

In the transmission of steam in pipes the question of loss of power by radiation of heat should be as carefully attended to from an economical standpoint as that of loss of steam through leaks. Unfortunately, while the condition of the iron pipe is made the subject of careful inspection, the condition of the pipe covering is often shamefully neglected, and not only is leaky covering continued in service but materials are used which, as regards the radiation of heat, are about as efficient as would be a perforated pipe for the restraining of pressure.

Of the various materials used in insulating pipes the most universal is asbestos fibre. In greater or less proportion it enters into the composition of nearly every pipe covering found in the market, and yet by a strange inconsistency, asbestos is itself a most excellent conductor of heat, and by itself assists rather than retards the loss of heat from the steam. This material is employed, however, because the conditions of service require a fireproof material, and also because its lightness and loose or porous structure, make it of value as a bond-fibre for the covering. On the other hand, the air inclosed within the material has high value as a non-conductor, and in some coverings constitutes the only offset to the heat conductivity of the asbestos.

We may therefore consider that the conditions of highest efficiency of a steam pipe covering depend, first, directly on the quantity of inclosed air, second, inversely, on the quantity of asbestos fibre used for bonds, and third, inversely, on the heat conductivity of the third material.

These qualifications appear singly and in combination in the various kinds of coverings now on the market. Thus we have asbestos and sponge, plaster of Paris and asbestos, and the combination of carbonate of magnesia and asbestos. In regard to the latter, the manufacturers of it claim that it has special value for this purpose because it is the lightest material used, and it contains the most air with the minimum of asbestos only 6.85 per cent. The magnesium carbonate, they state, is one of the very best non-conductors of heat known to chemistry, and that in practice this covering seems to meet the requirements with a surprising degree of efficiency.

Great Railroad Traveling.

"I happened to take the 10:30 A. M. train the other day, from Chicago, on the Lake Shore and N. Y. Central, and thought the entire trip would be a bore," said Geo. W. Lederer to a DRAMATIC TIMES reporter. "But imagine my surprise, when I found upon entering the train, a *fac-simile* of their famous Chicago limited, and positively the same comfort, convenience and equipment which I have so often enjoyed on the latter. I arrived in New York City at 2:10 the next day, the train being on time to the minute, and had sufficient time left that day to transact a great deal of very important business. I shall return again to Chicago on the very same train, as it leaves here at 1.55 P. M., and gives me a good half day to settle up my unfinished business."—*New York Dramatic Times.*

The 10:30 A. M. train to which Mr. Lederer refers, is the popular "Chicago and Boston Special," the latest addition to the train service of the Lake Shore & Michigan Southern R'y. The equipment, which is of Wagner build, consists of two Vestibule Sleeping Cars, one Vestibule Buffet Smoking and Library Car, running through to Boston, arriving at 3:40 P. M. next day; one Vestibule Sleeper through to New York, arriving at 2:10 P. M.; a vestibule Dining Car, Chicago to Cleveland, and Utica to Boston, and day Coach, Chicago to Buffalo, and Buffalo to Boston.

The train leaves daily from Van Buren Street Station at the hour named above, and is the greatest favorite with business men and tourists, as by it not only are the cities on the B. & A. R. R. reached early in the afternoon, but the Atlantic Coast resorts are reached before dark.

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THE STREET RAILWAY JOURNAL

Vol. VIII. *NEW YORK & CHICAGO, DECEMBER.* *No. 12.*

The Paterson Central Electric Railway.

Great progress has been made in the building of electric railways in the city of Paterson during the past year. The Paterson Railway Co. has greatly extended its electric system, and the success which has attended the operation of the electric cars on this railway has greatly stimulated other electric railway construction. A complete system of roads connecting Paterson with many of its neighboring cities and towns has been proposed, and a new railway, the Paterson Central Electric Railway, operating through considerable new territory has already been put in operation, the cars having made their first trips during the early part of July.





VIEWS ON THE PATERSON CENTRAL ELECTRIC RAILWAY.

This road, which is made the subject of this article, extends through the center of the city, has brought Paterson's natural attraction, the Passaic Falls, within easy communication, and running along the river road has made a very pleasant summer route. The road had a number of difficult features to overcome, among which may be mentioned the rebuilding of three bridges, the crossing of five steam and ten street railway tracks of another company, and a grade of 11 per cent., at the foot of which is a complete S curve of forty-five feet radius. The curves on the line were a special feature of difficulty, as can be judged from the fact that, though the road is only four miles in length, the longest stretch of straight track does not exceed 2,000 ft.

The rolling stock consists of eight open cars and ten closed cars. The former were built by the Gilbert Manufacturing Co., are mounted on trucks made by the same campany, and exceedingly handsome in design and tasteful in finish. The bodies are painted white, with gilt

39862

trimmings. The closed cars are also mounted upon Gilbert trucks, and were furnished by the Lamokin Car Works of Philadelphia. The bodies of these cars are sixteen feet in length, with rounded vestibules which are three feet ten inches in length, with white and gold coloring. The inside finish of the cars is quartered oak decorated with autumn leaves and sprays. The seats and backs are of fancy wood strips covered with Wilton carpet, and bronze trimmings are used throughout. The cars were constructed under Cochran's patents, all corners are tied by steel knees, and a trolley observation window is provided in the vestibule. Stanwood double steel steps are used. The height of the cars from the top of the rail to the base of the trolley is ten feet three inches, to allow passage of cars under a low bridge existing on the line.

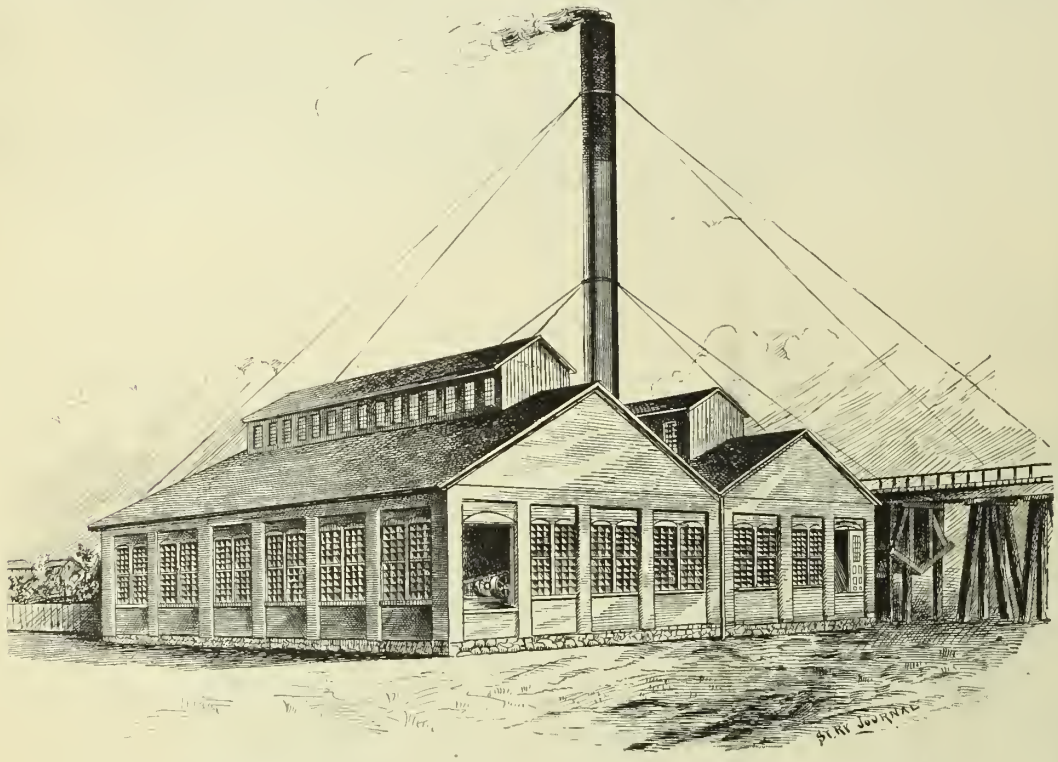


FIG. 1.—EXTERIOR OF POWER STATION—JERSEY CITY & BERGEN RAILWAY CO.

The track in the city is laid with Johnson center bearing rails, weighing fifty-eight and a half pounds to the yard, T rail being used outside the city. The company has built a large and well appointed car house, but has erected no power station, as it was found more convenient for the present to take the power from the electric lighting station of the Edison Electric Illuminating Co., of Paterson. In this station the railway company has for supplying current to the cars two 134 H. P. Edison generators. The road was installed by the electrical engineers of the company, Messrs. Reed & McKibbin. The officers of the company are Wm. Strange, president; Wm. Pennington, vice president; James A. Morrisse, treasurer; John R. Beam, secretary, and William Ring, superintendent. During the four months of operation the net earnings have amounted to 5 per cent. on the investment. The company has no bonded indebtedness.

The Jersey City & Bergen Electric Railway.

Of the large number of travelers who pass annually through Jersey City, the greater proportion think of the city only as the point to change from boat to car or from car to boat on the journey to or from New York. But the city has many points of interest within its boundaries, and of these one of the most noteworthy is the new electric station now being built by the Jersey City & Bergen Railway Co.

This street railway company is one of the largest in the state, operating, as it does, thirty-seven miles of track and owning more than 150 cars. All the street railway lines in Jersey City, with the exception of one, are under its control.

The location of the power station is between Newark Avenue and Montgomery Street, at a point not far from midway between the terminals of the proposed electric system, and close to the foot of the steepest grade on the line on Montgomery Street. The tracks of the Pennsylvania Railroad Co. pass on a trestle close to the station, making the facilities for the receipt of fuel excellent.

The exterior of the building is shown in Fig. 1. Brick is the material used in its construction, and the station is so arranged that it can be extended on the west side to accommodate more machinery should occasion require. The designer of the station and superintendent of construction of the railway is N. McD. Crawford, to whom credit for the many excellent features of the power plant is due.

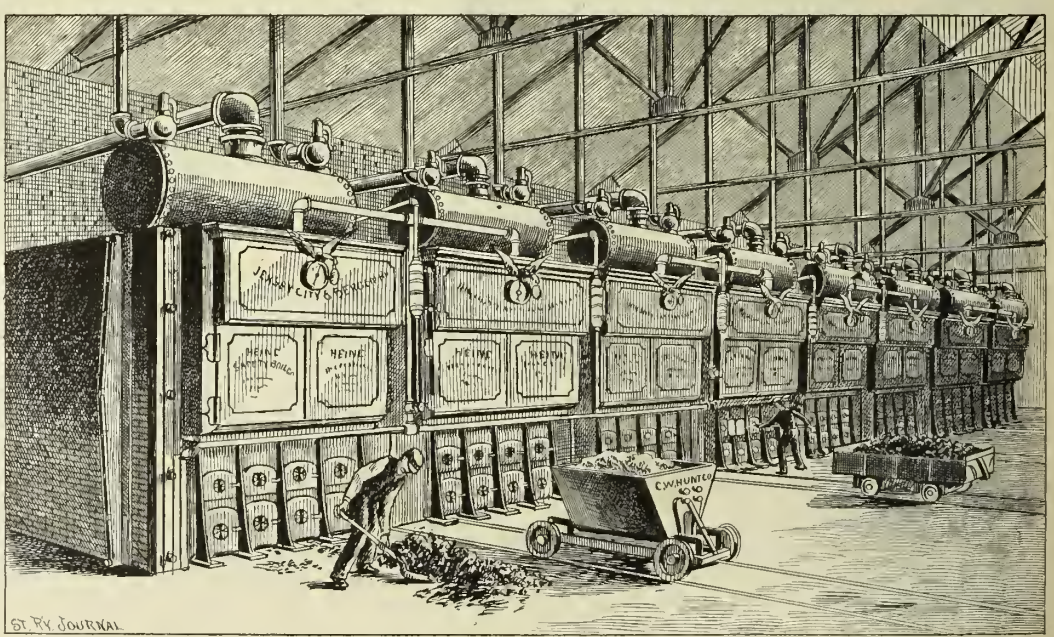


FIG. 2.—BOILER ROOM OF POWER STATION—JERSEY CITY & BERGEN RAILWAY CO.

The boiler room, which is on the north, is arranged for an ultimate capacity of 2,000 H. P, with eight boilers of 250 H. P. each. Two of these are of the Heine safety water tube type, and are already in place. The kind of boilers to be used to complete the plant has not yet been determined by the engineers of the company.

The boiler room equipment also includes a National feed water heater and a Worthington condenser and pump. The floor is of concrete, and the roof is supported on iron girders, and was erected by the Wallis Iron Co., of Jersey City.

Coal from the railroad cars is dumped into hoppers, from which it is taken to the furnace doors by means of coal handling apparatus manufactured by the C. W. Hunt company, reducing the labor of transferring the fuel from cars to furnace to a minumum. The engraving (Fig. 2) shows the completed boiler room with all boilers in position.

The engine room, which is separated from the boiler room by a firebrick wall, and faces the south, is provided with twenty-four large windows, making it very light and insuring good ventilation in summer. These features are still further secured by a monitor roof. The present engine equipment consists of three cross compound, condensing engines of 250 H. P. each, with cylinder dimensions 13 × 24 ins. by sixteen inches stroke, and a speed of 200 revolutions per minute. The engines were built by the Ball & Wood Co., of New York, especially for street railway or other heavy duty service, are provided with special low pressure valves, and with their nickeled cylinder jackets and oil guard impress the visitor with their handsome and powerful appearance. The foundations for three additional engines and generators are in place, and this machinery will be installed when the demand for power increases beyond the present capacity of the station. As shown in Fig. 3, which gives a view of the completed station, each engine will be belted directly to one 250 H. P., Westinghouse, four pole generator, the latter being so arranged in pairs that the commutator ends of two machines will come together, reducing the trouble of carrying and adjusting the brushes as much as possible.

All steam piping and wiring, as shown in the engraving, will be beneath the floor, and the walls and ceilings of the engine room are painted.

All of the new rail laid by the company is of the center bearing girder type, rolled by the Johnson Co., of Johnstown, Pa., and weighing seventy-eight pounds per yard. This rail is mounted on chairs, and the ties are spaced two feet six inches between centers. The return circuit is provided for by bonding the rails with copper bonds and a supplementary wire of the same material. This style of construction has been adopted by the railway company as standard for all the trackage owned by it, and the old horse railway construction is being changed to conform to it.

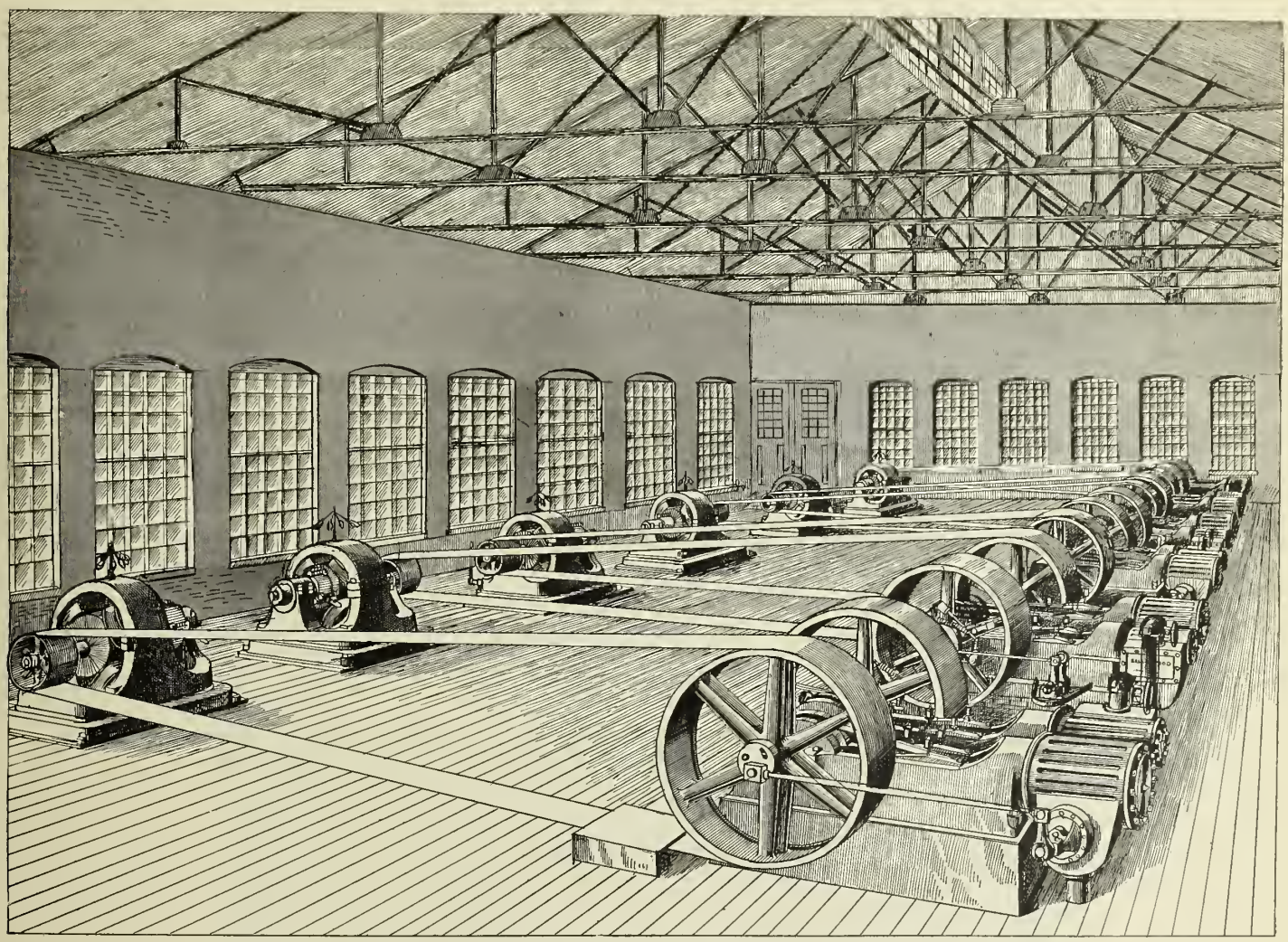


FIG. 3.—ENGINE ROOM OF POWER STATION—JERSEY CITY & BERGEN RAILWAY CO.

Fifteen motor cars with five trail cars will form the first portion of the rolling stock to be put in operation. The motor equipment of each car consists of two single reduction, Westinghouse motors mounted on a Peckham No. 5, radial geared, cantilever truck. The car bodies are from the works of the John Stephenson Co., Ltd., and are sixteen feet in length and provided with extra large platforms which open on only one side. The bonnets are extra long, and are supported by pillars. The body of the car is painted an ochre with gold lettering, and is decorated with a red stripe. The lettering on the lower concave is in silver, and the platforms are painted dark brown with yellow lettering. In the interior of the car the sashes and blinds are of mahogany, and the ceiling is finished in white wood and bass. The officers of the company are: President, Charles B. Thurston; vice-president, E. F. C. Young; secretary H. C. Ross; treasurer, Joseph S. Vanzandt; superintendent, Thomas M. Sayre; superintendent of construction, N. McD. Crawford.

The company expects to have cars running from the station by the middle of December.

Recent Consolidation in St. Louis.

The Cass Avenue & Fair Grounds, the Northern Central and the Union Railway companies, of St. Louis, have recently been consolidated under the title of the first named company. Bonds to the amount of $2,000,000 were issued some time ago. This amount will cover everything, including track construction, power house and cars.

The Municipal Assembly has granted permission to the company to extend its Cass Avenue line from its present main line terminus at Prairie and St. Louis Avenues westwardly to Goodfellow Avenue via Euclid Avenue and several city blocks and alleys. The clause is inserted in the ordinance providing that the cars shall not be run at a rate of speed exceeding fifteen miles an hour. Needless to say, this clause will not be strictly adhered to.

The whole system controls thirty-three miles of single track, or about sixteen and one-half miles double track. However, all of the above mileage will not be double track. The track construction, of which about one half is finished, is very substantial. The rail used weighs eighty-five pounds to the yard, and was made by the Johnson Co. Twelve ties are laid to the rail, and the joints are supported. A curve rail is used weighing 110 lbs. to the yard.

The power station is now in process of erection on the site of the old car stables of the Northern Central line of the company. The equipment will consist of three 1,000 H. P., Reynolds improved, Corliss engines, made by the Edward P. Allis Co., of Milwaukee, Wis. There will be only three generators, but each of these will be of 800 H. P. capacity, and will be the largest in the country. These machines will be run at ninety revolutions per minute. There will thus be one generator for each engine. We think this will be the first station in the United States to operate a horizontal engine directly coupled to the armature shaft of the generator.

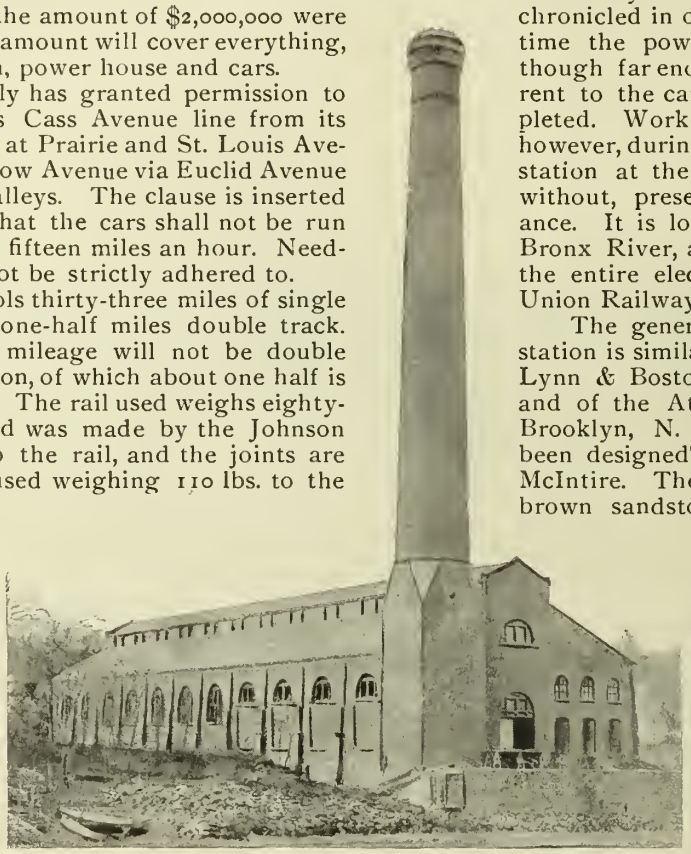


FIG. 1.—EXTERIOR OF UNION RAILWAY CO.'S POWER STATION.

The boilers will be made by the O'Brien Boiler Co., of St. Louis, and will be of the same capacity as the engines.

The car equipment will consist of seventy twenty-foot cars, each to be equipped with two twenty-five horse-power, W. P. motors.

The cars of the Grand Avenue line of the Citizens' Railway and the Seventh Street line of the St. Louis Railroad Co. will also derive current from the power station of this company.

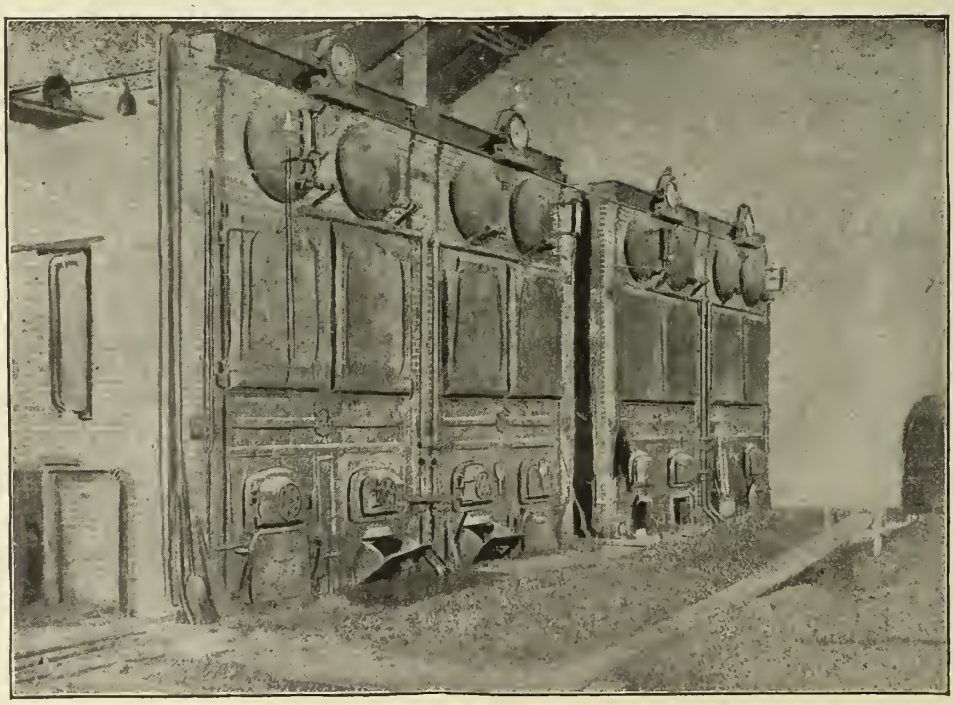


FIG. 2.—BOILER ROOM—UNION RAILWAY CO.'S POWER STATION.

THE Key West (Fla.) Street Railway will be electrically equipped.

Power Station of the Union Railway Co., New York.

The starting on September 18 of the electric system of the Union Railway Co. in New York City was duly chronicled in our October issue, but at that time the power station of the company, though far enough advanced to supply current to the cars, had not been entirely completed. Work has been carried on rapidly, however, during the last two months, and the station at the present time, both within and without, presents a most attractive appearance. It is located at West Farms, on the Bronx River, at about the middle point of the entire electric system belonging to the Union Railway Co.

The general arrangement of the power station is similar to that of the stations of the Lynn & Boston Railway Co., Lynn, Mass., and of the Atlantic Avenue Railway Co. of Brooklyn, N. Y., the three stations having been designed by the same engineer, L. H. McIntire. The building is of brick, with brown sandstone trimmings, and is 229 × 68 ft. As will be seen from the engraving (Fig. 1) showing the exterior, the building is provided with large windows affording plenty of light and ventilation. The interior of the building is divided into two portions by a firebrick wall. The portion containing the boilers is 78 ft. 6 ins. × 68 ft. The steam generating equipment (see Fig. 2) consists of four Babcock & Wilcox water tube boilers of 250 H. P. each, but room is provided and foundations already laid for twice this equipment, when an increase of capacity of the station is needed for the operation of additional cars. The equipment of the boiler room also includes Chapman valves and a Stillman damper regulator. The damper moves on ball bearings. Fresh water for the boilers is supplied at present from the city mains, but later it will probably be taken from a well fifteen feet in diameter and twelve feet in depth now being sunk adjoining the building.

All the fuel required is brought in barges directly to the station and taken to the boiler room by hand cars. The condenser is of a special type built by C. & G. Cooper & Co., Mount Vernon, O., from designs furnished by the engineers of the Union Railway Co., and is especially worthy of notice. It is of the jet type, lined throughout with brass, and has a capacity of 5,000 H. P. Salt

water is taken from the Bronx River through a supply main ten inches in diameter, by means of a Cooper-Corliss pump, 12 × 30 ins. Also erected in the basement, and belted to the crank shafts of each engine, is a Deane power pump, 4½ × 10 ins., which supplies feed water for the engines. In addition to these is a Deane duplex feed pump, 10 × 16 × 10 ins., and two Peerless injectors. Each engine is supplied with one Wainwright feed water heater, connected to a pipe leading to a large heater in the boiler room, where the feed water is heated to the proper degree by the exhaust from the condensing engine. The stack is round, 184 ft. in height with flue eight feet six inches in diameter.

The engine room, which is 150 ft. 6 ins. × 68 ft., presents a particularly handsome appearance, since all the piping and wiring is carried below the floor. The engines at present installed are four in number, of the tandem compound type, and were built by C. & G. Cooper & Co. Each engine is of 400 H. P. capacity, and the dimensions of the cylinders are sixteen and thirty inches by forty-eight inches stroke. The flywheel of each engine is twenty feet in diameter, forty inches face and weighs twenty tons. The engines run at seventy-two revolutions per minute and are lubricated automatically, the supply of oil being kept in a tank located in the basement. The engines are belted directly to the generators by means of thirty-six inch, two-ply belts supplied by the Charles Munson Belting Co. A good view of the interior of the station is given in Fig. 3.

The electrical equipment includes four Thomson-Houston M. P., 300 K. W., generators, running at 400 revolutions per minute. The generators are mounted on tracks built in the generator foundations, and can be shifted by means of a screw with ratchet and lever for belt adjustment.

The pier foundations for both engines and generators are brick arches and rest on rock, and the room also contains a five ton traveling crane. The floor of both engine and generator rooms is of cement.

The switchboard is of marbleized slate, is twenty-four feet in length by ten in height and contains twelve Thomson-Houston standard switchboard panels, eight of which are machine, and four are feeder panels. The engine room also contains a handsome gauge board of black marble, equipped with gauges manufactured by the American Steam Gauge Co.

The roof of the engine room was built by the Boston Bridge Co., and the ceiling is of Georgia pine four inches wide, laid herring bone.

Adjoining the station is a new car house built of brick, 150 × 200 ft. and two stories in height. This house will have a capacity for storing 200 cars.

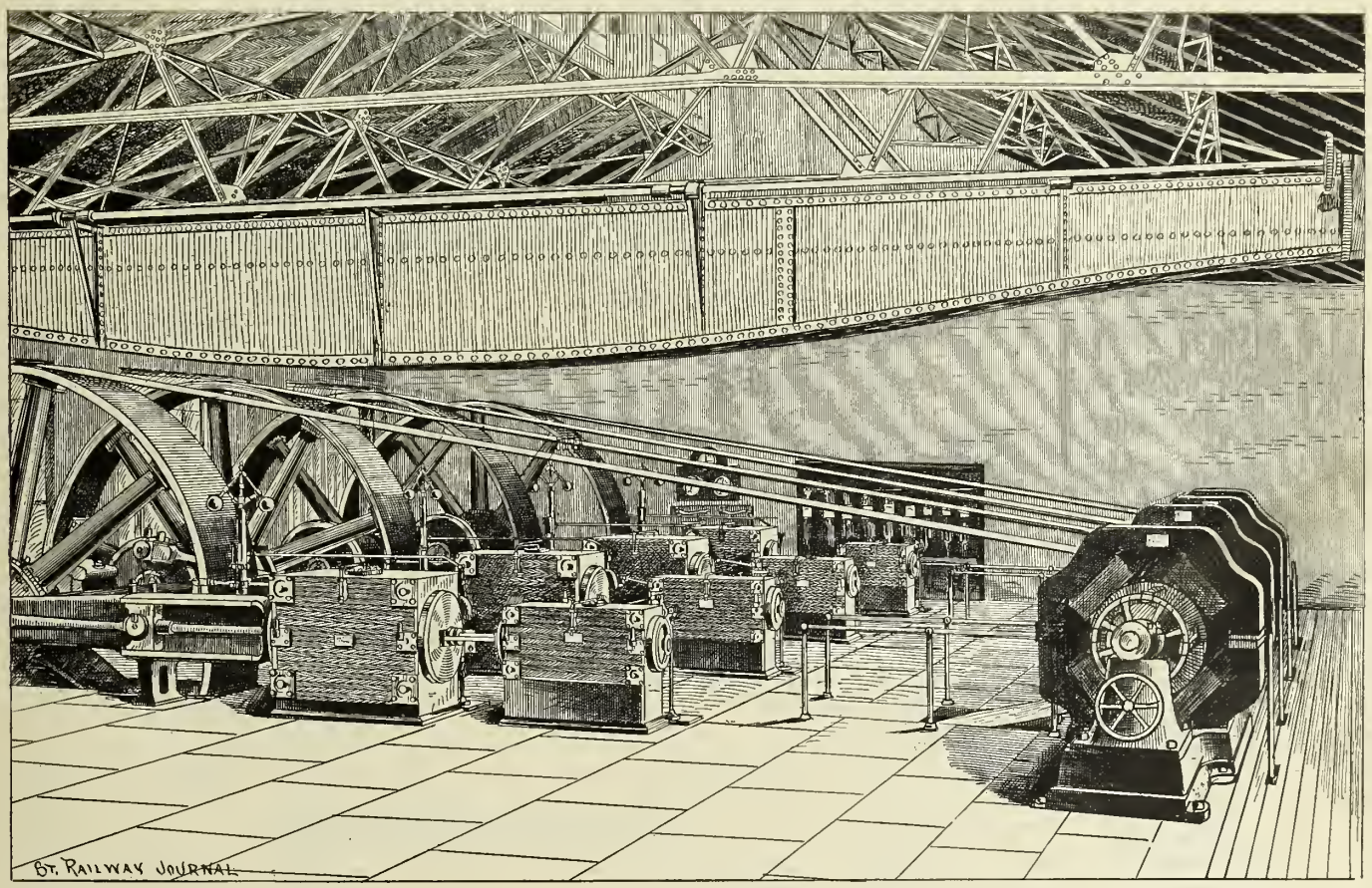


FIG. 3.—INTERIOR OF ENGINE ROOM—UNION RAILWAY POWER STATION.

Mr. Yerkes' Gift to the University of Chicago.

Charles T. Yerkes, of the North Chicago and West Chicago street railroad companies recently announced to the University of Chicago his willingness to give the institution a telescope and observatory at a cost of $250,000. It was proposed to purchase the great glasses originally prepared by Mautois, of Paris, for the University at Los Angeles. These glasses are forty inches in diameter and are now in the workshop of Alvan G. Clark, of Cambridge, Mass. The parties for whom they were originally prepared are not able to have them finished, and the university has now purchased them. Mr. Yerkes has paid into the treasury $25,000, a sum more than sufficient to make the preliminary payments, and Mr. Clark will at once begin the work of polishing the glasses. It may be possible for him to finish them in a year, and may require eighteen months. Meantime the building of the tele scope will also go forward, and within a year and a half the university will have an instrument with an objective greater by four inches than any other in the world. The plans for the observatory and the great dome in which the telescope will be mounted will now be prepared, and the work of building will be entered upon as soon as a proper site can be secured. The university hopes to prevail on the South Park commissioners to give a site for the observatory in Washington Park.

Electricity in Chicago—The Chicago City Railway Co.'s New Venture.

The directors of the Chicago City Railway Co. have decided to adopt electricity as a motive power on all their crosstown lines which are now operated by horse power, and have three of their lines, aggregating twenty-one miles of single track, already equipped, which will be in operation in time to take care of a share of the World's Fair traffic next year.

The three lines which will be first put in operation will be as follows: Two miles on 61st Street, from State Street to Jackson Park, with a branch on Cottage Grove Avenue to 63d Street, and thence on 63d Street to Jackson with a double loop extending north and south at the Park.

Second: Four miles on 47th Street, from Western Avenue east to Cottage Grove Avenue.

Third: Three and one-half miles on 35th Street, from California Avenue east to State Street.

The power house, from which these lines and the proposed lines will be operated, is located on Wabash Avenue, between 52d and 53d Streets, immediately in rear of the 52d Street cable power station, from which a portion of State Street line is operated. The building is attractive in design, being constructed of pressed brick and cut stone, and will be made absolutely fireproof. It is only one story high, with a trussed roof, thus giving comparative freedom from posts in the engine and boiler rooms.

The engine room (Fig. 1) is 90×128 ft., and will be finished in the interior with red pressed brick, wainscoted to a height of seven feet with white enameled brick. The power equipment will be of ten Wheelock engines, having 24×48 in. cylinders, with Hill valves of the automatic cut-off type, and at 110 revolutions are rated at 500 H. P. each, aggregating 5,000 H. P. The engines will be coupled in pairs, as is shown in the illustration, and each pair will drive a pair of No. 6 Westinghouse M. P. generators, which will run at 300 revolutions. The generators will be connected to the driven pulley by friction clutches, so that either machine may be cut out or in at the will of the operator. A novel system of rope transmission has been

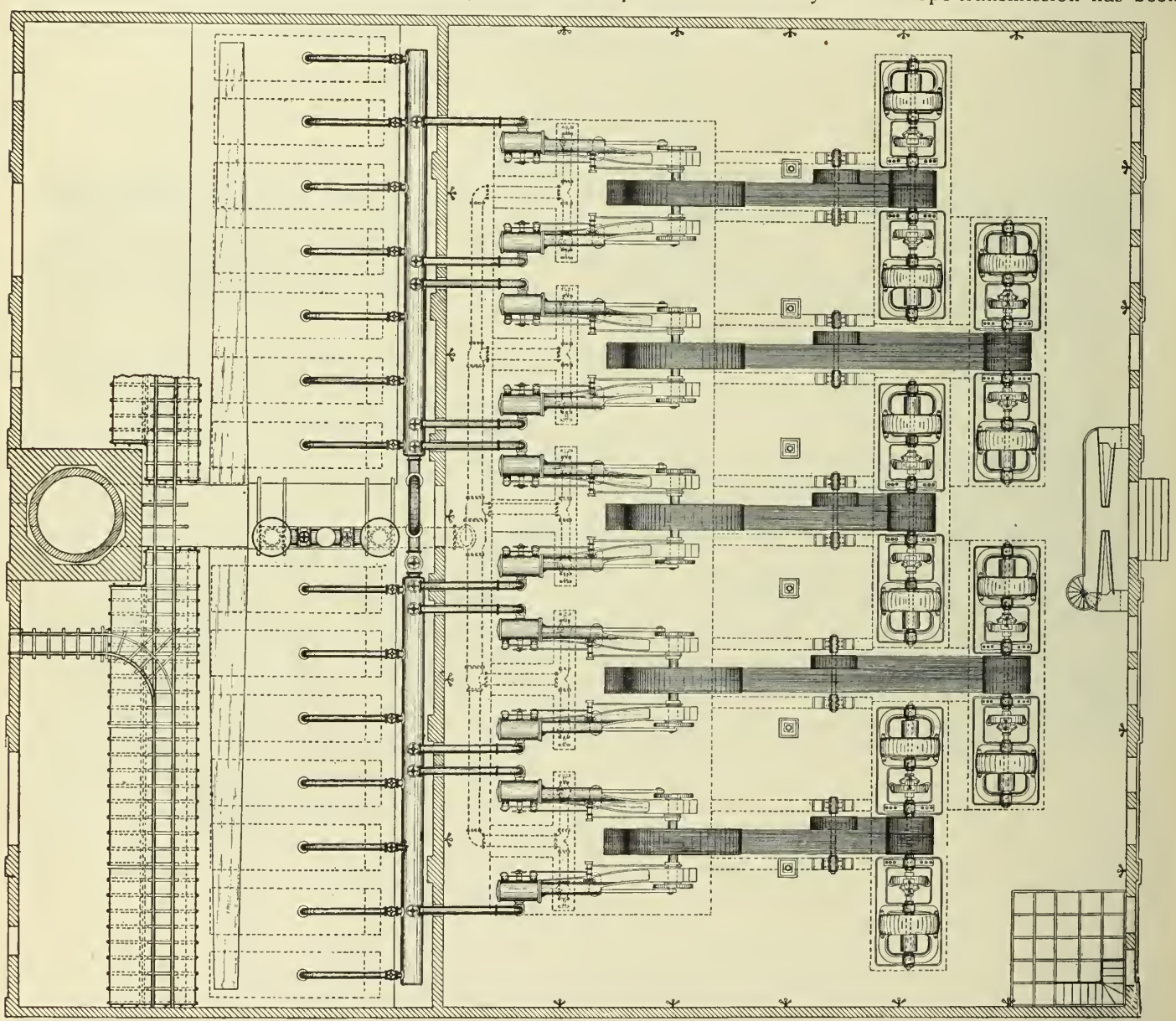


FIG. 1.—PLAN OF ELECTRIC POWER STATION—CHICAGO CITY RAILWAY CO.

adopted and is being installed by the California Engineering Co., of Chicago and San Francisco. A continuous rope will be employed, making twenty-one wraps on the driving drum, and thirty-two wraps on the generator pulley, the increased number of wraps on the latter being obtained by a compound winder, as shown in the engraving, the object being to secure an equal amount of frictional contact on the generator pulley with that on the driving drum. A tension device is provided, as shown in the elevation, which consists of a carriage any weight adjusted to take up the slack of the ropes and regulate the tension.

The boiler room is 56×128 ft., and is well lighted and ventilated. The boiler equipment will consist of fourteen Mohr tubular boilers, manufactured by John Mohr & Son, of Chicago, each 72 in. × 20 ft., and of 300 H. P. capacity. The smokestack will be 175 ft. high, with a 10-ft. flue.

Murphy mechanical stokers will be employed, and

the coal will be delivered from an overhead tank having a capacity of 400 tons. The water supply is direct from the city mains, supplemented by storage tank located under the floor, having a capacity of 90,000 gals. The feed water heaters are manufactured by William Baragwanath & Sons, and will deliver the water at 212 degs. F. to the boilers which are fed by two Shaffer & Budenberg exhaust steam injectors. A Worthington duplex pump will also be installed as supplementary to the injectors. The switchboard is situated above the floor, away from the influence of the machines, on a balcony of ornamental light iron work. It is the intention of the company to make the entire equipment of power house and street construction one of the best in the country, and it is hoped that when in operation it will help to overcome the prejudices which have thus far existed against the introduction of electricity in the streets of Chicago; and no doubt this equipment will tend to raise Chicago to a position in the forefront of rapid transit enterprises.

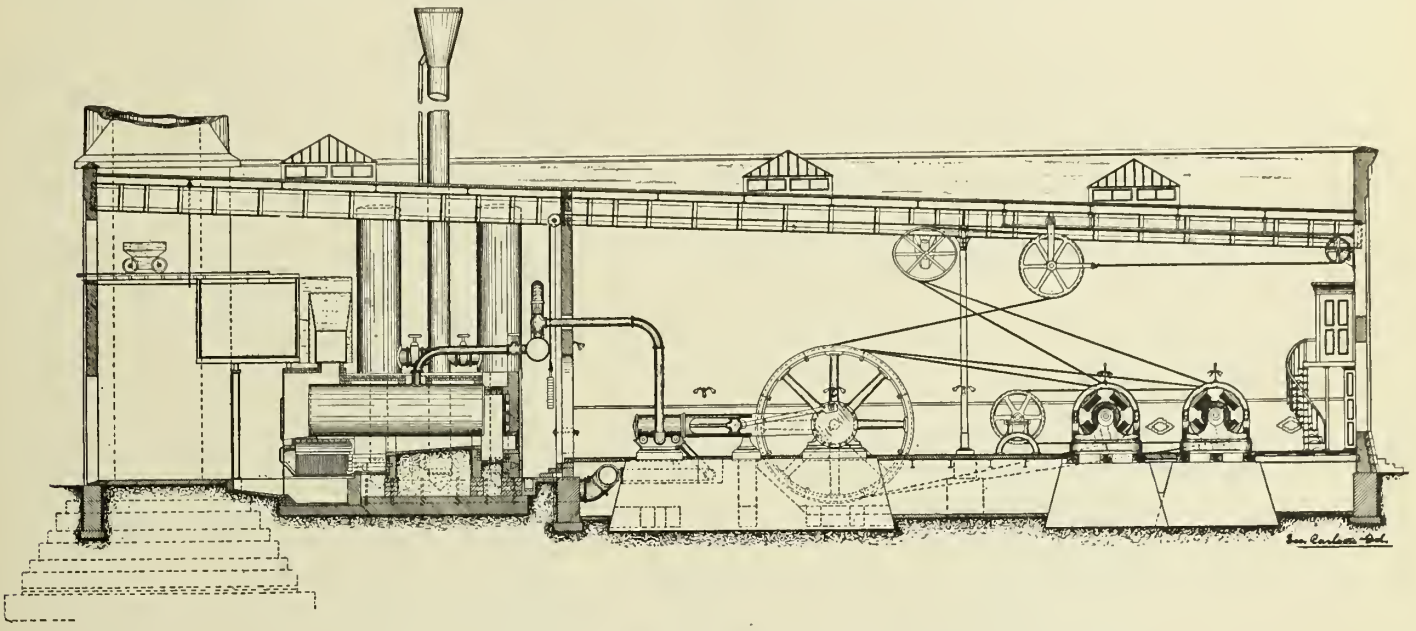


FIG. 2.—SECTION OF ENGINE ROOM—CHICAGO CITY RAILWAY POWER STATION.

The track of the lines so far constructed is laid with eighty-two pound Johnson girder rails supported on steel chairs, which in turn rest upon 6×8 in. oak ties placed two feet six inches apart. The supplementary wire of the return circuit is composed of No. 00 B. & S. gauge, and is cross connected to rails at every third joint. The rails are bonded, and the circuit is further improved by sinking old car wheels some feet below the water level at intervals of a quarter of a mile. The overhead construction is of the cross suspension type, and in the business portion of the city iron poles will be employed of the steel tubular type, and in the outlying districts wooden poles. Guard wires will also be employed wherever necessary, and there will also be the usual equipment of lightning arresters, cut-outs, etc. The trolley will consist of No. 0 B. & S. gauge of hard drawn copper wire, which will be divided into sections with independent feed wires. The initial car equipment will consist of sixty-one Brill cars mounted on McGuire trucks, having a nine foot wheel base. There will be forty-five double equipments of Westinghouse S. R. G. motors of twenty-five horse power each, and sixteen single equipments of the same motor. The selection of this type of motor was made only after a careful investigation of electric traction in a number of large cities.

The introduction of electricity on these lines has come about largely through the influence of M. K. Bowen, the present superintendent of the Chicago City Railway Co.'s system, by whom and the chief engineer, R. J. Hill and F. Fitch, the power house designs were selected.

A COMMITTEE of insurance men has inspected the system and methods of fire protection established on the Exposition grounds at Chicago, and has reported that they are in all respects adequate and satisfactory.

The Brain Conduit System for Electric Tramways.

This system has been designed to avoid the troubles and objections incident to the use of the open slotted conduits, and also the difficulties and complications of the automatic closed conduit. It is simple, cheap and durable, and is the invention of C. T. B. Brain, of Liverpool, Eng. who has secured patents in most countries. Mr. Brain has had considerable experience in this class of work, and in designing his system has endeavored to remove the various faults and weaknesses which have been the source of trouble in the past. The financial requirements of the case have also received due consideration, and the construction as well is such that the necessary disturbance and labor in the roadway are much reduced.

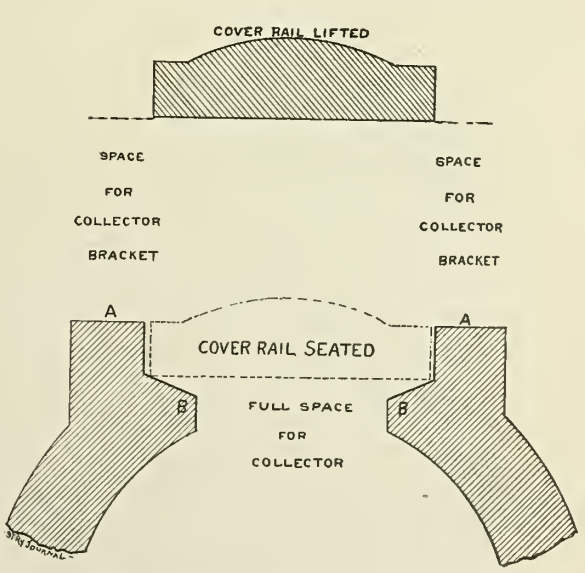


FIG. 1.—SECTION—BRAIN ELECTRIC RAILWAY CONDUIT.

The system has been tested by a series of trials extending over the past two years. The conduit is small and possesses a wide slot; this is covered by a continuous rail, formed of stout, flat, steel bars, joined end to end and called the cover rail. It sinks flush with the road surface, and rests upon a ledge or flange on each side of the slot, thus excluding the dirt and preventing dangerous exposure of the conductor which is placed centrally underneath the rail.

The different engravings, especially Figs. 1 and 4, illustrate the general construction. To obtain access for the connection between the car and the line con-

ductor in the conduit the cover rail is held up about one and a half inches high by rollers underneath it and connected to the car, which is described hereafter in detail. The cover rail is two inches wide by seven-sixteenths of an inch thick, is flexible, and as it does not weigh three pounds per foot, the maximum load carried, due to its working, cannot exceed 3 lbs. × 10 ft. = 30 lbs. Fig. 4 shows the neat appearance and unobjectionable character of the conduit on the road surface, and also gives a good idea how the conduit is protected from dirt and flooding. Owing to the depth to which the bedded rail sinks into the seat, and to its great rigidity in a horizontal plane, always retaining, even when raised, the shape in which it is fitted to the conduit, the action of the rail in returning to its seat is most certain both on straight lines and curves. In practice, as a safeguard, this is still further insured by a roller near each end of the car running on the unlifted rail, before and behind the raised portion.

allow a small sliding movement necessary for working and for expansion and contraction; and small fixed studs prevent the rail moving along the slot. A considerable experience has been gained with the working of the rail, which seems to confirm is practicability. No trouble has been found at crossings or turnouts. At the fork of the conduits the end of the rail covering the single line has fastened to it by a stout pivot a short length of cover rail (see Fig. 5), which can move like the points of an ordinary rail. The free end of this is grooved to fit tongues on the ends of the other rails, and can be moved

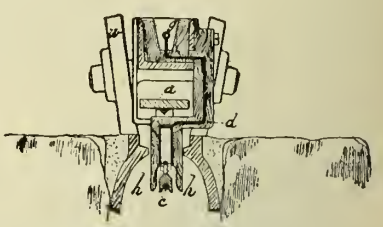


FIG. 2.—CROSS SECTION THROUGH CENTER OF COLLECTOR.

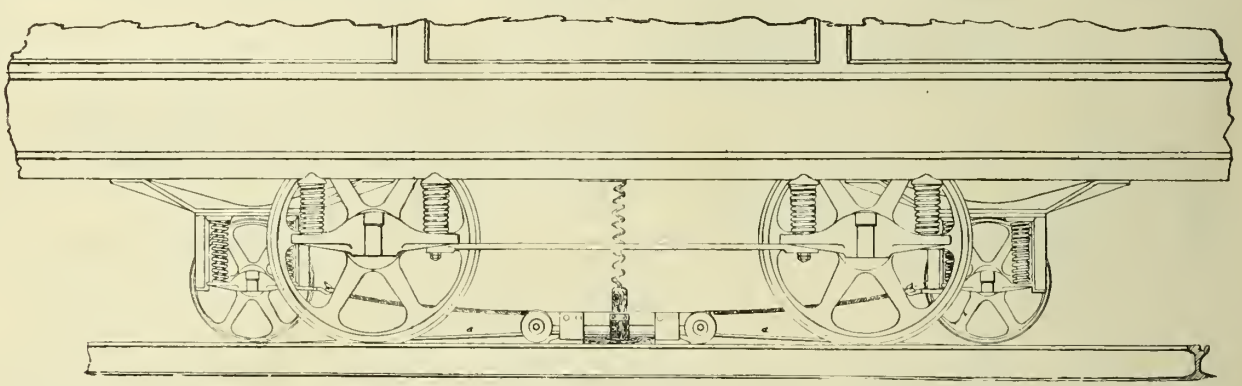


FIG. 3.—ELEVATION OF COLLECTOR, SHOWING METHOD OF ATTACHMENT.

Figs. 2 and 3 are an elevation and section of the collector trolley, in which *a*, *a*, is the cover rail, *c*, the conductor, *d*, a flat conducting strip, which is the connection passing into the slot; *h*, a hard insulating block incasing the conductor. The trolley is drawn by ropes hooked to each end.

The flexure of the cover rail is so very slight that the structure of the metal is in no way strained, its elasticity being so little taxed. The effort due to the operation of the rail is practically confined to the weight carried and into contact with the rail covering the conduit of either route by pivoted cover plates.

In the experimental road at the Helby Works of the Telegraph Manufacturing Co., in England, there is a long, straight piece of track on which considerable speed can be obtained, terminating in a sharp curve of twenty-five feet radius; the line then continues straight at a little less than a right angle for some distance, allowing the curve to be rapidly traversed in either direction. From off the straight length there is a turnout with

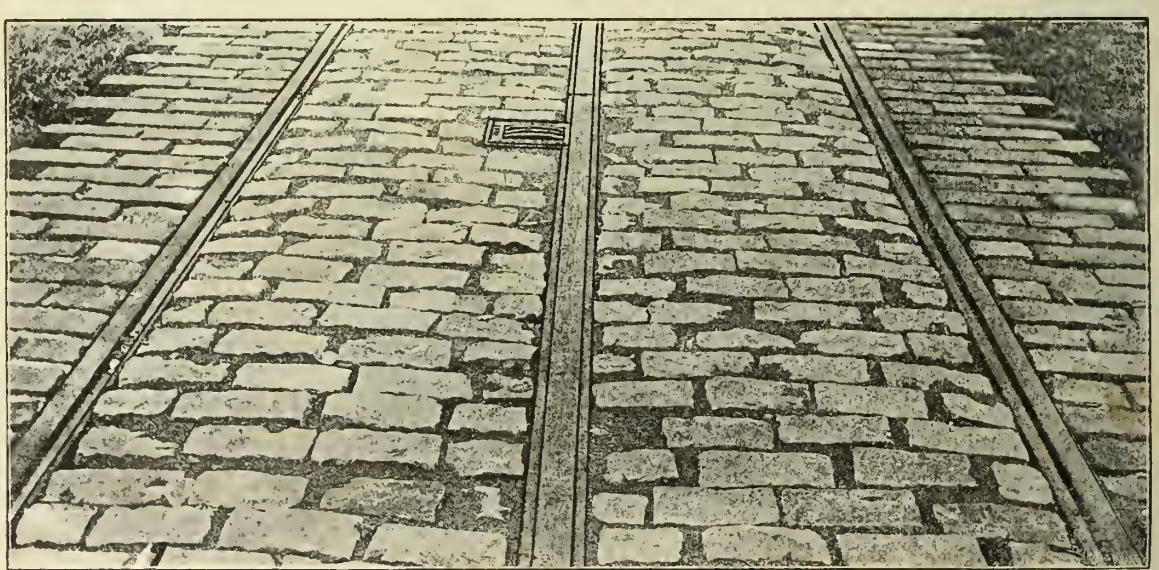


FIG. 4.—STREET EQUIPPED WITH BRAIN ELECTRIC RAILWAY CONDUIT.

lifted. The rolling friction due to weight (thirty pounds) requires a tractive force of one pound or two pounds. Taking the rise at two inches instead of one and a half inches, the weight lifted is 3 lbs. × 5,280 ft. × $\frac{2}{12}$ in. = 2,640 ft. lbs. per mile, or a pull of one-half pound, which, with friction, should also never exceed two pounds. Even were the cover rail strained there would be no tendency to hog up, as in being lifted and replaced both sides would be in turn stretched. The joints are made to points made as abrupt as possible; it winds round with curves of thirty-five to fifty feet radii, and passes right across the straight track, cutting it at an angle of forty-five degrees; continuing, the lines join at the small curve, the two curved conduits meeting to form a long, fine point. Fig. 5 shows the abrupt turnout, while Fig. 6 is a general view of the upper part of the line, looking up the straight run from near these points, which will be seen at the bottom.

The experimental line thus described differs materially in the arrangement of the conduit from that of the Blackpool Railway. The latter cost £4,500 per mile, and this at 7½ per cent. equals 1.75d. car mile run per mile laid, more than maintenance and fuel. On the other hand, the Brain conduit provides a much larger working slot (slightly wider even than at Buda-Pesth) without a large conduit, while, it is claimed, its small cost and mechanical simplicity just meet the requirements of an electric railway conduit.

We are indebted to the *Railway World* of London, for the foregoing engravings.

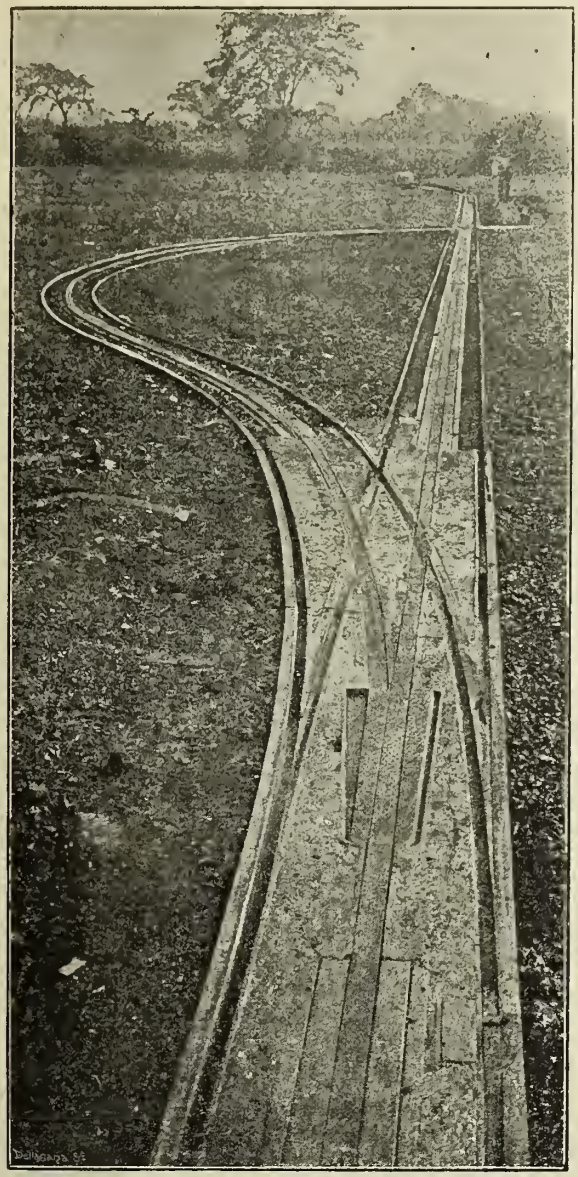


FIG. 5.—ABRUPT TURNOUT—BRAIN ELECTRIC RAILWAY

Improved Connelly Motors.

The prolonged tests that have been made with the Connelly motor on the lines of the North Chicago Railway have so thoroughly sustained its claims that the Connelly Motor Co., of Illinois, of which J. M. Roach (general manager of the North Side system) is president, has undertaken the manufacture of these machines for the equipment of the North and West Sides feeder lines, and seven motors are now nearly completed, which will at once be put in operation on the Larrabee Street line, North Side. The iron work of the motors is being constructed at the new shop of the motor company on Illinois Street, under the supervision of V. T. Lynch, and the cabs are being made in the car shops of the North Chicago Railway Co.

In the improved motor the gas engine remains about the same, being adapted in this case for burning either Pintsch gas or commercial gas, the charge being exploded by a flash in place of an electric spark, as formerly employed. The cylinder is provided with a water jacket, and the circulation for cooling is maintained by a small pump, the water being led to a system of circulating pipes located under the floor.

The mechanism for transmitting the power to the axles, however, has been greatly simplified by the new company. In the operation of the motor on the car, it will be remembered, the engine runs continually and the power is transmitted by means of a large disk, which is mounted on the opposite end of the crank shaft from the flywheel. This disk is keyed loosely on the shaft, which permits of its being moved forward or backwards, by means of a lever, to engage with a friction pulley, fifteen inches in diameter, which is attached to a heavy horizontal shaft, upon which it may be moved by means of a traveling head and threaded rod to the right or left from the center of the large disk. As soon as the car stops the driver lifts a nut latch above the threaded rod which returns the friction pulley to the middle of the disk automatically. When starting the car in either direction the disk and friction pulley are in contact near the center of the former, in which position an enormous leverage and increase of power is secured for starting and for ascending grades or rounding curves, but by moving the friction pulley to the right or left, by means of the threaded rod, farther from the center, the speed is increased. The threaded rod is revolved by a round leather belt from a pulley on the horizontal shaft, and which is brought into service by means of a tightener operated by a short hinged lever, which may be thrown over to engage with the slack side of the belt.

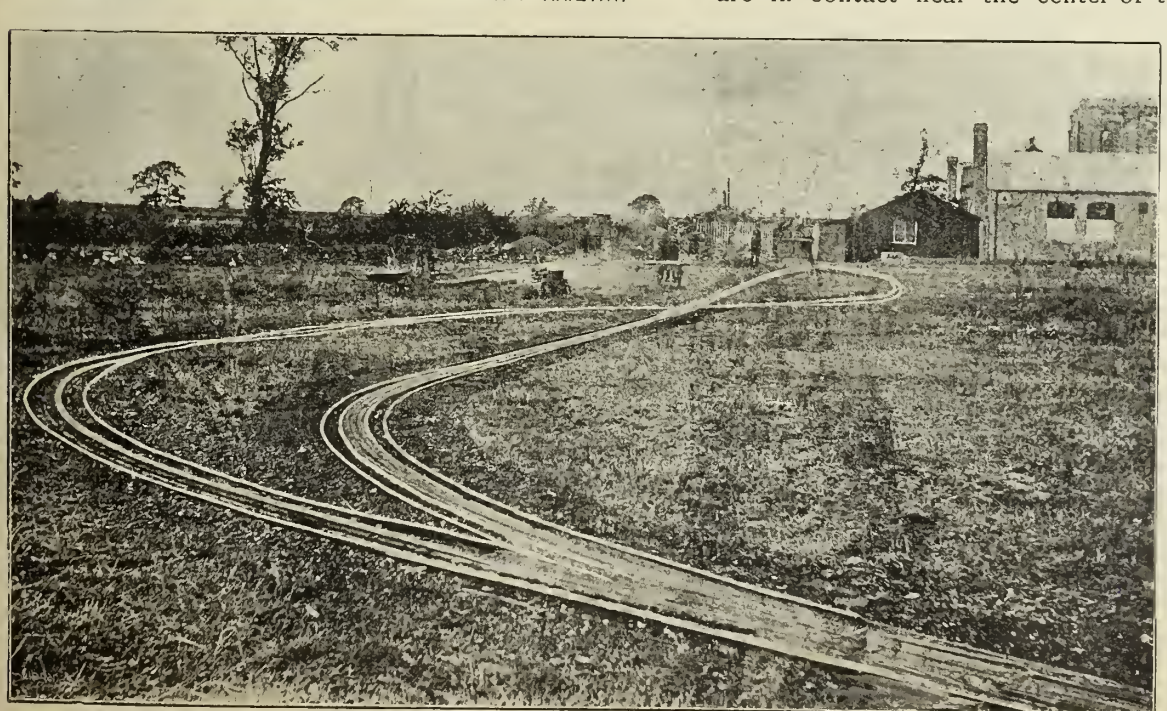


FIG. 6.—DOUBLE LOOP—BRAIN ELECTRIC RAILWAY.

The power is

transmitted to one axle by means of a sprocket chain, which engages with the driving pinion on the horizontal shaft, and with a sprocket wheel on the driving axle, upon which the weight of the engine chiefly rests, thus securing sufficient traction. The machine is very compact and is housed in a stout, well built car, not designed to carry passengers, but which will tow a number of trailers. Iron storage tanks are provided, in which the fuel gas is compressed, and there are also water tanks and circulating pipes, before mentioned. The weight of a complete motor car is about 8,600 lbs.

A number of motors are also being made by the original Connelly Motor Co. for the Chicago roads at their shops at New Castle, Pa. These works are now being enlarged to accommodate their increased business, and when completed will have the capacity to turn out one finished motor per day.

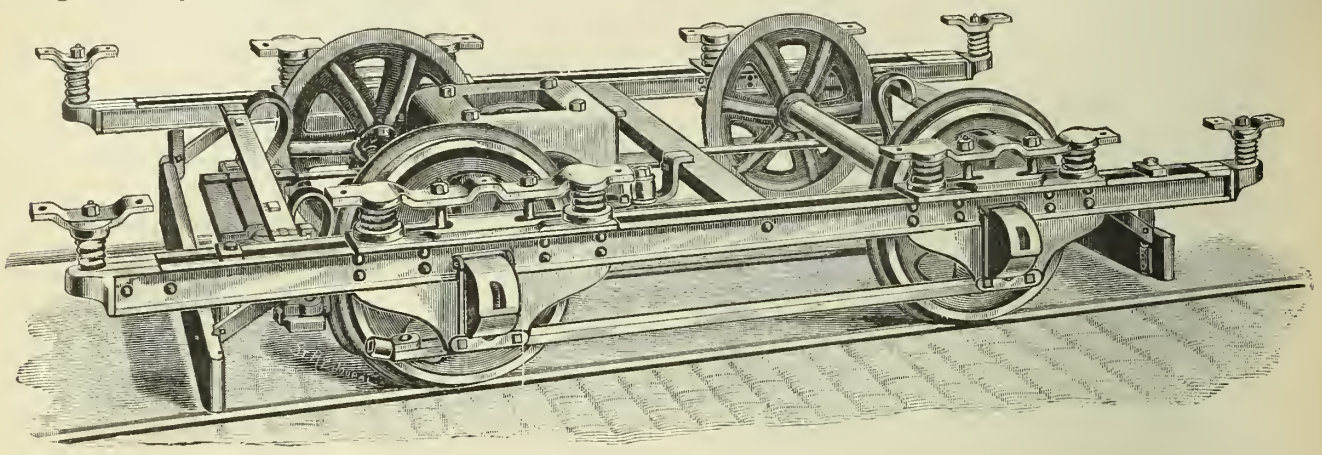


FIG. 1.—WEST END 4 WHEEL MOTOR TRUCK.

West End Radial and Four Wheel Trucks.

The accompanying engravings illustrate two new types of trucks devised by the engineers of the West End Railway Co., of Boston, Mass., and manufactured by the Globe Iron Works, E. C. White & Co., of New York. Fig. 1 shows the four wheel truck adopted as a standard for all of the short cars of the West End Railway Co. The principal claims made for this truck by the manufacturers are extreme simplicity of design and great durability. The truck has a long sill plate, the distance between the end springs being fourteen feet, and six spiral springs of uniform material and design are used on each side. The brake is quick acting, simple and flexible, and as it and the boxes are thoroughly cushioned, the truck is practically noiseless. Independent flexibility of axle, wheel and box, insure a minimum strain on the truck frame and the car body as well as easy riding when passing over rough track, special work or crossings. The truck takes a twenty-five foot curve readily, and will carry any weight or length of car body.

Fig. 2 shows the radial type of truck adopted, which will be used by the company for eight wheel cars to replace the double trucks as rapidly as the latter wear out. As will be seen, the truck is exceptionally heavy in design, with the intention of making it as durable as possible, and at the same time simple in construction, having a minimum of wearing parts, and no rollers are used.

No weight whatever is put on the center axle, this acting merely as a rudder or steering device. This secures two important results: First, the entire weight of the body is carried on the end trucks, insuring easy riding over rough tracks and crossings; and second, the entire weight of the motor is carried on the working axles, giving the maximum amount of traction. A large number of springs are used on the two end trucks, insuring a buoyant and easy motion to the car body. The truck frame is made of steel channel iron struck up on a former, thereby dispensing with many rivets and bolts. The boxes are all outside of the frame, and are all interchangeable.

Eight brake shoes are used with a peculiar construction of brake, the power being applied near the kingbolt or pivotal point, making the brake very powerful and requiring but a fraction of a turn of the handle to set the shoes.

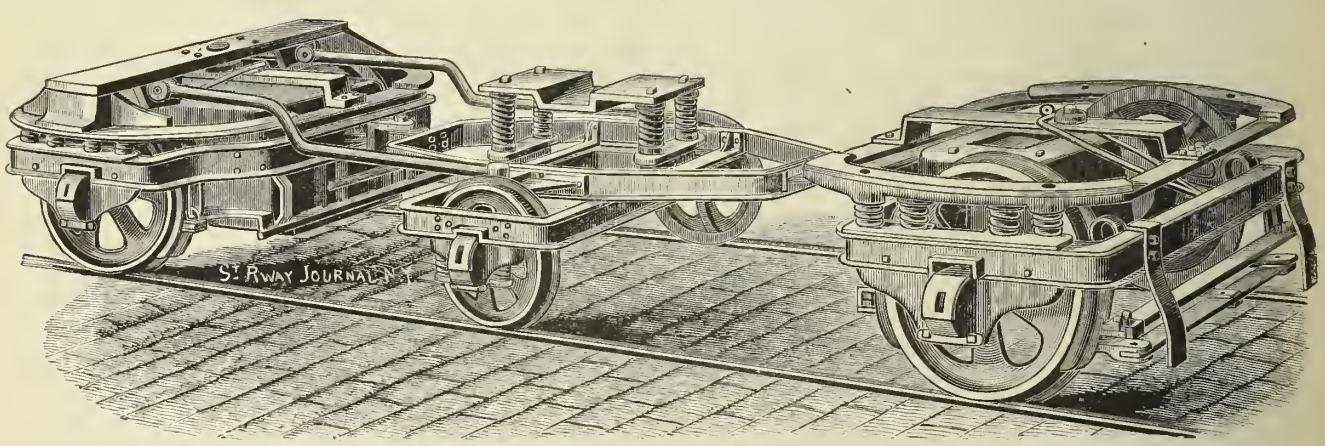


FIG. 2.—WEST END RADIAL MOTOR TRUCK.

THE cable or electric car of to-day is far ahead of the bobtail car of yesterday, drawn by a single, flea bitten mule, but will be far behind thestreet car of to-morrow. In spite of grumbling passengers and stupid and venal councils and ignorant and unjust criticism, the street railway managers are doing their work well, and deserve the thanks and appreciation of every intelligent American. The public might as well try to dim the brilliance of the sun with a rush light or bring a herdic in competition with a street car as to prevent the certain progress of the street railway.—*Cleveland Convention*, 1892.

A New Kind of Accident Insurance.

The board of directors of the Montreal Street Railway Co. on November 17 decided to set aside a sinking Fund from the gross receipts to be known as Insurance fund, and will insure themselves hereafter in all cases of accident. Any surplus remaining over at the end of the year will be divided among the drivers and motormen who have operated free from accident for the year passed, upon the number of miles run by each of the men, thus making a premium so that all employes of the company are interested in operating as successfully as possible as co-partners with the company.

The experiment will be watched with interest.

Rae Railway System.

Some four years ago the first attempt was made at Elkhart, Ind., to equip a street railway with single motors geared to both axles, the plan being one proposed by Frank B. Rae, in which a rigid frame supporting the motor and countershaft was carried upon the axles, and the power transmitted by bevel gearing from the countershaft to the car axles. This method of applying the power was criticised at the time by a number of electrical engineers, who predicted failure on account of the rigidity; but the advantage of a single motor driving both axles seemed sufficiently great to warrant a thorough test, and some forty roads, equipped with the Rae system, demonstrate the success of the single motor. Extreme rigidity of the motor carrying frame and perfect alignment are necessary to keep the bevel gears in proper mesh; at the same time sufficient spring in the whole arrangement must be allowed to avoid lifting one wheel of the truck on curves, and when this condition is not exact, broken gears and other troubles immediately ensue. To more thoroughly overcome the difficulties and objections to the rigid method of driving both axles from a single motor, and at the same time obtain the advantages of flexibility claimed by employing a motor on each axle, Mr. Rae has brought out the arrangement illustrated. While the bevel gearing has been adhered to, all the other features of the Rae system, familiar to our readers, have been greatly modified.

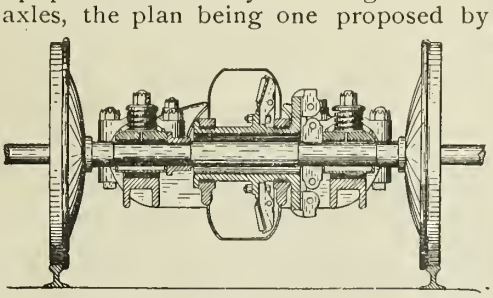


FIG. 1.—END VIEW—RAE MOTOR TRUCK.

The frame heretofore used has been dispensed with, and the motor itself forms the frame, and is directly supported on the axles, as shown in Fig. 4, which represents a plan view of a forty horse power truck equipment.

The countershaft is dispensed with, the motor being of the slow speed type and geared direct between the armature shaft and car axles. At one end the bevel gear is directly upon the axle, while at the other it is mounted upon a sleeve or quill in bearings which are a part of the motor frame. This quill end of the motor frame rests upon springs, which relieves the motor greatly of jar and consequent crystallization, and permits the axle within the quill to take any position without putting any twisting strain upon the motor. This motor construction is seen in Figs. 1 and 3.

The power is transmitted to this axle by means of a flexible coupling between the quill and the axle, and will be understood by reference to Fig. 2, which is an isometrical drawing of the coupling. This device consists of three parts; the first, being clamped to the axle, is provided with two projections which fit loosely into recesses in the second part. Upon the quill is clamped a piece with two projections similar to that upon the axle, the projections also fitting into the second part, but at right angles to the other.

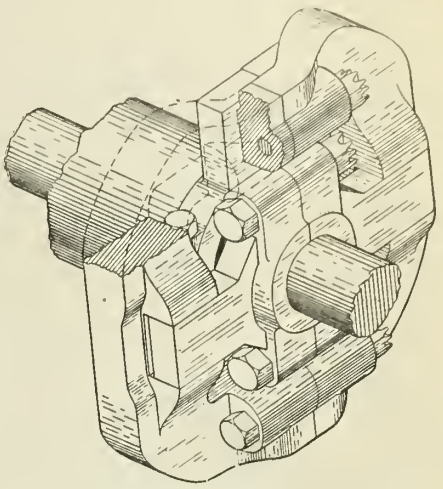
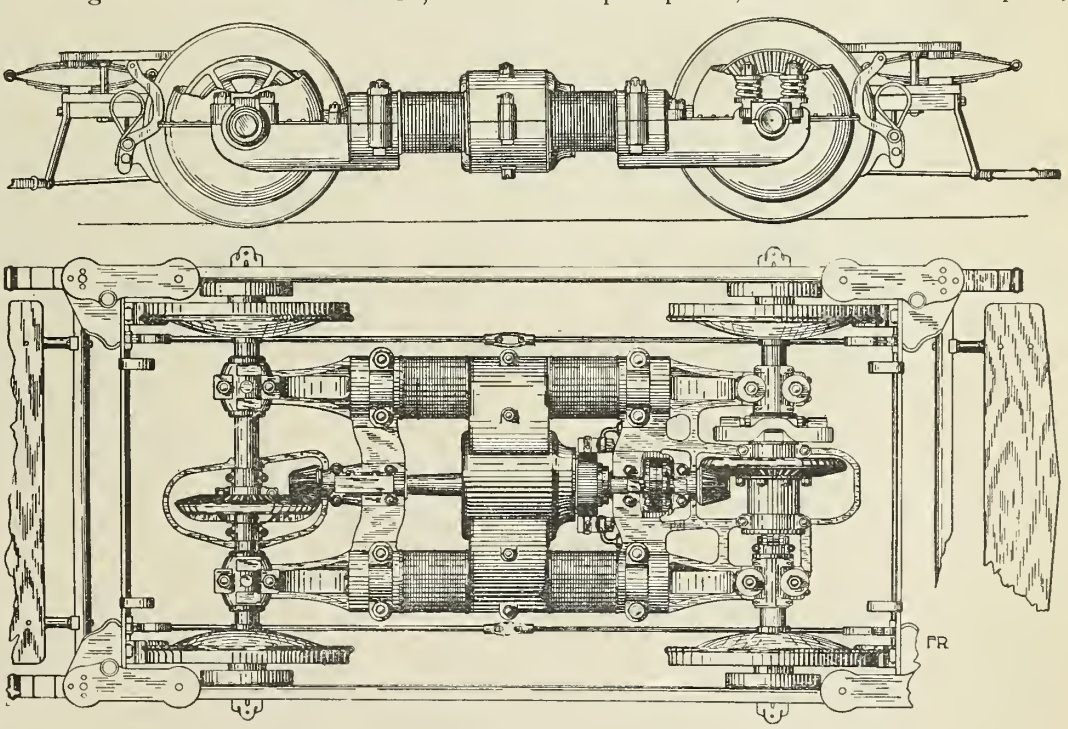


FIG. 2.—ISOMETRIC VIEW OF COUPLING.

It will thus be seen that the axle may take any position in relation to the quill and still drive without altering the angular velocity between the quill and axle, and without cramping the motor frame or affecting the gears, the work upon the gears being in proportion to the duty at any point of rotation.

Upon the rear axle, or the one to which the gear is directly attached, the motor bearings are held from movement endways by a thrust bearing formed directly upon the axle, similar to that used upon propeller shafts, which effectively prevents any shifting of the motor upon the axle.

The field magnets of the motor are of round, wrought iron, to which the pole pieces, each formed of two parts, are cast iron bolted to the field pieces; the magnet yokes, which also form the supports upon the car axles, as well as the boxes for the armature shaft, are in one piece. This construction reduces the entire motor to eight distinct pieces plus the armature and gears. These eight pieces are put together with twelve bolts, and the locked nuts for these bolts are all upon the top and accessible through the traps of the car. As will be seen by the side elevation (Fig. 3), the clearance between the motor and ground is greater than in other single reduction equipments.



FIGS. 3 AND 4.—PLAN AND SIDE ELEVATION—RAE MOTOR TRUCK.

The electrical designs of the motor have been carefully worked out, the efficiency agreeing with that of the best design, and it has proven in operation upon extreme work to be absolutely sparkless upon any load. The increase in temperature in field coils, armature and commutator is hardly perceptible after a full day's duty. Contrary to the usual practice of rating street car motors, this equipment is designed to furnish its full rated horse power continually and not intermittently.

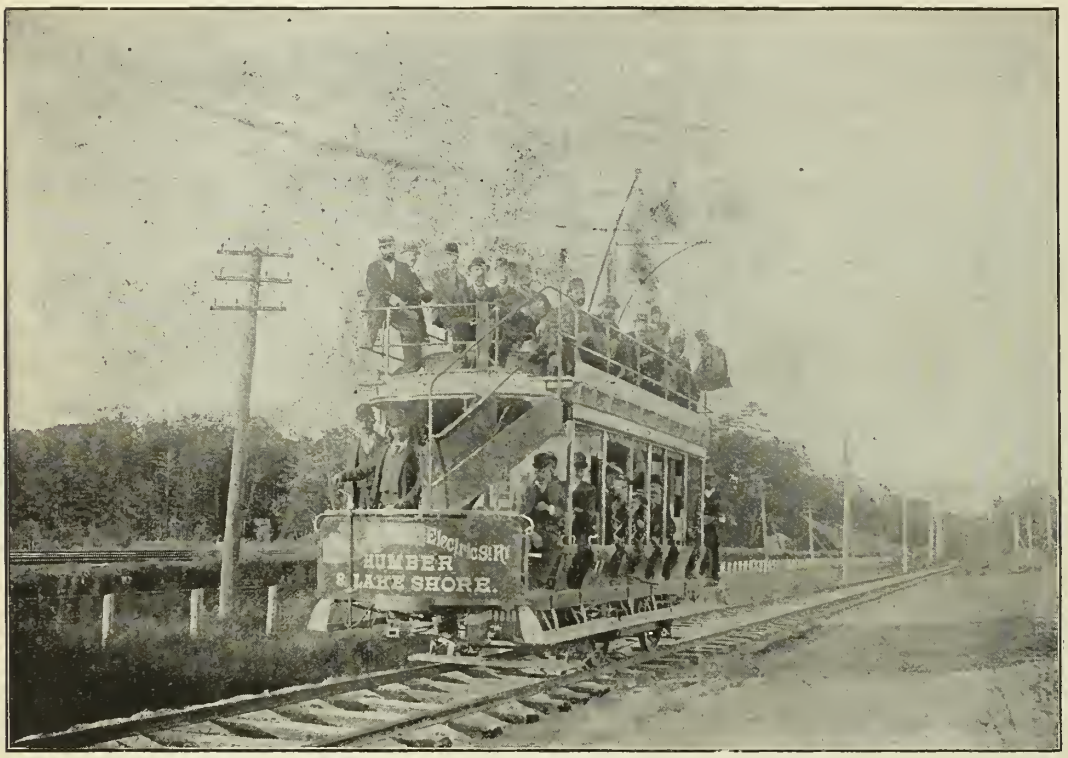


FIG. 5.—DOUBLE DECK CAR EQUIPPED WITH RAE SYSTEM.

The first road to equip with the new Rae system is the Toronto & Mimico Electric Railway, a suburban line along the lake shore near Toronto, Ont., operating only during the summer months. Double deck cars are used, and are mounted upon McGuire trucks.

Statement from St. Louis.

The figures herewith presented show the number of passengers carried and trips made by the street railways of St. Louis for the third quarter of 1892 :

	Trips.	Passengers.
Baden & St. Louis	5,136	44,684
Bellefontaine	58,070	915,659
Cass Avenue & Fair Grounds	147,412	1,865,553
Citizens'	110,238	2,564,266
Jefferson Avenue	46,562	539,426
Lindell	163,380	3,276,754
Missouri	267,970	3,735,678
Mound City	96,126	1,144,159
People's	58,880	1,275,289
St. Louis	207,964	3,282,423
St. Louis & Suburban	31,972	1,923,227
Southern	73,600	1,379,330
Union Depot	146,858	2,745,711
Total	1,414,168	24,692,195

The Fourth Street, Forest Park & Laclede Railway being now included in the Missouri railroad system, reports together with that company. The reports of the Northern Central and Union lines are also included in that of the Cass Avenue & Fair Grounds system.

Assuming the population of St. Louis to be 500,000, the above report gives about sixteen rides per month per inhabitant, or 192 rides per year. S. L.

Intramural Railway at the World's Fair Grounds.

Work has already been begun on the elevated intramural railway at the World's Fair grounds in Jackson Park, Chicago, and the construction will be rapidly prosecuted from this time on. The undertaking is an immense one, involving as it does the building of an elevated structure several miles in length, and the erection of a power plant capable of developing at the maximum 5,000 H. P. The installation is to be a temporary one, but the work must be practically as well performed as if it were to be permanent, for failure to insure thoroughness in all respects would jeopardize the entire enterprise. In the map of the Fair grounds published in the STREET RAILWAY JOURNAL of January last, the general route of the road was shown, and no radical changes from the plan then adopted will be made.

It is proposed here to note briefly the lines on which the great undertaking is to be executed, for it is believed that the enterprise is one of special interest to street railway engineers. The successful operation will demonstrate the adaptability of the electric motor to the peculiar and exacting conditions of elevated railway work and its ability to carry great numbers of people at a rapid rate of speed. Should it fail in this respect, the patronage of the road would be relatively small. The distances to be traversed are comparatively short, and if passengers cannot be transported quickly, a very large proportion would regard it as scarcely worth while to climb the station stairways. No one connected with the enterprise considers the possibility of achieving less than pronounced success in all respects, and certainly the engineering staff comprises men who are abundantly qualified to speak authoritatively concerning the engineering and electrical problems to be encountered.

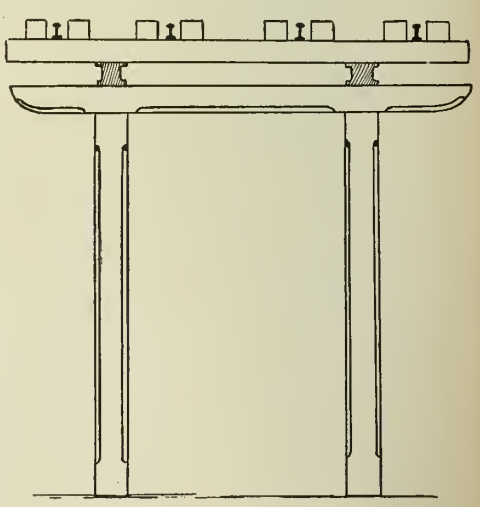


FIG. 1.—SECTION OF ELEVATED RAILWAY BETWEEN STATIONS—WORLD'S FAIR GROUNDS.

The station in which the electric current will be generated for the line is to be located in the southeastern part of the ground, about 300 ft. from Lake Michigan and not far from the Forestry Building. While the Building will be plain, it will make an excellent appearance, and will add to the character of that part of the grounds in which it is located. Like other buildings, the station is to be built of staff ; the rear wall, however, is to constructed of brick, as it will contain the boiler flues. By the use of staff inside the station the building will be made very

nearly fireproof. The site of the plant is but three feet above the level of the lake, and excavation at this point discloses nothing but quicksand. The station is divided into two departments, of which the engine room is 140 ft. long and 80 ft. wide, and the boiler room 140 ft. long and 50 ft. wide. On account of the quicksand considerable precaution was necessary in building the foundation for the machinery. A timber platform composed of two layers of 4×12 in. plank was first laid over the area to be covered by the engines and condensers. The timber work was then covered with concrete to the depth of three feet, and on the top of the latter were built the foundations for engines and condensers.

The equipment of the road is to be sufficiently large, so that all the power necessary under the most extreme conditions of demand on the road can be readily developed. The boiler plant will consist of Babcock & Wilcox tubular boilers, rated at 3,000 H. P., which can be called upon if necessary to supply 5,000 H. P.

These will be equipped with oil burners and with Greene's fuel economizers. The engine and dynamo equipment will be as follows: One 2,000 H. P. cross compound Reynolds-Corliss engine coupled direct to a Thomson-Houston 1,200 K. W., multipolar generator; one 750 H. P., Reynolds, tandem compound engine coupled direct to a Thomson-Houston 500 K. W., multipolar generator. Both will be furnished by the E. P. Allis Co. of Milwaukee; one Williams vertical, cross compound engine, constructed by the Lake Erie Engine Co. of Buffalo, coupled direct to a Thomson-Houston 500 K. W., multipolar generator; one Greene horizontal, tandem compound engine, built by the Providence Steam Engine Co., belted direct to a Thomson-Houston 500 K. W. multipolar generator; one McIntosh & Seymour tandem compound engine coupled direct to a Thomson-Houston 200 K. W., multipolar generator.

The arrangement of the power house is such that the engine foundations extend for a distance of ten feet above the floor. On the floor in the rear of the engines the condensers will be located. The equipment here will consist of two Allis, one Worthington, one Deane and one Conover condensers, and one Gould triplex boiler feed pump and one Smith-Vail duplex pump. The condensers will take water from a vitrified pipe conduit leading from the lake, lifting it about five feet to the point where it performs its work. It will then be delivered to a vitrified escape pipe and flow back to the lake.

The flow to and from the lake is a gravity fall, and the only service to which the air pumps are put is to lift it a distance of five feet.

Between the engine and boiler rooms, at a distance of about ten feet from the floor, will be located a gallery passengerway from which the spectators can see the entire plant, including engine, boilers and condensers. The length of the road is to be four miles of double track with loop terminals supported on an elevated structure, ranging in height from 20 to 33 ft., which consists generally of timber bents 25 ft. apart, carrying steel I beam stringers. The bents are composed of wooden posts, on which the cap rests, and to which it is secured by cast-iron brackets.



FIG. 2.—ELEVATED ELECTRIC RAILWAY STATION AT MAIN ENTRANCE—WORLD'S FAIR GROUNDS.

The post foundations are concrete, 7×7 ft., and twelve inches thick, except at points where special weight is to be supported. The rails, which were made by the Illinois Steel Co., weigh sixty pounds to the yard, and are the type of the standard rail of the Pennsylvania Railroad Co. There are no sharp curves on the line, the radii varying all the way from 100 to 200 ft. The radii of the loop terminals are 100 ft.

The grades range from .5 per cent. to 2 per cent., but for the most part the track is level. There will be eleven stations, including one at each terminal; the intermediate stations will consist of little more than ticket offices and platforms. The stations are located at the summits of the grades, so that a train leaving a station starts on a grade, while iten counters a grade when approaching a stopping place. It is hoped that this arrangement of the stations will result in a material saving in power.

Trains will consist of a motor car and three trailers

each, mounted on two trucks like the ordinary elevated railroad coach. Seats will be arranged back to back, and will accommodate ninety passengers, and, if necessary, at least forty persons in addition could find standing room. The motor cars, of which there will be eighteen, will be each equipped with four Thomson-Houston 50 H. P., S. R. G. motors, capable of working up to 100 H. P. each. The coaches will be built by the Jackson & Sharp Co., of Wilmington, Del.

Trains will run on two minute headway during busy hours, but the intervals between trains can be reduced to a minute and a half if the traffic increases beyond the present estimate.

Current will be distributed along the line by a sixty pound steel T rail for about one-third the distance, and for the remainder by three rails of the same weight. The outside rails and the iron of the structure will constitute the return circuit. Connection between the motor and the current carrying rail will be effected by means of an under running trolley.

It is estimated that the total expense of the installation will be about $450,000, and the company will secure

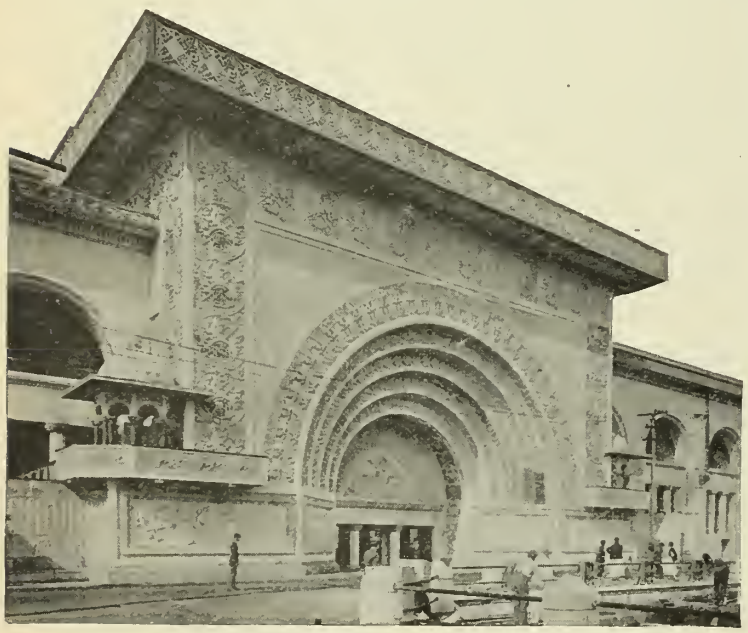


FIG. 3.—GOLDEN GATE OF TRANSPORTATION BUILDING.

its return from a ten cent fare. The Western Dummy Railroad Co. was awarded the contract for operating the road in May last by the Exposition authorities. According to the agreement with the latter, the company will pay into the Fair treasury 25 per cent of the gross receipts in consideration for the franchise.

The contract for constructing the elevated structure was let by the company to Remington & Co. of Chicago, who hope to finish their work during the present month. The staff of the company consists of W. E. Baker, general manager; C. P. Matlack, chief engineer; R. I. Sloan, consulting engineer for the structure; B. J. Arnold, consulting and designing engineer for the power plant and power station; C. H. Macloskie, electrical engineer.

The Transportation Building at the World's Fair grounds, Jackson Park, Chicago, is now practically completed, and Mr. Willard Smith, the chief of the department, is busily engaged in allotting the space. It will be out of the question to accede to the demands of all those who intend to exhibit, as the space is far too limited. The main entrance to the Transportation Building, shown in the accompanying illustration, is, perhaps, the most ornate of that of any structure on the grounds. The bas reliefs illustrate various means of transportation, and depict the evolution of means of transit. Before the Exposition opens this entrance will be gilded, and will form one of the most brilliant and striking architectural ornaments in the grounds.

A Marine Type of Engine and Boiler For Street Railway Work.

The three triple expansion, open front, vertical engines, manufactured by the Globe Iron Works Co., of Cleveland, O., for the Woodland Avenue & West Side Railway of the same city, as noted in our souvenir edition, are now being installed in the new power house of the company, and will be put in operation soon.

These engines will each be coupled direct to two 250 H. P., Westinghouse generators, the armature shaft of which will be an extension of the engine shaft. This is a radical departure from ordinary practice, and the result will be watched with a great deal of interest.

The engine cylinders are, respectively, fourteen, twenty-three and thirty-six inches in diameter with a twenty-four inch stroke. The initial steam pressure will be 150 lbs., and at 140 revolutions these are rated at 500 H. P. Single port piston valves are employed for the high pressure and intermediate cylinders, and a double port slide valve for the low pressure cylinders. The system of exhaust is so arranged that the last cylinder can be run high pressure, there being a pass-over steam pipe provided so that in case the high pressure piston should stop on the centre the other may be utilized for starting. Five levers operate the valves; the first controls the throttle, the second the valve in the pass-over pipe, and the other three operate cylinder drain valves. No screw valves are employed.

The speed is controlled by a Porter-Allen governor having a hydraulic attachment, which operates the Joy valve gear.

Mechanical oiling is employed throughout. Brass conveyors lead out from a tank or from a pressure reservoir or from sight feed cups and deliver the oil to the cylinders and to every moving part, some of them being telescoped to follow the movements of the parts, while the cups on the crossheads take their supply on the up stroke from a depending pipe. There is also a conveyor provided to deliver cold water to the journal bearings in case they should become heated. The engine being open front, a slipper guide is provided for the crossheads. The main shaft and wrist pins are each seven and a quarter inches in diameter, and the latter is nine inches long. These are not forged to the elbow, but are pressed on and keyed.

The flywheels are each eight feet in diameter and weigh seven tons. The engine is designed to economize space, and measures only fifteen by seven feet on the ground and is twelve feet high from bottom of bedplate. The valves are so placed that they are accessible from the floor, so that it is not necessary for the engineer to go upon the platform except for occasional inspection and for oiling.

These engines are highly finished, and present a very attractive appearance, as we can testify, having recently had the pleasure of inspecting them at the company's works. They are of the marine type and are only slightly modified from the standard engine which the Globe Iron Works Co. has for a long time been manufacturing for the lake and ocean service, and it is confidently believed that they will readily adapt themselves to the fluctuating loads of an electric line and prove as efficient as they have in marine service.

The three boilers which are to be employed in the same plant, and which were also manufactured by the Globe Iron Works Co., will be of 500 H. P. each, and quite different from anything heretofore employed in the street railway service. They are of the marine Scotch type and have proved very efficient in marine service tests. The boilers are twelve and a half feet long and twelve feet in diameter, having a fifteen-six-teenths of an inch shell, and designed to carry 150 lbs. pressure.

The furnaces—three in number in each boiler—are constructed with the Adamson ring, and are each three feet in diameter and about six feet long. The furnaces are provided with the Ætna grate and Martin's patent balanced door. Behind the furnaces is a combustion chamber from which the gases return through 184

three and a half inch tubes, and are conducted by the boot to the flue leading to the smokestack. Behind the combustion chamber there is a water space about six inches wide at bottom and widening out to nine inches, the faces being supported by one and three-eigthths inches rivets spaced seven inches apart. The heads of the boilers above the water line are stayed with eighteen three inch bars having heavy nuts at the ends, as shown. The total heating surface is 1,740 sq. ft.

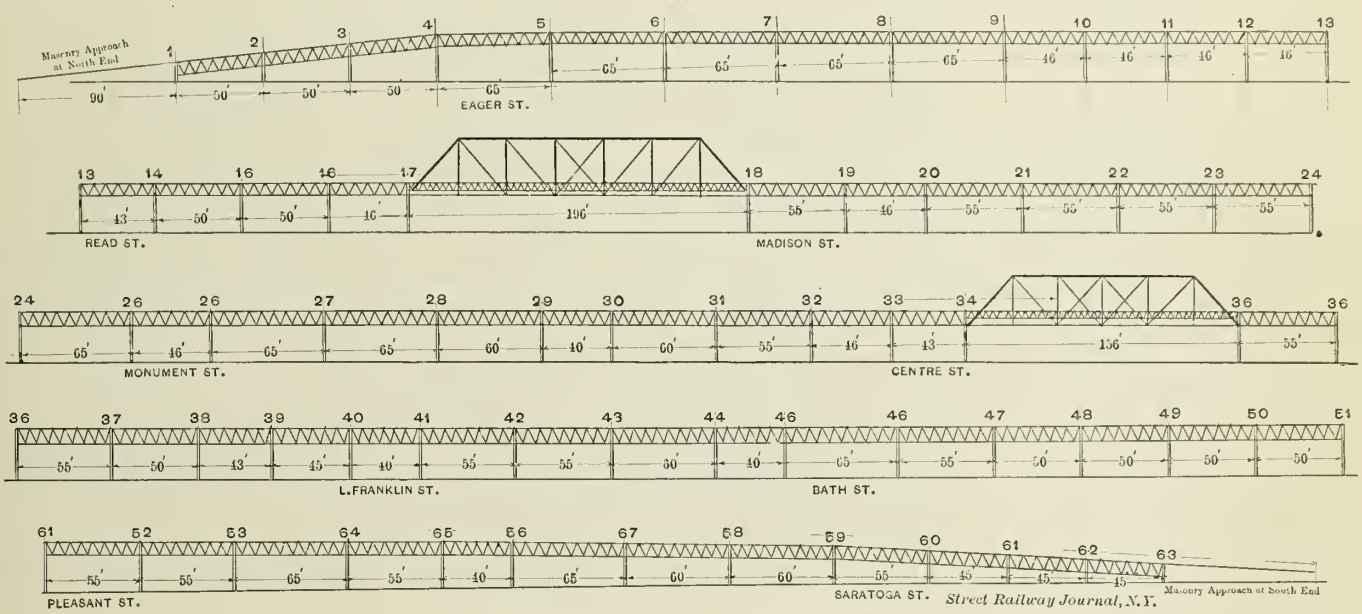
Lake Roland Elevated Electric Railway.

The Lake Roland Electric Railway, work on which is now being pushed rapidly forward in Baltimore, will be elevated for the distance of four-fifths of a mile within the center of the city, and hence possesses a peculiar interest, as it will test the advantages of electric power for elevated railways. The city terminus of the railway, which will be twenty miles in length, will be at the corner of Lexington and Charles Streets, and it will leave the city by way of North Guilford Avenue. It is the portion of the road on this avenue which, for about 4,000 ft., will be carried on a continuous viaduct, with lattice girder spans of from forty to sixty feet, and with two long spans of 196 ft. and 159 ft. respectively. Figs. 1 to 5 show elevation of this structure which will be furnished by the Pennsylvania Steel Co., and which will weigh about 2,700,000 lbs. A drawing of one of the stations, of which there will be four on this part of the line, is also given (see Fig. 6).

Some distance from the city terminus, and near the power station, the road will run over another elevated structure called the Quarry Viaduct, and about 600 ft. in length, and including three spans of 130 ft. each. This viaduct will be supplied by the Variety Iron Works Co., of Cleveland, O. Elsewhere the track will be laid on the surface of the ground. The northern terminus of the line is at Lake Roland Park.

The power station, which is located on Jones Falls Stream, not far from the center of the electric line, with its branches and proposed extensions, is built of stone, the only brick used in its construction being in the arches between the I beams in part of the foundation. The boiler room, which is 30×65 ft., contains six boilers of the Corliss vertical type, eighty-four inches in diameter, and having a capacity of 160 H. P. each, Centennial rating. The floor is of concrete, and is supported on twenty-inch I beams, each thirty-four feet in length.

The engine room, which is separated from the boiler room by a two foot stone wall, is 60×100 ft., and contains two 750 H. P., tandem compound, condensing, Corliss engines, built by the Corliss Engine Co., of Providence, R. I. Each of these operates one end of a common shaft, upon which are carried three flywheels 20 ft. in diameter, from which are driven three Thomson-Houston M. P. generators of 400 H. P. each, power being transmitted by means of Schieren belts. The piping is arranged in duplicate, and also so that the engines can be run condensing or non-condensing. The walls of the building are two feet in thickness, and the building is fireproof.



FIGS. 1, 2, 3, 4 AND 5—SIDE ELEVATION OF ELEVATED RAILWAY—BALTIMORE.

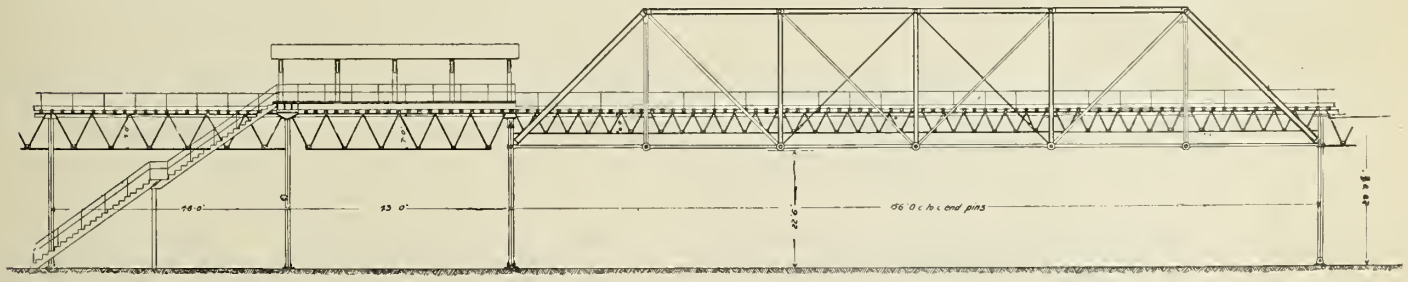


FIG. 6.—SIDE ELEVATION OF ELEVATED RAILWAY STATION AT CALVERT STREET, BALTIMORE.

On the river side of the building a retaining wall has been built twenty feet in height. This wall has been carried down three feet below the bed of the river, and is six feet thick at the base and three feet thick at the building line. Passing under the boiler room is a stream called Stony River, flanked on either side by a retaining wall.

The facilities for the receipt of fuel are of the best. Coal is obtained from the Baltimore & Lehigh Railway, the cars being run on a trestle constituting a private siding directly opposite the end of the boiler room and at an elevation twelve feet higher than the boiler room. Here it is dumped into coal pockets provided with chutes from which the coal runs into small cars. It then passes over scales where it is weighed before firing the boilers.

The rolling stock of the company includes twenty-five 34-ft. Pullman cars, each mounted on two four wheel McGuire trucks, and equipped with Edison No. 16, thirty horse power motors, two being used on each car. The company also has two sixteen foot vestibule cars equipped with Baxter motors, as well as several open trail cars.

The track, except on the viaduct where a T rail will be used, is being laid with the Duplex rails, furnished by the

Duplex Street Railway Track Co., of New York. The railway company began by employing a sixty-six pound rail, but at the request of the city engineer this was changed to a seventy-four and a half pound rail, having a five inch bearing surface and made by the same company.

The contractors for the overhead construction are J. G. White & Co., of New York. The president of the company is James L. McLane, the general manager Joseph H. Smith, and engineer A. V. Abbott. The railway is controlled by the Jarvis-Conklin syndicate.

The Trolley in Brooklyn.

The city of Brooklyn, into which the trolley system had such a hard time to enter, is now being rapidly supplied with modern electric cars, and the overhead wires are being extended in many directions. Several lines of the Brooklyn City Railroad Co., which are equipped electrically, now start from Fulton Ferry, the overhead wires having recently been placed over Fulton Street, the Broadway of Brooklyn.

The method of overhead construction on this street is very interesting, as it is carried for the entire distance under the structure of the Kings County Elevated Railway Co. Fig. 1. shows the general appearance of the line at Flatbush Ave. and Fulton St. Under that portion of the structure where the girders of the elevated railway are at a considerable height above the street railway tracks the regular span construction is used. The span wires are attached to the elevated railway pillars in the usual way, and the only point in which the construction differs from that of ordinary practice is that, of course, no guard wires are used.



FIG. 1.—VIEW ON FULTON STREET FROM FLATBUSH AVENUE, BROOKLYN.

At points along the line where the elevated railway is so low as not to permit this construction the trolley wire is attached to the elevated structure as shown in Fig. 2.

The railway girder is encircled by an inverted U shaped clamp which is held rigidly in place on the girder by means of two long iron bolts which pass through each arm of the clamp on the under side of the girder, and are held in place by nuts. Both bolts pass through

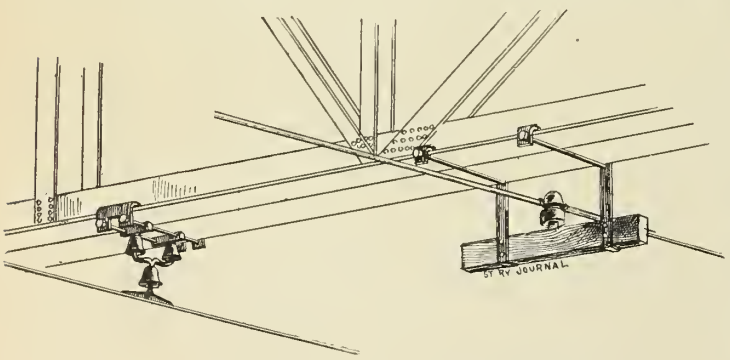


FIG. 2.—METHOD OF TROLLEY ATTACHMENT TO ELEVATED STRUCTURE—BROOKLYN.

and support two blocks of wood, to each of which is affixed an ordinary bell insulator, by which in turn the regular trolley insulator with the trolley wire is supported. By this method, as will be seen, the trolley wire is doubly insulated from the railway structure.

As will be noted, the method of direct support differs materially from that employed by the Union Railway Co. in New York and illustrated in our September issue.

The Improvement of Roads.

An energetic attempt is being made in different sections of the country to arouse the general public to the importance of improving the highways. It is proposed to petition the general government to establish a Road Department, an Institute of Road Engineering, and a permanent road exhibit in the city of Washington, as well as to have a comprehensive exhibit of road construction and maintenance at the World's Columbian Exposition. The Road Department, it is suggested, should be similar to the Agricultural Department at Washington and have for its purpose that of promoting knowledge in the art of constructing and maintaining roads, and provision for teaching students so that they may become skilled road engineers. Albert A. Pope, of Boston, Mass., will forward to any portion of the country blank forms for a petition to be presented during the early part of next year to the government at Washington, outlining the plans proposed.

New Tower Wagon.

Adjustable tower or "hurry up" wagons are coming to be regarded as necessary parts of the equipment of every well regulated overhead electric road, and quite a number of special designs have been put upon the market, each laying claim to merit in certain particulars. One of the latest devices for this purpose, and one which seems to have many points of excellence is illustrated in the accompanying engravings, Figs. 1 to 4. It is somewhat similar to, but heavier and stronger, than the one used by the same company described in our February issue of this year.

By reference to the figures it will be seen that the working platform is always maintained in a horizontal position and can be used at different elevations for special work, standing, at the highest point, sixteen feet above the pavement. In Fig. 1 it is folded in place upon the body, which position it occupies in going to or from the work. Fig. 2 shows the ladders raised for a short job, such as putting on an insulator or repairing a broken guy rim. Fig. 3 shows the position when used for construction work, and Fig. 4 shows the wagon in use for work under a bridge or any low place.

The ladder and platform are raised by means of a manilla rope or wire cable attached to the center of the forward ladder, from which it is led over a grooved pulley at the top of an upright hinged lever, and thence down to a reel under the body, the shaft of which extends

slightly beyond each side of the body, to which a crank handle may be adjusted and which has a ratchet for holding it in position. By means of the crank the rope is wound upon the shaft and the platform raised to any position, the lever in the meantime canting forward out of the way of the ladder, but kept in the same position relative to the center bar of the ladder by means of a small sheave attached to the end of the center bar, which runs in a shallow groove on the side of the lever.

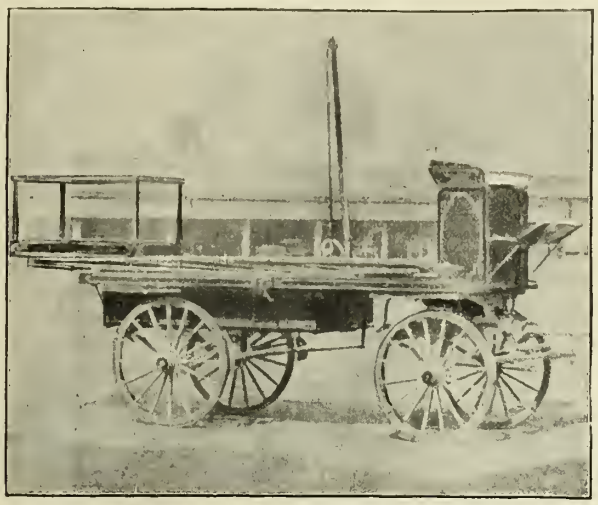


FIG. 1.—TOLEDO LINE WAGON CLOSED.

When raised the operator carries the foot of the rear ladder to the end of the wagon body where iron sockets are placed to receive the ends; or it may be placed on the ground as shown in Fig. 2. Guy rods or braces are attached if necessary, as shown in Fig. 3, and each pair is drawn taut by a screw and lever nut at the side of the body. Four jointed rods are also provided, which may be attached to the four corners of the working platform, and when not in use folded up out of the way, but which may be used to securely brace the platform sideways, and hold it against any side strain, as when tightening up the support wires.



FIG. 2.—ONE POSITION FOR LOW WORK.

The two-horse or heavy wagons are built with a platform twelve feet long, six feet wide and side rails six inches deep, protected on the top by half-oval irons.

Underneath the back part of the platform is a box seven and a half feet long, four feet wide and fourteen inches deep for the storage of wire and other line supplies. This is reached from the rear by lowering the tail gate, or when ladders are raised through trap doors in the platform. Under the seat there are storage boxes for small parts and tools, which may be reached through an opening through a rear side of the box. The seat can be turned forward until the back rests on the footboard, and in that position forms a work bench continuous with the top of the boot. A gong is placed under the footboard and is worked by a foot lever. The ladders are light but strong, being constructed in the form of a truss. The



FIG. 3.—TOLEDO LINE WAGON RAISED.

axles of the heavy wagon are one and five-eighths inch steel for the front and one and three-fourths inch for the rear. The wheels are the Sawen patent, and in front are three feet six inches in diameter and in the rear are three feet eight inches, with oval edge tires $1\frac{3}{4} \times \frac{3}{4}$ ins.

Lighter wagons for a single horse differ somewhat

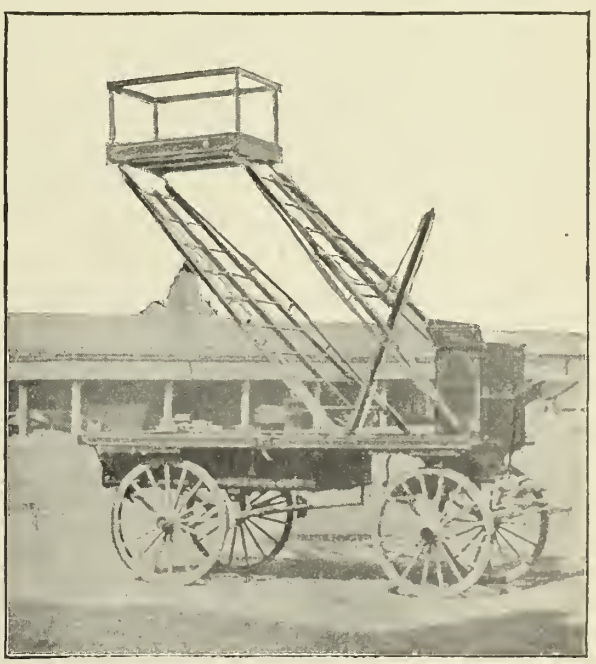


FIG. 4.—ANOTHER POSITION FOR LOW WORK.

from the one described in the construction of the body, which has a box with higher sides twelve feet long, four feet wide and eight inches deep, and has the front wheels somewhat smaller and the rear wheels larger than those employed on the two-horse wagons. In both sizes, however, the ladders are raised in the same manner.

The wagons were designed by L. H. Lincoln, of Toledo, and are being manufactured by the Milburn Wagon Co. of the same city.

The Siemens & Halske Electric Railway Conduit.

The success attending the operation of the conduit system for electric railways in Buda-Pesth, the capital of Hungary, which has now been in operation since July, 1889, has been so encouraging that the promoters, Siemens & Halske, have decided to introduce the system in this country through their American representatives, Wright & Meysenburg of Chicago.

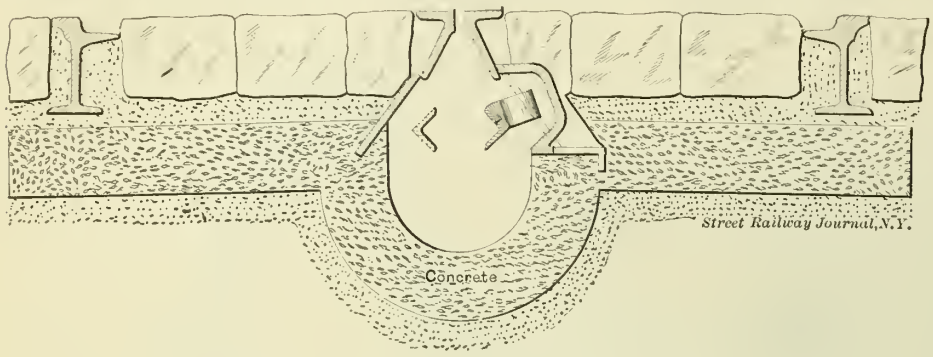


FIG 1.—ELECTRIC RAILWAY CONDUIT—SECTION BETWEEN YOKES.

By the courtesy of this firm we are enabled to present our readers with the accompanying engravings which illustrate very clearly the method of street construction which it is proposed to employ in order to adapt the system to the conditions prevailing in American practice. This construction, it will be noted, differs materially from that employed on the other side, and which was illustrated in the STREET RAILWAY JOURNAL in July, 1891, but the essential features and those to which the success of the system is largely due, have been retained and these are the forms of the conductors, the method of mounting them, and the plow or trolley which conveys the current to the motors.

Two forms of construction are illustrated, the first of which is shown in Figs. 1 and 2, where the conduit is placed between the rails; the former is modeled after the designs employed in cable railway construction, being about eighteen inches deep and ten and a half wide, with manholes at intervals through which access may be had to the conductors.

The second form is shown in Fig. 3, in which case the conduits for a double track line are placed between the tracks, so that one yoke answers for both conduits, and an opening having a corrugated cover is provided the entire length of the line, by which access can be had to the conductors at any point. By this means the cost of construction is materially reduced, and being in the center of the street, it is not exposed to so much wagon traffic, and receives the drainage of but a limited surface.

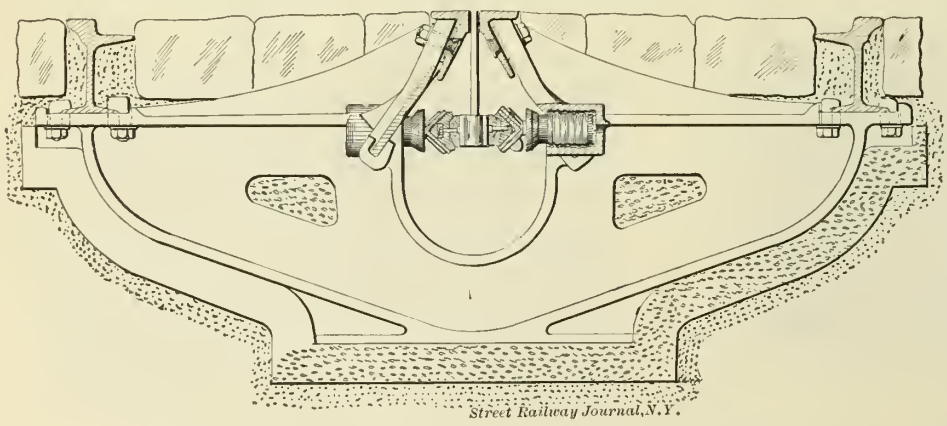


FIG. 2.—ELECTRIC RAILWAY CONDUIT—SECTION AT YOKES.

In this case the plow will be mounted under the side of the car and it will be necessary to turn the car at the ends of the line either by means of a loop or a turntable.

The conductors, both for the positive and negative poles consist of angle bars which are supported on either side of the tube, and provided with suitable expansion joints every thirty feet. The angle bars are supported by triple insulation, the supporting pin being insulated from the porcelain cup by means of a core of Siemens cement, and the porcelain from the yoke by a shell of the same material. The angular form of the conductors and the shape of the sliding trolley contacts prevent the trolley from jumping off the conductor and insure a continuous contact regardless of the motion of the car up or down or sideways. Springs in the plow hold the contact plates firmly against the surface of the conductor, and through these plates and their connections the current is taken up from one pole, led up along the shank to the motors and returned to the other pole in the same manner.

A modified form of cable slot rail is employed, which has the inner face extending slightly below the angle formed by the lower web, which serves to lead the drippings into the middle of the tube, and prevents the moisture from following the lower web and falling upon the conductors. Fig. 4 shows the method of constructing the catch basins, the arrangement of the drain tiles, the manhole frames and covers. The cost of the street construction will be about the same as for cable construction, but the economical results achieved in Europe in the operation of this system are so great that the saving in operating expenses would seem to warrant a liberal outlay in roadbed and conduit construction.

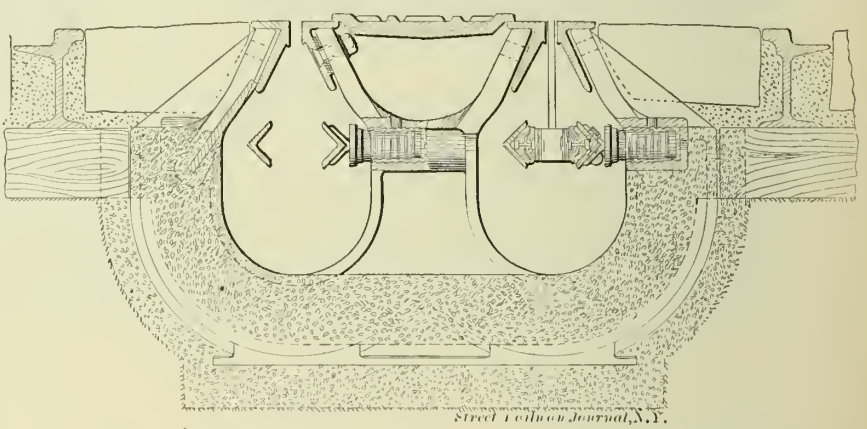


FIG. 3.—ELECTRIC RAILWAY CONDUIT FOR DOUBLE TRACK ROAD.

From January 1, 1892, to June 30, 1892, the four conduit lines in Buda-Pesth carried 5,485,010 passengers. The cars traveled 630,648 miles. The total cost of operation was $58,039.63; the receipts $141,980.77, which shows that the road was operated for 40.8 per cent. of its receipts. The average receipts per passenger were 2.588 cts. and the expenses, 1.056 cts. While the rate of wages is about one-half that of this country, the price of coal is about three times as great, and the rate of fare one-half. Hence it may be inferred that the operating expenses in the two countries will be about the same.

As this system employs a low voltage (only 300 volts) there is little liability of loss from leakage, and the possibility of burning out of armatures and fields of the motors is greatly reduced. An important economical feature of this system is the employment of large generators

coupled direct to large engines. The practice in this country until recently has been the employment of a number of small generators driven direct by belts or from a countershaft; but the result of nearly fifty years' accumulated experience in general mechanics has satisfied Siemens and Halske that direct coupling as now practised by them is the most economical, as all friction due to slip and tension is eliminated. In some types of the large generators, which are from eighteen to twenty feet in diameter, the armature revolves outside of the magnets. By this construction the necessary speed is obtained without excessive speed on the part of the engine. The commutators of these machines are very durable, being guaranteed for 20,000 hours, and in some instances have run eight years. In some cases further economical results are obtained by the use of storage batteries at the station in which surplus power is stored as a reserve.

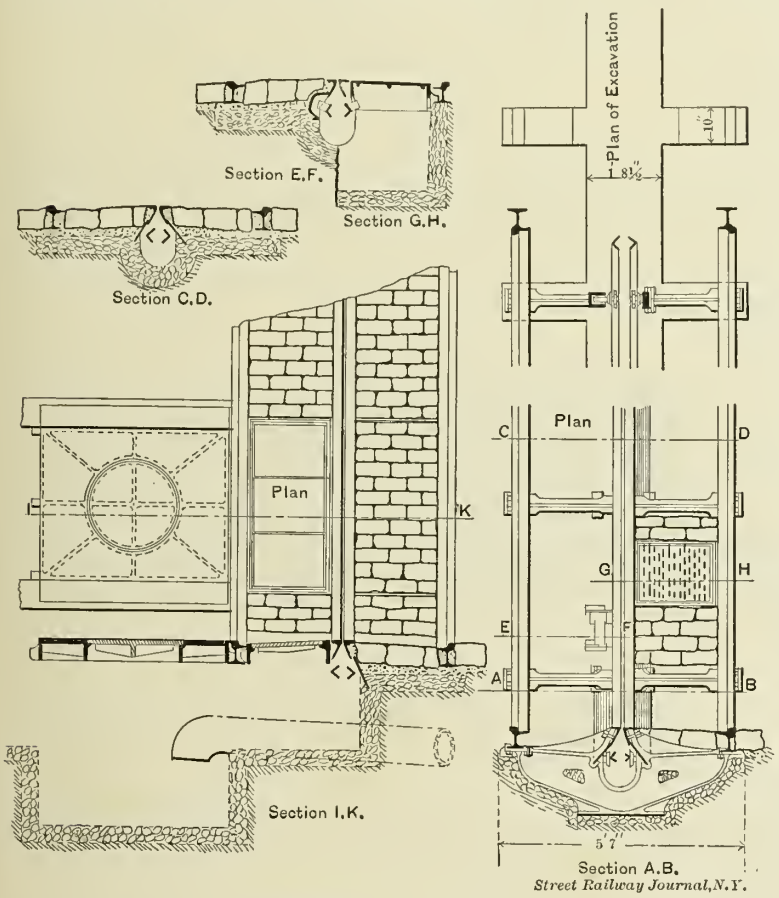


FIG. 4.—GENERAL ARRANGEMENT OF ELECTRIC RAILWAY CONDUIT.

In introducing the conduit system in this country the promoters propose to employ any of the leading types of motors now in use, but prefer motors of their own manufacture which will be made after the designs furnished by Siemens & Halske. The interest in the conduit system is on the increase in this country although disastrous results have followed its introduction in nearly every case thus far. It has stood the test of time on the other side, however, and the reputation of the firm of Wright & Meysenburg is sufficient guarantee that, whatever its merits, it will not be for the want of good workmanship if it does not succeed equally well in American service.

THE lines of rapid transit in a city are the arteries of its life. It grows along them, and by reason of them. They are private enterprises in the direct profit they pay to their promoters. In the larger profits, by far the larger, that are bound to make for the community profits in new conveniences of living, in the opportunities of swift and cheap carriage, in the multiplying manifold of the values of real estate, in that they cut up farms into building lots and bring the dinner table within arm's length of the office and the workshop, they are public enterprises, inseparably woven into the life of the community.—*Pittsburgh Convention*, 1891.

The Toronto Railway Company.

The city of Toronto has received a large share of attention in street railway circles during the past two years, and this article is written with the view of giving the readers of the STREET RAILWAY JOURNAL an idea of the development of the street railway system of Toronto, and also to correct some wrong impressions that have been given in regard to the position of the present company with reference to its contract with the city.

The street railway system of Toronto was established in 1861, when Alex. Easton and others were granted a franchise for a term of thirty years, a license fee of $5 per car per annum being charged. The rate of fare was five cents, and tickets were sold at six for twenty-five cents and twenty-five for $1, with school tickets at reduced rates. There was no transfer system, and no cars were run on Sunday. The street railway was not a commercial success in the early days, but with the growth of the city it became so. The license fee of $5 per car per annum was lately changed to a tax of $600 per annum per mile of single track, but under the new arrangement the city constructed the pavements required in connection with the tracks, and kept the same in repair.

In 1869 Mr. Easton sold out the railway to Messrs. Kiely Bros., at which time the plant consisted of forty horses, twelve two-horse cars, two one-horse cars and four or five busses. In this franchise the city retained the right to take over at the expiration of the same all the real estate, stock, plant, tools, etc., at a value to be determined by arbitration, and operate the road itself or give the franchise to another company. Acting upon this power, the city made preparation to take over the railway on the date of the expiration of the franchise, viz., March 14, 1891, but it was found necessary to grant an extension of time, the arbitration proceedings not having advanced sufficiently to admit of the transfer being made. The ownership of the railway was finally assumed by the city on May 20, 1891, the amount of the arbitration award being $1,453,788. The city operated the road with James Gunn as manager until August 31, at which date the present company assumed control, taking over from the city all buildings, plant, tools, real estate, etc., and began to operate the road as owners on September 1, 1891, with the following gentlemen as officials: George W. Kiely, president; Wm. McKenzie, vice-president; C. C. Woodworth, treasurer; H. A. Everett, general manager; James Gunn, secretary and superintendent.

The principal features of the present franchise are:

1. Exclusive right of operation within the city limits.

2 The city retains privilege to assume the ownership of the railway at the expiration of the franchise.

3. The city to keep all pavements in repair and lay down permanent ones when old tracks are reconstructed or additions made to present ones.

4. The company to pay the city $800 per annum per mile of single track and 8 per cent. of the gross earnings as well.

5. Single fares five cents (at night ten cents), six tickets for twenty-five cents and twenty-five for $1; also time limit tickets good from 6 to 8 A. M., and from 5 to 6:30 P. M., at eight for twenty-five cents; children under nine years half fare. School children tickets good between 8 A. M. and 5 P. M., except Saturdays, at ten for twenty-five cents. In addition to the above, free transfers are given all over the city.

6. The system of motive power to be electric and to be approved by the city engineer and confirmed by the City Council.

Immediately on assuming control, several changes were made in the running of the routes, the most important one being the forming of a belt line embracing King, Sherbourne, Spadina and Bloor Streets, a distance of about six miles. This route has become so popular that it is now one of the best earning lines in the city.

On November 23, 1891, the then city engineer, Granville C. Cuningham, in accordance with the terms of the agreement between the city and the company, made a very exhaustive report to the City Council, recommending the adoption of the trolley system as the only one suitable to the requirements of Toronto, after having visited and thoroughly examined the best systems in the States. The report was not adopted at that time by the council; it being so near the end of the year, it was deemed advisable to hold the matter in abeyance until after the elections. The new council had not sufficient information on the subject, and a deputation of aldermen with two outside experts were sent on a tour through the States to look into the different systems, principally the storage battery, who on returning confirmed the recommendation made by Mr. Cuningham. The matter was finally settled on May 18 by the unconditional adoption of the trolley system.

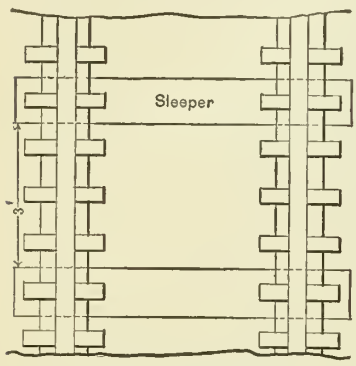


FIG. 1.—PLAN OF TRACK CONSTRUCTION—TORONTO.

In the meantime, Mr. Kiely president, and Mr. Woodworth treasurer, sold out their respective interests in the company, and Mr. McKenzie was made president, H. A. Everett, vice-president and managing director, J. C. Grace, secretary and treasurer, and James Gunn, superintendent.

Immediately on the adoption of the trolley system by the City Council, the company set vigorously to work

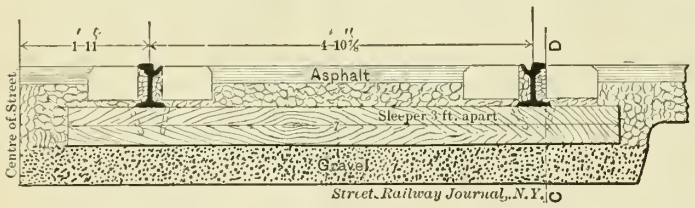


FIG. 2.—TRANSVERSE SECTION OF TRACK CONSTRUCTION—TORONTO.

to prepare for the change of system. The work of reconstruction was commenced about July 1, and on August 15 the first trolley car was run. On September 5, the opening day of the Exposition, the first line equipped with new material throughout was put in operation, and notwithstanding the many prophecies that the inauguration of an electric service at such a time would greatly increase the chances for the "deadly trolley" to get in its work, there was not a single accident to report, and the thousands of people were transported daily without mishap or

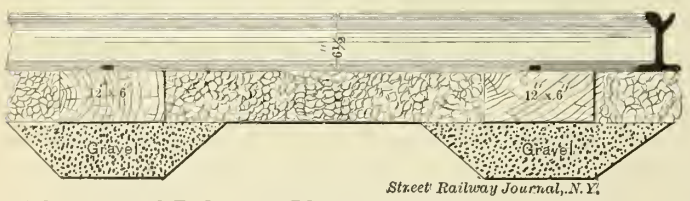


FIG. 3.—LONGITUDINAL SECTION OF TRACK CONSTRUCTION—TORONTO.

inconvenience. The record of the largest number of passengers ever carried on the system in a single day was broken during this period, when transportation was given to over 170,000 people.

Since the reconstruction of the tracks commenced—about July 1—about thirty miles of the seventy composing the system have been laid with new rail and pavements. The style of rail used is a six and a half inch groove girder, weighing seventy pounds per yard, with an extra heavy two foot fishplate to support the joints. The rails are laid on 6 × 8 in. cedar ties resting on gravel foundations, with six inches of good concrete and two and a half inches of asphalt to form the pavement (see figures).

The cars are being constructed at the company's shops, and are very handsome in design and finish, the standard length of eighteen feet and seven foot wheel base having been adopted. The inside finish is of quartered oak, bronze trimmings and spring seats with upholstered backs. When the present syndicate assumed control there were about 260 cars in use, but since that time thirty open cars and si ty box cars have been constructed.

The road is being operated at present with temporary power, but contracts for the equipment of the permanent power house have been let as follows: Engines, 3,000 H. P. Armington & Sims, Providence, R. I.; twelve return tubular 250 H. P. boilers, Polson Iron Works, Toronto; feed water heaters, Newbold & Son, Norristown, Pa.; condensers and feed pumps, John Abell Engine Co., Toronto; nine generators 250 H. P., General Electric Co.'s (Edison type). The motor equipment consists of seventy Edison, five Westinghouse and one Thomson-Houston.

"Abolish the Joints."

A prominent engineer being asked how the existing troubles with the rail joints on electric and cable roads could be remedied, made answer as above. In the light of past experience this would seem to be the most effective remedy, and if applied, must be in the line of a continuous rail, produced either by riveting or electric welding or by otherwise supplying a practically continuous rail.

This subject has recently been brought into prominence through an able and timely paper on "Experiments on the Expansion of Continuous Rails," presented by Mr. A. J. Moxham, at the Cleveland Convention, and printed in our November issue.

The paper states, after detailing the particulars of abutting and riveting 1,160 ft. of track into a continuous rail, that

"The experiment has proved absolutely and beyond cavil, that the expansion and contraction are restrained and held by the surface friction of the surrounding roadbed. From first to last, from a temperature of twenty-two degrees below freezing point (or ten degrees), to a temperature of eighty-nine degrees above freezing point (or 121 degs.), extending from March to August, there was *absolutely no movement of the track out of place.* Even at the ends was this true; proving that not only will the roadbed hold the track as a complete structure, but that it will do it consecutively. Once bedded, it will hold a rail ten feet or thirty feet, as well as one 1,100 ft. On this point there is no room for error."

Fortunately we have not to depend upon this single experiment for a precedent. The elder Trautwine, in the 1872 edition of "The Civil Engineer's Pocket Book," on page 391, states:

"It is a remarkable fact, not satisfactorily accounted for, that when lengths of from 100 yds. to some miles have been perfectly welded or riveted together tightly and spiked to the ties as usual, no elongation or contraction by heat or cold could be detected."

On what experiment the above statement was based, we have no means of determining, but from the reputation of the writer we may be assured that it has some foundation in fact. Another case in point is a statement found on page 96, in a book entitled "The Permanent Way and * * * * of European Railways," published in 1858, by Zerah Colburn and Alex. L. Holley, as follows:

"On the other hand several interesting examples show that the fastenings may be sufficiently strong, or that the heat absorbed by the rail may be carried off by the ground, as to keep the rails in place, even without any allowance for expansion. I. K. Brunel has stated that he has welded together 100 ft. of bridge rail, and riveted together another length of one-quarter of a mile. These were securely fixed to the longitudinal timbers and accurate gauges set at each end. The result was conclusive, that there was no accumulated motion either at the extremeties or at any part of the two lengths. Barlow's saddle back rail (see cut) which is *bedded into the ballast*, is now riveted closely and firmly together for five or six miles, without any practical inconvenience from expansion. Sir John Hawkshaw once erected a parapet 750 ft. long, formed of cast iron plates nine feet long and one inch thick. This was firmly riveted together and held down tightly, and was proved to retain its position perfectly under all actual variations of temperature where put down."

In the same connection the same authors state that

"A variation of ten or twelve degrees is said to produce a force of expansion in iron, equal to one ton to the square inch. A variation of

150 degs. would thus, in its produced expansion or contraction, cause a strain equal to the strength of the iron itself. * * * * *

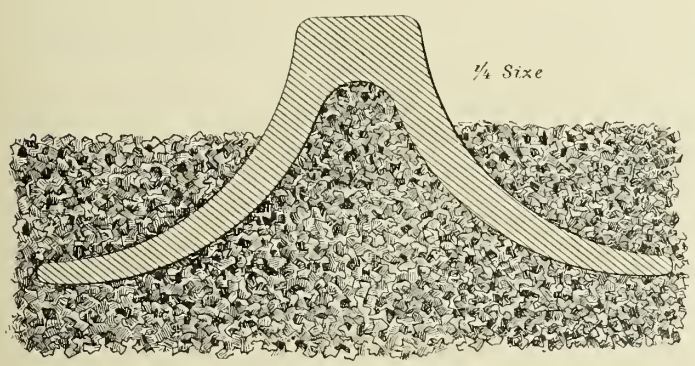
"Track in this country, where laid with close joints in cold weather, has been raised vertically one foot and thrown laterally two or three feet by expansion. In England the same thing has occasionally happened. * * * * *

"Practically, for a climate like that for this country, there is no authority for disregarding the expansion and contraction of rails."

The experiments on which the authors based these last conclusions were with exposed *iron* rails on steam roads. With the employment of steel rails, as in modern practice, we know that the strain induced by the variation of the temperature does not overcome even the elastic limit of the metal, and doubtless there were conditions which produced the buckling in the track referred to, with which we are not familiar.

"In the same work the Barlow rail is condemned because it has exhibited several faults, splitting and peeling of the head, sucking up water beneath, thus preventing drainage, difficulty of packing (tamping) and being unstable in bearing. * * * It is interesting to observe that this rail has been closely riveted in lengths of five or six miles without experiencing any difficulty in expansion."

It will be noted above that the Barlow rail was "bedded into the ballast," so that this fact accounts largely for the absence of expansion. In modern street railway practice the girder rail is usually bedded in the pavement or in macadam, and when so laid can doubtless



THE BARLOW RAIL.

be riveted or welded without any evil effects, but with an immense saving in regard to joints. The builders of street railways have been so accustomed to look to steam practice for their models that they have overlooked the fact that the conditions differ widely, and that some of these conditions are favorable to a construction that has failed in steam practice, and the Barlow rail is, doubtless, a case in point. We do not refer, however, to the form of the rail, but to the fact that the ends were riveted together.

Recent practice in street railway construction by a number of lines in this country would seem to confirm the opinion that variations of temperature do not affect the girder rail unfavorably in paved streets, and that the tracks do not creep as in steam practice. We have frequently stated that track was being constructed with the ends of the rails abutting, and that no space was left for expansion, and those who attended the Cleveland Convention and had an opportunity to inspect the new construction on the Woodland Avenue & West Side line will remember that the rails were abutted closely together, the practice being warranted by previous experiments on the same line. In fact it is a question if the space, which is usually allowed at the end of rails when laid in cool weather, really closes up when the temperature increases. It may in some cases, but the accumulation of gravel and dirt between the ends will naturally prevent the joint from closing, and as rails thus laid do not buckle, it is safe to suppose that they will not when riveted or welded. On the other hand we recently investigated a case in Toledo where a street car track was laid with a girder rail in a *dirt road* during cool, wet weather, and sufficient space not having been left between the ends, the rails twisted out of shape during the warm weather so that the cars could not be operated, and it was found necessary to rebuild the track, saw off the ends of the rails in some cases and in others to substitute new rails, as the old rails had become too badly bent to be of service.

In addition to the advantages claimed for the continuous rail in Mr. Moxham's paper, the rail itself will be strengthened. In case such construction is employed, it should always be laid in warm weather, in which case the tendency to contract will strengthen the metal, and besides, the rail will have the advantage of the well known law of the transverse strength of beams, which is that a beam firmly fixed, or anchored, at both ends and loaded at the center is twice as strong as when merely supported at both ends and loaded in the middle. So convincing are the arguments in favor of a continuous rail that a street railway company in St. Louis proposes to construct four miles of track in this manner as soon as welding machinery can be obtained.

The saving that would be produced by the employment of the continuous rail is briefly stated at the conclusion of Mr. Moxham's paper as follows:

"One important saving that would be effected by a 'track without joints' would be in the weight of the rail. A rail of 100 lbs. per yard is to-day in use, and next year will be extensively used. Perhaps, without their knowledge, the cause of this has been the street railroad men's dearly bought and sad experience with joints. The joint being defective, the effort has been made to secure such stability of track as to relieve the joints by means of a heavy rail. In a 100 lb. rail there are but thirty pounds of wearing surface, of which not more than eighteen pounds can be used before the rail will have to be thrown out; therefore there will be eighty-two pounds unused. For mere stiffness and rigidity, a sixty-six pound rail, if supported by the proper number of cross ties, will answer every engineering demand, even of electric cars at high speed. Anything over this goes to the debit of 'bad joints.'"

The conclusions arrived at in the paper, and our own opinion in the matter as outlined above, are, we find, in accord with that of Mr. Augustine W. Wright, of the firm of Wright & Meysenburg, Chicago, who is a well known authority in street railway matters, and who was consulted before the experiments alluded to were tried, and to whom we are indebted for calling our attention to the extracts which we have quoted from Trautwine, Colburn and Holley.

The Tank Lightning Arrester.

BY ALEX. JAY WURTS.

The modern electric railway plant is of such broad dimensions and represents such a large capital outlay, that any interruption to its service must seriously curtail net receipts, not only through the actual loss of fares during the hours of enforced idleness, and during which time, of course, expenses are still running apace, but also through loss of public confidence.

In many of our cities and towns, particularly in the Western section of the country, it has been common practice during thunderstorms to shut down the plant, pull down the trolleys and wait till the storm shall have spent itself. In one case, with which I am familiar, the direct losses from enforced idleness during thunderstorms amount to over $6,000 per year. The value, therefore, of an efficient and reliable lightning arrester for the protection of street railway apparatus cannot be overestimated. So far the ordinary spark gap arrester has proved of value in that it has, without question, saved many thousands of dollars worth of property. There is, however, a difficulty in connection with lightning discharges which is not usually recognized, and which, with ordinary spark gap arresters, is very difficult to avoid. The theory of such discharges, which observation in many cases has proved to be correct, is that the discharge is much more likely to occur at some points in the line than others. An arrester may, therefore, be connected to the circuit at the ineffective point (called a nodal point), and the discharge may pass the arrester and take place at another really strong point in the circuit, which, in many cases, will be the generator.

It is not an easy matter to clearly explain to the average central station man why static discharges do not readily pass through coils of wire. The simplest scien-

tific explanation would involve technicalities which it is my desire to avoid. There is, however, one simple way of pointing to this as a fact. A trolley wire is connected to the earth through the generator and motor armatures by unbroken copper conductors of large carrying capacity. Why, then does a trolley wire need lightning arresters at all? Why do not the static charges at once pass to ground through the armature coils? Or, in other words, why do these discharges pierce the high insulating material of the armature and jump to the frame of the generator or motor when the wire on which this charge which already

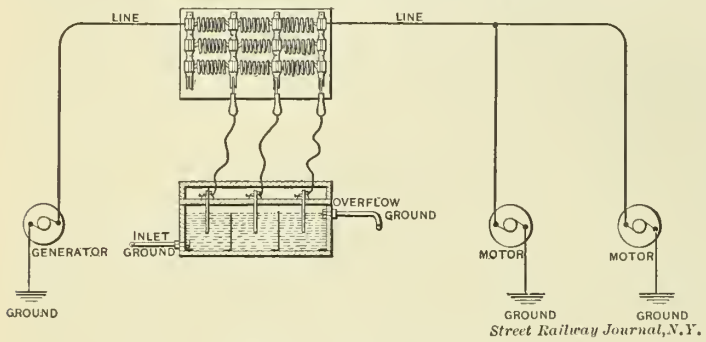


FIG. 1.—TANK ARRESTER.

exists is so well grounded? It is because *static charges do not readily discharge through coils of wire*—through the coils of an armature. The charge forces its way partly through the armature coils, and, being greatly impeded in its progress (by inductive resistance) there results what is technically known as "side flash" through the insulation to the iron frame of the generator.

The best path for the discharge is one in which it is not required to pass through a coil, and in which the resistance is low. The ideal arrester, therefore, should tend to prevent the accumulation of the charge on the line. It should afford a number of paths of low resistance from several points of the circuit, and it should offer a high resistance to the passage of static charges from the line to the armature. These requirements are admirably met by the "tank arrester," which consists of a coil of wire connected in the main circuit with several discharge circuits leading from different points in the coil to electrodes immersed in a tank of water, the latter being connected to the ground. This arrester is particularly adapted to the protection of street railway generators. Its construction will be readily understood by referring to the diagram (Fig. 1). Fig. 2 is taken from a photograph.

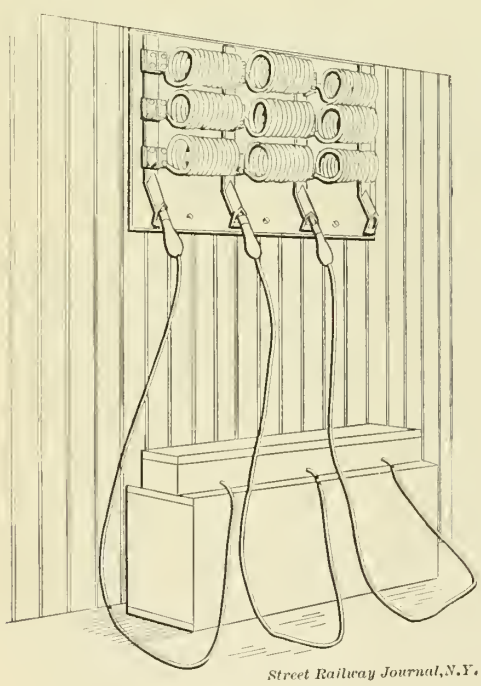


FIG. 2.—TANK ARRESTER.

The coils, made of No. 0000 copper wire, are nine in number, arranged three in series and three in parallel. The current capacity of No. 0000 wire is about 300 amperes, so that the capacity of the entire set of coils may be varied by any multiple of this number. The set shown in the cut has a capacity of 900 amperes, and is mounted on a backboard, the dimensions of which are 32 × 20 ins. The tank is of wood lined with galvanized iron, and its dimensions are 32 × 28 × 10 ins. The three electrodes are ordinary flat, arc light carbons held in simple clamps, and the method of connecting these to the coils is clearly shown. The inlet, is of course, connected to the city main, and thus forms the best possible ground connection for the tank. The coils are to be connected in series with the station ammeter, and when thus connected will stand guard over the entire station. The action of the combination is as follows:

All charges which may accumulate on the trolley line or feeders will be forced to pass through the coil before reaching any of the generators. The function of the coil is then to cause the fatal "side flash" to occur *there*, rather than in the coils of the armature, and this is the most readily accomplished from the fact that there are several low resistance paths from this coil to earth without the necessity of piercing any insulating material or jumping over the smallest air space. In other words, there is an exceedingly difficult path for the lightning discharges to reach the generators, and an extremely easy path for them to reach the earth. Furthermore, the fact that the line is directly connected to earth without the intervention of the air gap, offers a constant drain through which the static charge may dissipate itself, that is, the charge need not accumulate on the line till its intensity is sufficient to jump the spark gap of an ordinary lightning arrester.

Dynamo leakage is, of course, to be expected, and during the first stages in the development of this arrester, the leakage was so excessive that the scheme would have been abandoned had it not been for the fortunate discovery that this leakage was reduced about 70 per cent. by the use of running water. With running water fed through a half inch pipe at ordinary city pressure the leakage amounts to six or seven amperes at 500 volts. But in consideration of the almost certain protection that the arrester will afford, this loss of power sinks into insignificance, and in fact the leakage need only occur during thunderstorms, as the discharge circuits may be cut out at other times by pulling the plugs shown in the figure.

The advantages of this arrester are summarized as follows:

1. The presence of the coil in the dynamo circuit, which prevents the discharge from passing to the dynamo and forces it through the tank.

2. The opportunity for constant leakage of the charge, by which the accumulation of a charge sufficient to break through the insulation of the generator is avoided.

3. The numerous discharge circuits connected with the coil which secure facility for discharge from a number of points, thus avoiding with certainty the nodal points of the circuit.

4. The avoiding of a short circuit on the generator at the time of a discharge, and the possible injury of the generator or the opening of the circuit breaker.

5. The affording of paths to the ground, avoiding the use of coils or inductive circuits in the discharge path, and securing low ohmic resistance.

6. The fact that one arrester will protect all the generators in the power house.

A number of these arresters have been in use during the past season in various sections of the country, and those who have reported their experiences, write in unqualified terms regarding the wonderful protection afforded by this arrester.

THE chief motive power for the machinery at the Exposition will be supplied by a gigantic engine, to be furnished free to the Exposition by the E. P. Allis Co., of Milwaukee. The engine will be furnished as a part of the company's exhibit, upon a special contract providing that it shall be used for the motive power, and that no other engine of equal size shall be exhibited. It will be an engine of the quadruple type, and will be of between 3,000 and 4,000 H. P. In 1876 the Corliss was considered one of the wonders of the exposition, but its builder rated it at only 1,400 H. P., or less than half of the one being built by the Allis company. The Allis exhibit represents an outlay of $175,000.

Should the Positive or Negative Pole of a Generator be Grounded?

The question always arises in connecting the generators in an electric railway station, whether the line should be made the positive or the negative side of the circuit, and, as our readers know, practice has varied widely in this regard. To obtain a decision on this point the STREET RAILWAY JOURNAL requested the opinion of a number of prominent electrical engineers upon the subject. Their replies are given below:

MR. ELIHU THOMSON, of Lynn, Mass., says: "Yours of the 11th inst. has been received. In answer to your inquiry I would say that I do not think there is any method of connecting up generators which is general for all cases. My opinion is that it would be the best practice to alternate the connections from time to time."

MR. FRANK J. SPRAGUE, of New York, says: "In reply to your favor of November 17, I think the better plan is to make the line the negative side of the circuit, so that if there is any arcing at joints or supports the trolley wheel will be the sufferer instead of the line, and also because the earth plates, where used, will last longer."

MR. S. H. SHORT, of the Short Electric Railway Co., Cleveland, O., says: "I think it best to have the negative pole of the dynamo connected with the trolley line, this method of connection causing less trouble with electrolysis in ground wire and rails."

MR. J. H. BICKFORD, of Salem, Mass., says: "I hardly feel like expressing myself upon the question named. There is a great difference of opinion in regard to this matter, and there are, undoubtedly, arguments in favor of both ways. My preference in the matter would be to have the overhead wire positive, although as a matter of protection to the trolley wire itself from becoming burned when a break occurs between it and the trolley wheel, it would be better to have it negative, as the damage would then occur to the trolley wheel. In a town where there are several lines of road operated by different companies, it is, of course, absolutely important that all the overhead wires should be of the same polarity, and as a general thing the trolley wire is positive. There may be some other good reasons, aside from those I have mentioned, for making the trolley wire negative, but I have never given the matter sufficient consideration to determine what they are."

MR. J. H. VAIL of the General Electric Co., New York, says: "I believe it is for the best interests of the operating company, that the ground connection should be the positive side of the system. As the current travels in the direction from positive to negative, the results of arcing between the trolley and the trolley wire will not be as liable to impair the durability of the trolley wire as if the direction of current were reversed. For instance, under the latter condition, and an arc taking place, the trolley wire might be seriously reduced in strength by burning at the arc between wire and trolley wheel, the fused metal being carried from the wire to the trolley wheel. But with the trolley wire as a negative side, under an arc, the trolley wheel is more liable to lose its metal. I believe that examination of burned trolley wheels proves this.

In addition to the above, I have frequently received reports as to the result of damages from lightning. It has been specially observed by several outside men in charge of construction and operation of railway plants, that the effects from lightning are less disastrous when the positive side of the system is grounded, than when the negative side is. I believe that a standard of practice should be agreed upon by all parties interested in constructing and operating street railway systems by electricity, and that the standard should be universally followed.

Some constructors practise certain methods of bonding and grounding street railway tracks, the work lacking both permanency and efficiency, as well as being under certain conditions detrimental to other systems of distribution for public service. On these practices it is not necessary for me to enlarge at this time. It appears to me as being of vital importance that faulty methods of work should be entirely eliminated and that the best methods of construction, embracing permanency and efficiency should always be followed."

Meeting of the Ohio State Tramway Association.

The eleventh annual meeting of the Ohio State Tramway Association, and one of the most interesting meetings in the history of the Association, was held at the Clarendon Hotel, Zanesville, O., November 16. The meeting was called to order at 10:30 A. M., by the president, Hon. John N. Stewart, of Cleveland, O.

The delegates present and the companies represented by them were as follows: East Cleveland Railroad Co., Dr. A. Everett, president; L. E. Beilstein, assistant secretary; the Cleveland City Cable Railway Co., Charles Hathaway, John Koch; Woodland Avenue & West Side Railway Co., J. B. Hanna, secretary; Toledo Consolidated Street Railway Co., Albion E. Lang; Cincinnati Consolidated Street Railway Co., John Harris, superintendent; Columbus Consolidated Street Railway Co., E. K. Stewart, general manager; W. F. Kelly, engineer; Canton Street Railway Co., W. A. Lynch, president; Akron Street Railway Co., F. A. Seiberling, secretary and treasurer; Zanesville Street Railway Co., F. A. Seiberling, secretary and treasurer; Ashtabula Street Railway Co., J. N. Stewart, president; Cincinnati, Newport & Covington Street Railway Co., Charles Hathaway.

The report of the secretary and treasurer was read and adopted and showed that the Association was in a very properous condition.

The Executive Committee then presented the following report:

REPORT OF EXECUTIVE COMMITTEE.

OHIO STATE TRAMWAY ASSOCIATION.

ZANESVILLE, O., November 16, 1892.

Your Committee most respectfully reports

That it appears to be to the best interests of the Association that the next annual and succeeding meetings be held on the Third Wednesday of each September. This change is suggested on account of the growing interest in the annual meetings and the feeling, as suggested by some of our members, that the National association meeting should succeed that of ours, and, as now arranged, one appears to too soon suceed the other.

The honorary membership that was provided for by resolution last year appears to have awakened no small degree of interest among the representatives of manufacturing firms, and many are availing themselves of this membership in our Association.

Many manufacturers have from time to time made application for exhibition space that they might exhibit their wares at our annual meetings. On account of the expense and holding meetings in the smaller towns of the State, this feature has been discouraged by the Committee.

The following roads have complied with the conditions of membership, and are duly admitted: The Hamilton & Lindenwald Electric Transit Co., Hamilton, O.; The Citizens' Electric Light & Power & Railway Co., of Mansfield, O.

Respectfully submitted,

THE COMMITTEE.

On motion the report was received and adopted, after which the president, Mr. J. N. Stewart delivered the following address:

ADDRESS OF THE PRESIDENT.

Gentlemen of the Ohio State Tramway Association:

We are to-day assembled in Twelfth Annual Convention in the beautiful and prosperous city of Zanesville. It is meet that we should gather at this place to deliberate upon the present and prospective advancement of our interests, as you will see when I have given you a little of the historical reminiscence of its early day.

The first attempt at vesting franchise rights in the State of Ohio was given by the Congress of the United States in May of 1796 to a Mr. Zane, of Pennsylvania, to open up a highway or wagon road for the travel of the public, conditioned upon his maintaining ferries across the Muskingum River at this place, and certain grants of land were made him as a bonus therefor. The supposition is that neither the highway nor the ferries were free, but that by some device known to that day the "coppers" were gathered on both ends of the route. The contract awarded to Mr. Zane provided that he should maintain the ferries so long as the Congress of the United States should demand, but, with Yankee sagacity, we find Mr. Zane to have sublet the job, and devoted his time among the resident populace to "booming" a project to "bridge the stream."

In about the year 1800 this man Zane, of Pennsylvania, appears to have gained citizenship in Ohio and gotten "solid" down at Washington, as, under instructions from the Postmaster-General, the town of "Westbourn" assumed the name of, and was thereafter known as, "Zanesville." History says there was "one store and several grog shops, but no tavern" (no reflection on Westbourn). Zanesville appears to have been fortunate enough to have gotten one some time in 1802, for the Hon. Lewis Cass, in his "Camp and Court of Louis Philippe," says: "At Zanesville the party found comfortable quarters at the Hotel McIntire, of whose hospitable hostelry the King bears fond remembrance." So you see, my brothers, the King of France, as well as ourselves, has sojourned here.

From Zanesville in 1808-9, we find about the first "lobby committee" to have gone forth to besiege the Ohio Legislature, then in session at Chillicothe, the purpose of the committee being to secure for this place the location of the state capital. I judge the committee to have had "influence" and to have been fairly successful in their work, for the winter sessions of the General Assembly of 1810-11 and 1811-12, were held here, and great were the expectations for the future of the capital city; but alas for the fond anticipations of the Zanesvilleites, their vast expenditures of money, in anticipation of being the foremost city in the state, had placed them upon the very verge of bankruptcy. The fickleness of mankind and the methods of a lawmaking body were not appreciated by that confiding "lobby committee," or right then and there we would have had a "ninety-nine year" precedent established, for we find that in the winter of 1812, whatever pledges had been made were being broken and the present site at the city of Columbus, fifty-four miles from here, was determined upon as the home for future lawmaking. The first coining of money in Ohio was at Zanesville, in its early days; unfortunately, however, it was being done in competition with "Uncle Sam" and the infant industry soon came to grief.

Verily this is an historic spot. Its people appear to have been as successful as those of any other part of the state, notwithstanding their ancestry began by "damming" the Muskingum River (to get its water power). A view of the present growth and prosperity of the city of Zanesville fully indicates that a flourishing city can be maintained, though abandoned by the highest legislative body of the state, so the street railroads of Ohio are not without hope.

The membership of this Association has steadily increased, until now nearly all of the street railways of the state are enrolled upon the books of the secretary. It is a source of gratification to note the increasing interest and attendance upon our annual meetings and I cannot close this, my second, term as president of this Association, without thanking the gentlemen who as members of standing and special committees have lent such valuable aid and assistance in furthering the interests for which we are associated. During the year some minor troubles have arisen between employers and employes, but, as a rule, they have been found to have been hastily and inadvisedly precipitated, and without unnecessary delay have been satisfactorily adjusted between both parties at interest. We are to congratulate ourselves that the advancing conditions surrounding the operations of street railroads under modern methods is calling to our service a large increase, and, as a general thing, a better class of operatives, than has heretofore been engaged, bespeaking better service for the public and ourselves.

In retiring, I desire to thank my associates for their generous and hearty co-operation in the management of the business of this Association, and also the street railway press for their kind and considerate treatment, and as well to those courteous and complacent gentlemen, we are pleased to call "Supply Men," who come forth smiling whenever anything from a spike to a trolley wheel is needed to give stability to our undertakings, or solace to our soul.

Gentlemen, we are ready to proceed with the business of the Convention.

Dr. A. Everett then offered the following resolution, which was adopted:

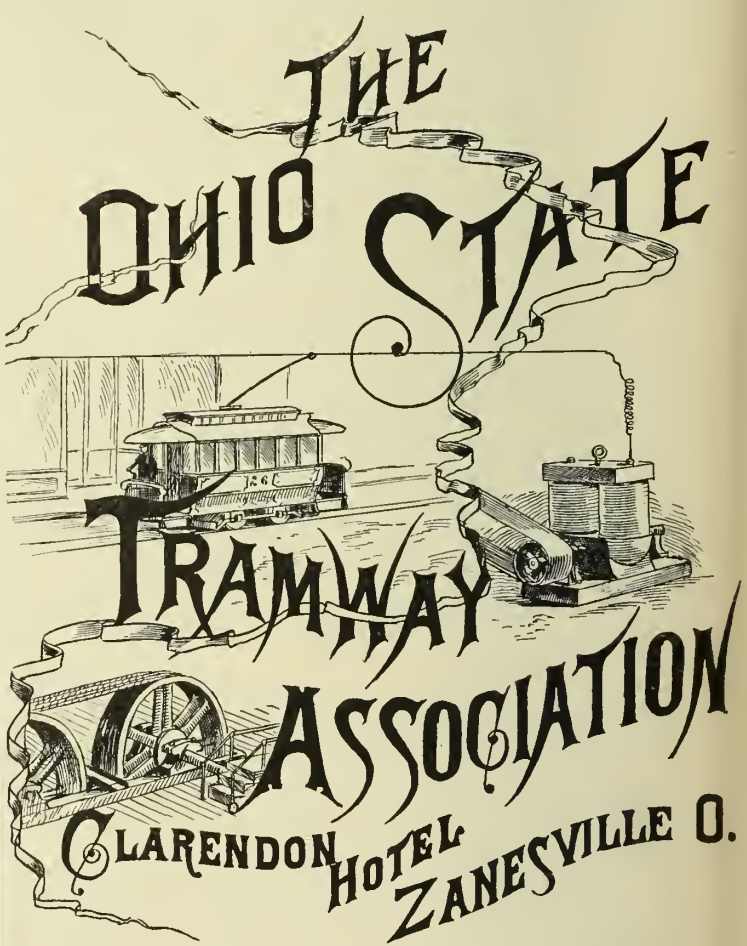
Resolved: That the time of the meeting of the Ohio State Tramway Association be changed to September instead of November, in order that the meeting may come before, instead of after, the meeting of the American Street Railway Association, the date to be fixed by the Executive Committee.

The president then called for remarks from the various representatives of manufacturers and dealers in street railway apparatus and supplies, and H. A. Dorner, of Dorner & Dutton, J. A. Hanna, of McGuire Manufacturing Co., P. K. Andrews, of the J. G. Brill Co., F. D. Russell, of the Rochester Car Wheel Co. and W. E. Haycox, of the Fulton Foundry Co., explained the points and merits of the products of their respective companies, the subject of trucks receiving the largest share of attention.

The meeting then adjourned until 1:30, when an executive session was held at which matters of vital importance to street railway companies of the State of Ohio were discussed, after which the meeting was again opened and quite a lengthy discussion on the subject of fenders, or life guards, was held, which was participated in by Messrs. Everett, Kelly, Harris, Hathaway, Koch, Squires and A. E. Lang. The discussion was interesting, and the various forms of fenders were considered, and the general opinion seemed to be that the double end fenders and side guards afforded the greatest protection against accidents to life. The remarks of several of the gentlemen showed that the majority of accidents were occasioned by people being thrown under the car from the sides rather than from the front of the car. Mr. Squires, of the American Casualty Insurance & Security Co, stated that fully 75 per cent. of the accidents that were brought to the attention of his company were caused by persons being drawn under the car on the side. The discussion also brought out the fact that the majority of accidents, where motor cars and trailers were used, occurred under the trailer and not under the motor car. It was also thought that fewer accidents would happen if a higher rate of speed was maintained than is at present.

Mr. A. E. Lang then gave an account of the experiments that were made in Toledo with the Mekarski system of compressed air, a full report of which has appeared in the STREET RAILWAY JOURNAL.

The relative merits of wooden and metal poles were then discussed and also the various styles of sand boxes.



The chair then appointed a committee for the purpose of nominating officers for the ensuing year, and selecting the next place of meeting. The committee reported as follows: For president, Albion E. Lang, of Toledo, O.; vice-president, W. J. Kelly, of Columbus, O.; secretary and treasurer, J. B. Hanna, Cleveland, O.; chairman of Executive Committee, W. A. Lynch, of Canton, O. These officers were elected unanimously. The next place of meeting selected was Cincinnati, and the Executive Committee named the fourth Wednesday in September, 1893, which met with the approval of the convention.

The meeting then adjourned.

The following, in addition to the delegates mentioned above, were present: J. A. Hanna, McGuire Manufacturing Co., Chicago, Ill.; P. K. Andrews, J. G. Brill Co., Chicago, Ill.; Frank A. Rogers, the Short Electric Railway Co., Cleveland, O.; Elmer P. Morris, The General Electric Co., Boston, Mass.; Francis H. Strieby, Central Thomson-Houston Electric Co., Cincinnati, O.; J. F. Macartney, Railway Equipment Co., Chicago, Ill.; F. D. Russell, Rochester Car Wheel Works, Rochester, N. Y.; W. E.

Haycox, Fulton Foundry Co., Cleveland, O.; H. A. Dorner, Dorner & Dutton, Cleveland, O.; C. B. Squire, American Casualty, Insurance & Security Co., Cleveland, O.; The street railway press was represented by Clarence E. Stump, of the STREET RAILWAY JOURNAL, New York.

There was no regular banquet, but most of the attendants at the convention dined together in the evening at the Clarendon Hotel. We present on the opposite page a reproduction from cover of the menu card which was printed in colors and presented to the Association by the STREET RAILWAY JOURNAL. The secretary of the Association in acknowledging same writes as follows:

OHIO STATE TRAMWAY ASSOCIATION,
ZANESVILLE, O., November 16, 1892.

PUBLISHERS STREET RAILWAY JOURNAL, NEW YORK.

GENTLEMEN:—We received the menu cards for the annual dinner of the Ohio State Tramway Association. They are very pretty, and the design illustrating electricity and the cable driving the horse to other fields of labor is certainly very appropriate at this time. I believe there are less than 3,500 horses now in street car work in the state of Ohio, and in one year I don't think there will be one half of this number left. Please accept the thanks of our Association for your enterprise in getting up the design, as well as for your generosity in presenting them to us. Very truly yours,

J. B. HANNA, secretary and treasurer.

Discussion on Return Circuits at the Cleveland Convention.

Below will be found an abstract of the discussion on the report of the committee on "A Model Electric Railway Roadbed and Underground Wiring," presented at the eleventh annual meeting of the American Street Railway Association at Cleveland, O., and not heretofore published. With the consent of the secretary of the Association, we now present the matter to our readers.

MR. PEARSON, of Boston: There is one point in connection with this report on track construction which has not been touched upon to-night, and which merits attention; and that is, the return ground. In small towns and systems where there are few cars running, the ordinary method of returning the current through the rails and supplementary wire will be sufficient unless the distance is great. On large roads where the traffic is heavy, more return grounds than have been used heretofore will have to be installed. We found it so in Boston, and from a lack of return feeders a great deal of electrolytic action was caused in our supplementary wire, and we are now putting up a large amount of overhead copper for return grounds. I do not think it possible to put it underground, as it will corrode and rust away. There is no advantage in using iron, as the conductivity is only one-seventh that of copper.

The question has been asked me if we run the positive or negative current through the trolley wire. Originally we ran the positive through the trolley wire, but we found that the action on the supplementary wires was too great, and we changed it and put the negative to the trolley wire. I do not imagine there will be much less effect, as it merely transfers the action to another point.

MR. SMITH, of Waterbury: I would like to ask the gentleman if he has had any experience of trouble with water pipes?

MR. PEARSON: I had not in mind any particular trouble with water pipes, but naturally, if you have a large volume of current going through the earth, it will take hold of a water pipe or gas pipe, or any other pipe, and there will be an electrolytic action set up; and in any large railway system, if the attempt is made to use the earth for return ground by putting in ground plates in driven wells, or by putting them in the rivers, and the return current is not provided with a good metallic circuit, it seems to me that the current must inevitably injure the water pipes and all other pipes. The current when it leaves the car goes into the ground, and taking a water pipe may go a mile on that pipe, then leave it for a better conductor; the result being that the pipe will be corroded at this latter point.

This is all I have in mind on this matter; I simply wish to bring to the notice of the Convention something which I think must be taken into consideration in regard to the return current.

MR. RICHARDSON, of Brooklyn: I would like to ask the gentleman whether he has given thought to the idea of using a portion of the old iron rails which we have to take up, by putting them in the ground; on the basis, as he says, that in iron there is only one-seventh of the power of transmission as of the same weight of copper. I meant to take the relative value of our old steel rails, about thirteen or fourteen dollars a ton, and using five, six, seven or eight, side by side, and making a continuous pathway for the return circuit, fastening them, of course, with proper fastenings, so to make a continuous conductor, not necessarily under the roadbed, but alongside of it, or between that and the sidewalk, so as to provide a proper return, instead of depending on gas pipes, water pipes, or the earth.

MR. PEARSON: It seems to me the difficulty would be to make a joint. If you could weld the rails together or if you could solder them, I think possibly it would work; but I do not believe you could make the joints in any other way that would carry a large volume of current without heating and corrosion.

MR. RICHARDSON: Would that point or joining need to be by copper plates?

MR. PEARSON: I think that would be a poor construction, as the iron and copper would form an electrolytic element, and cause corrosion, even if no current was passed through the joint. The passage of the current would also heat the joint and cause further oxidation.

MR. RICHARDSON: One other question: Is that simply a theory, or has it been tested in practice?

MR. PEARSON: It is partly theory and partly practice. We attempted, in the early days of electric railroading, to use the rail for the return conductor, not putting in supplementary wires, and found it almost impossible to maintain a joint of any sort. Where you drive a large volume of current through the joint oxidation takes place, and the joint soon becomes worthless. This condition will exist, no matter how large the joint is made, and if you use dissimilar materials or metals, a local electrolytic action will also take place. With steel in contact with iron, the effect will be produced in a lesser degree than with copper, and it will take longer for the trouble to develop. It does not seem to me practicable to use old rails for conductors.

MR. BAUMHOFF, of St. Louis: Have you compared the relative consumption of fuel with the trolley wire connected with the positive pole of the generator and the consumption of fuel when the trolley wire is connected with the negative pole of the generator?

MR. PEARSON: No, sir; we have not; it would be rather a difficult thing to do. I cannot see why it should make any difference, as the total resistance of the circuit is equal to the sum of the resistances of the various parts, and the loss in potential is proportional to the total resistance. I do not see what difference it could make whether the resistance is greater on the negative or positive side of the circuit; it is merely a question of driving the current through a certain resistance.

MR. RAMSEY: I would like to ask Mr. Pearson in this connection whether or not he thinks it worth while to consider the use of old cables, discarded from cable roads, for the purpose mentioned? It weighs about two pounds to the foot, or about five or six tons to the mile, and may be purchased at about fifty dollars per mile.

MR. PEARSON: We used considerable cable, old steel and iron cable, in getting across the rivers and connecting our supplementary wires from one side of the track to the other, but it cuts away very fast. For instance, in one place we put in seven ropes or cables, and soldered the joints thoroughly at each end, and in less than four months they were entirely gone. If you had soil which was comparatively dry and sandy, it might do for a time; in a place where the soil is moist and salty, I doubt whether you would get enough life out of it to pay for putting it down.

MR. RICHARDSON: There was one thing the gentleman referred to, I would like to know, why there should be any more difficulty because of using copper plates and rivets in connecting the rails for a mile or less in length;

for instance, laying eight center bearing rails, each thirty feet long, and connecting them as specified, why should there be any more destructive electrolytic action between the copper and iron than there is with the copper bond wires which are used to connect our rails together on the surface?

MR. PEARSON: I think as a rule, in track construction to-day, we use supplementary wires as well as bound wires on the rails, the former having a low resistance as compared with the bond wires and joints, the greater current passes on the supplementary wire and does not go through the joint. If you cut the supplementary wire, and compel all the current to pass through the bond wire, there will be trouble; but as long as you have a good supplementary conductor, so that the current does not pass though the bond wire, the joint will remain cool, and there is no great tendency to oxidation, especially if tinned rivets are used.

MR. RICHARDSON: Do you think there would be any more heat generated with the rails four feet underground than with those at the surface?

MR. PEARSON: The heat would depend on the amount of current passing and the resistance of the joint. Of course the proof of the pudding is in the eating, and the only way to decide this question is to lay the rails as you suggest, several miles in length, and lay them in such a place that a large volume of current will pass through them.

MR. F. S. HOLMES, of New York: I asked an experienced engineer, a pioneer, I believe, in street railroad work, some days ago, what his experience was with ground plates, and he said that in case there was a sufficient number of ground plates along the line, he found that the amperes of current divided about equally between the rail return and the ground wire. Now, in an ordinary battery, the positive pole is the pole that gives and is consumed, and the negative pole is the pole that receives deposit. The construction we have to-day where ground plates are used for return currents makes the trolley wire and the various plates and supplementary wire along the line of the railroad positive and the large ground plate at the station negative. This is wrong, because where this is done the supplementary wire and ground plates along the line are rapidly corroded and eaten away, while the negative plate at the station is uninjured. The conditions should be reversed, the station plate being made positive and the line plates and supplementary wire and trolley negative to it. Corrosion will thus be largely confined to the station plate, which can be easily replaced, and the plates and supplementary wire along the road will remain nearly intact. Of course, to accomplish this the current will flow out by the ground, which will be positive, and back by the trolley wire, which will be negative.

Cost of Gas Motor Traction.

A correspondent of the London *Engineer*, in a recent issue of that paper, gives some interesting figures comparing the cost of operating street railways in Great Britain by horse power, as determined from statistics, and by the Connelly gas motor, as estimated. The correspondent, J. E. Weyman, selects eight localities in Great Britain and Ireland, including sections of the city of London, with miles run ranging from 847,000 to 4,000,000. Some of the results are as follows: For Edinburgh with 846,996 miles run, total expenses of horse traffic, £20,767; gas motor, £13,210; balance in favor of gas motor, £7,557. For Liverpool with 3,062,408 miles run, total expenses—horse traffic, £64,885—gas motor, £47,472; balance in favor of gas motor, £17,413. For South London with 872,131 miles run, total expenses—horse traffic, £18,301—gas motor, £13,008; balance in favor of gas motors, £5,293.

WE have long realized the fact that humanity would sooner or later secure the release of the horse from the cruel requirements of our business, and the substitution in some form or other of a mechanical motive power.—*Buffalo Convention*, 1890.

The Resistance of Return Circuits in Electric Street Railway Practice.

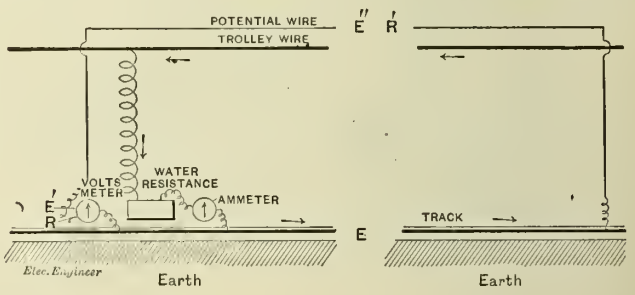
BY R. L. WARNER.

In general electric street railway practice, and more especially where cars are operated at considerable distances from the power station, the securing of a circuit of the lowest possible resistance consistent with economical construction becomes a matter of particular importance. For the overhead or positive side of the circuit the problem is a comparatively simple one, it being merely a question to what extent increased outlay for feeders is compensated for by increased efficiency of transmission. The return circuit through the rails and earth presents, however, an entirely different set of conditions, varying with the location and the seasons, and dependent upon the character of the soil, nature of the construction, cleanliness of tracks, etc. So far as the constructing engineer is concerned, the problem is mainly one of efficient bonding. The question then is, What *is* "efficient bonding," and how may it be most economically secured?

This question has received a variety of answers from engineers, but accurate data as to the relative value of the various methods employed are extremely scarce. It was with a view of securing, if possible, some definite information on this subject that the writer jointly with Mr. G. L. Thayer, undertook, at the instance of a well known firm of engineers, a series of tests, the results of which are here given.

Portions of the tracks in use in Utica, Rochester and Buffalo were included in the tests, the object being to determine the resistance in ohms of known lengths of track representing different methods of construction as regards bonding, etc. The method first tried for determining this resistance was that of the Wheatstone bridge. A portable bridge and battery were taken to Utica, and during the night, after the machines had shut down, the feeders were cut out, the trolley wire and tracks connected at one point and the bridge put in at a known distance, the length of the track and trolley wire forming one arm. The idea was to determine the resistance of this circuit in the ordinary manner and then deduct the known resistance of the length of trolley wire to find that of the tracks. Owing, however, to a counter E. M. F., due to connections and grounds, it was found impossible to balance the bridge, and this plan had to be abandoned.

A fall of potential method was next tried with better success and was used in the subsequent tests. The Utica power station is located



at some distance from the lines operated near the tracks of the R. & W. R. R. Advantage is taken of the proximity of these tracks to secure a return circuit from one portion of the road downtown, the machines being connected direct to the tracks by No. 0 copper wire. The top wire of a barb wire fence running parallel with the railroad was connected to the rails as a potential wire at a known distance from the station, and a Weston voltmeter was used to determine the drop through this length of track, the current being read from a Weston ammeter placed between the machines and the track.

The use of a cut-out feeder as a potential wire, which had been intended at Rochester and Buffalo, was prevented by the fact that these roads operate all night with but a short stop, and it became necessary to run a special line of iron wire for each piece of track tested. The extreme end of a line was tested in each case, where the cars run at long enough intervals to leave the track clear for some minutes at a time. The iron potential wire was connected to the track by filing out a rail joint and wedging the wire against the end of the rail. A No. 5 copper wire bound to a fishing pole was used to take current from the trolley wire, and a convenient adjustable resistance was made by fastening one copper terminal plate on the inside of a wooden bucket filled with water, and suspending another from a slide on the top of the bucket. The capacity of the resistance was increased as desired by the use of salt. A Weston voltmeter of high resistance was used in every case, except the first day on Park Avenue, Rochester, when a Weston instrument of but 597 ohms resistance was used. A correction was, therefore, made in this case, for the resistance of the potential wire. The diagram shows the connections used.

In the case of the Lake Avenue line, Rochester, a nearly constant counter E. M. F. was found. The main circuit was, therefore, broken, and readings of the counter E. M. F. taken before and after each regular reading, and the amount of this counter E. M. F., added to the observed E. M. F., gave the actual drop in the rails due to current flowing.

The tracks tested were as follows:

A

Location: Utica, near power station. 690 ft. single track built of sixty pound T rails, joined by angle bars and laid on sawed ties. No bonding. Condition of tracks, June 8, dry and hot at rail joints. Time, 10 A. M.

Resistance (mean of 26 observations) = .2006 ohm.
" = .2907 ohm per 1,000 ft.
" = .15349 " " mile single track.
" = .7675 " " " double track.

B.

Location: Park Avenue line, Rochester, from car barns west, 3,000 ft. double track, built of flat rails, sixty pounds per yard, set on chairs. Bonded with one No. 3 galvanized iron wire, or two No. 6 galvanized iron wires " and other wire on hand at the time." Wire soldered and riveted to rails. No continuous wire. Rails cross bonded with iron wire every 200 ft. Tracks cross bonded only by the switches at and near barns, which, apparently, answered the purpose of cross bonds very well, as the fall of potential was the same through both tracks. Length of time in use, two months. Condition of tracks, June 28, dry; June 30, very wet, the test being made during a heavy rain. Time, 11 A. M.

Resistance (mean of 14 observations) = .0453 ohm.
" = .0151 ohm per 1,000 ft.
" = .0797 " " mile double track.
Resistance (mean of 12 observations) = .0412 ohm.
" = .0134 ohm per 1,000 ft.
" = .0717 " " mile double track.

C.

Location: Lake Avenue, Rochester, from city limits south, 3,270 ft. single track, built of forty ponnd T rails, laid on sawed ties, no chairs. Bonded with one No 3 copper wire riveted to rails. Continuous wire No. 3 copper is run inside each rail and a soldered strap connection made with each bond wire; rails cross bonded every 200 ft. The tracks are on opposite sides of the street inside the curb, some sixty feet apart, and are not connected in any manner near this point. The track tested on one side of the street may, therefore, be safely called single track. Length of time in use, two years. Condition of track, June, 30, wet. Time, 4 A. M.

Resistance (mean of 18 observations) = .0256 ohm.
" = .007838 ohm per 1,000 ft.
" = .0413 " " mile single track.
" = .0207 " " " double track.

D.

Location: End of Tonawanda Street, Buffalo. 4,110 ft. double track, built of sixty pound groove rails set on chairs. Bonded with one No. 3 copper wire, soldered and riveted to rails. Continuous wire No. 3 copper is run inside each rail, and a soldered strap connection made with each bond wire. Rails are cross bonded every sixty feet; tracks cross bonded every ninety feet. Length of time in operation, about one year. Condition of tracks, July 2, dry. Time, 1 P. M.

Resistance (mean of thirty observations) = .01982 ohm.
" = .004815 ohm per 1,000 ft.
" = .0254 " " mile double track.

E.

Location: Line running from Buffalo to Tonawanda. Connects with Tonawanda Street line at city limits. 3,810 ft. single track, built of forty-five pound T rails laid on sawed ties. Bonded with two No. 4 galvanized iron wires, soldered and riveted to rails; no continuous wire. Rails are cross bonded every sixty feet. Length of time in operation, about one year. Condition of tracks July 2, dry. Time 3 P. M. No very heavy currents could be used with this track owing to the limited capacity of the station, the cars being operated by one 120 K. W. machine.

Resistance (mean of twenty-four observations) = .0832 ohm.
" = .0218 ohm per 1,000
" = .1154 " " mile single track.
" = .0577 " " " double "

The resistance has in each case been reduced to ohms per mile double track, the assumption being made that the resistance of two tracks in parallel will be half that of either one, which is very well borne out by a comparison of the results obtained. A consideration of the conditions of the different pieces of track tested affords an explanation of the slight differences of resistance for tracks of similar construction. Track " B" shows a resistance of .0797 ohm when dry, as compared with .0577 ohm for track " E," the method of construction being similar with the exception that " B" was bonded with one No. 3 wire, two No. 6 wires and " other wire on hand at the time," while the Tonawanda line, " E," was bonded throughout with two No. 4 wires, the wire used in both cases being galvanized iron. The difference in favor of the more thorough bonding is over 27 per cent. It will be noticed that the more lightly bonded track has a sixty pound rail, as compared with a forty-five pound rail for the track of lower resistance. The construction of tracks " C" and " D" in Rochester and Buffalo respectively, is very similar and the resistance proves to be less in the case of the former, which was very wet when tested. It happens in this case again that the lighter rail is in the track of lower resistance. Comparison of the results for the two days on Park Avenue track " B," shows that the resistance is some 10 per cent. less when the tracks and earth are wet.

Taking results representative of the three general cases for comparison we have:

" A." Resistance of unbonded track (double) per mile = .7675 ohm.
" E." " double track bonded and cross connected with *iron* wire *non-continuous* = ... .0577 ohm.
Resistance being only 7.5 per cent. of A.
" D." Resistance, double track, bonded and cross connected with *copper* wire, *continuous wire* = ... .0254 ohm.
Being a reduction of 56 per cent. from " E." due to *copper* and continuous wire.

That weight of rail does not enter appreciably as a factor in the resistance of the return circuit is shown conclusively by a computation of the resistance due to bonds alone. In case " D," taking the average length of a bond as three feet, 176 bonds per mile, there is, roughly, 530 ft. of bond wire per mile for each rail. In one mile of double track then, there are eight No. 3 wires in parallel, four of them 5,280 ft. in length, and four 530 ft., the resistance of which proves to be .0236 ohm.

Case " D."—Total resistance of tracks, *tested*..... .0254 ohm.
Resistance of bonds and continuous wire *alone, computed*..... .0236 "
Difference..... .0018 "

Similarly for case " E."
Total resistance of tracks, *tested*..... .0577 ohm.
Resistance of bonds *alone, computed*..... .0556 "
Difference..... .0021 "

From this it will be seen that it is possible to compute within a few per cent. the actual resistance of the return circuit with *any* proposed method of bonding, etc., as readily as may be done for the overhead construction.

That the use of a continuous wire with each rail in addition to bonds, commonly recommended as " best construction," is not only much more expensive but also considerably less efficient than thorough bonding alone, may be readily proven. Taking, for instance, case "D" above, suppose that instead of *one* bond of No. 3 copper at each rail joint with continuous wire inside rail, there be used *two* bonds of No. 3 copper *without* continuous wire. Assuming as before an average length of three feet per bond, there would be for double track construction per mile eight No. 13 wires, 530 ft. long in parallel, with a resistance of .013 ohm. Allowing for resistance of rails and connections .002 ohm, the total resistance of one mile double track = .015 ohm. The resistance with continuous wire instead of additional bond (see " D") was .0254 ohm, or 0104 ohm *more* than in the case assumed. The length of No. 3 wire required per mile double track for construction " D" would be

Continuous wire.....	21,120 ft.
Bonds.....	2,120 "
Cross bonds.....	1.240 "
Total.....	24,480 "

or 3,898 lbs. of copper at fourteen and a quarter cents per pound, costing $555.47, while for the assumed construction it would be

Bonds.....	4,240 ft
Cross bonds.....	1,240 "
Total.....	5,480 "

or 872 lbs., costing $124.26.

The change amounts in substance to cutting out four pieces of wire 4,750 ft. in length and substituting for them rail of practically unlimited carrying capacity, effecting a reduction in resistance of 41 per cent. and a saving in cost of copper for the return circuit of over 75 per cent. The possible saving would, of course, be considerably greater in the case of roads using No. 1 or No. 0 continuous wires, and would seem to be well worthy the consideration of street railway managers and constructing engineers.—*Eletrical Engineer.*

European Opinions of Our Publications.

From the Glasgow Herald.

"The STREET RAILWAY JOURNAL is the most important organ of the business in America, and it is also an outspoken and impartial one."

"There was recently noticed in our review columns a work just published in New York, entitled " Street Railways: Their Construction, Operation and Maintenance." The book should be in the hands of every one who desires to be acquainted with the details of the various systems. With the aid of numerous illustrations the author, Mr. C. B. Fairchild, editor of the STREET RAILWAY JOURNAL, explains the entire mechanism employed under the different methods of traction in use. While Mr. Fairchild purposely refrains from expressing any opinion as to the relative merits of existing systems, he gives carefully prepared tables of the estimated cost of constructing and equipping a cable and an electric road under the same conditions. The author is acknowledged to have a special knowledge of his subject."

THE electric railway at Halle, Germany, constructed on the overhead system, has given such good satisfaction that the managemeut has extended the line. This road was installed by the General Electric Co., of Berlin, which also installed the electric railway at Gera, and has recently received the contract for installing another electric railway on the overhead system at Dessau.

Editorial Correspondence.

Toledo, O.

This city, which is located on the Maumee River, about nine miles from lake Erie, has a population of about 100,000, and is better provided with street railway facilities than any other city of its size in the country. All the lines of the city are operated by two companies, the Toledo Consolidated and the Toledo Electric Street Railway Co., whose managing officers gave us a most cordial welcome. As the lines were quite fully described in our March, 1892, issue, there is little that remains to be said except to note a few additional mechanical details and give such results of practice as are permissible and will be of advantage to others.

The first thing that attracts the notice of a stranger is that there are two trolley wires over each track on a portion of the lines supported by duplicate poles and cross suspension. This is one of the unfortunate conditions resulting from the rivalry between the old and new companies. The city authorities having given the latter company authority to run upon the track of the former in certain streets rendered it necessary to have two wires, as the old company would not share their current with their rivals. In the wiring of the lines of the Consolidated company the telephone and other poles were used for supporting the trolley wire, and in some cases where the tracks are laid to the side of the street next the sidewalk the trolley is supported by iron brackets attached to the telephone poles.

TRACKS.

The tracks of the Electric company's lines are laid single in some of the streets with turnouts, and turnouts are located on all curves. This, in the estimation of the manager, is a desirable arrangement, as the driver can see ahead from the curve and make the next turnout in case an approaching car is not in sight. It is noticed that on the single track lines the rail joints stand up much better than on two track lines where the cars run continually in the same direction. This experience corresponds with that of several other cities, which has been before noted in these columns. A curious experience was had by the Consolidated company on one of its new tracks (as is incidentally mentioned in another article) by the buckling and spreading of the rails, owing, it is supposed, to their being laid in cold weather, without sufficient allowance at the ends for expansion. This occurred where the track was laid on a dirt road, and necessitated the taking up of the rails, sawing off the ends in some cases and replacing others with new rails.

BOILERS.

Two types of boilers are employed in the plant of the Consolidated company, four being 150 H. P., Harrison safety, and two 300 H. P., Stirling water tube. The latter, we were told, are giving the best satisfaction. Oil is burned as fuel which is delivered to the furnace by Reed burners. It requires about eighty barrels of oil a day at a cost of forty cents a barrel to operate the plant which furnishes power for driving sixty-three cars and also power to outside parties for operating stationary motors.

ENGINES.

The three tandem compound, condensing engines of this plant, which were manufactured by Hooven, Owens & Rentschler, of Hamilton, O., are giving excellent satisfaction to the company, as are the other two cross compound, condensing engines in the Electric company's plant, which were manufactured by C. & G. Cooper & Co., of Mt. Vernon, O. The Electric company also employs a 250 H. P., McIntosh & Seymour engine for lighting purposes, and proposes to increase the power plant by the addition of a 1,000 H. P., Cooper engine.

The arrangement of the power station of the Consolidated company with the generators above the engines on the second floor is not very satisfactory to the management, as the vibrations of the machinery are communicated to the building, and the arrangement of the countershafting consumes a great amount of power.

GENERATORS.

The generators employed in the two plants include two types of the Thomson-Houston, Westinghouse four pole machines and Edison machines. In the plant of the Electric company is a novel arrangement of air pipes, which, in warm weather, are utilized for delivering a blast of cold air to the generator bearings, thus keeping down the temperature. A small Sturtevant fan, located in the basement, supplies the air blast. The Jewell belting is employed in the Electric company's station, and belting made by the Munson company in that of the Consolidated, and in both cases good results are reported.

MOTORS.

Both lines employ a variety of motors, including the Thomson-Houston of both the double and single reduction types, the Westinghouse and Eickemeyer. The Electric company also employs several motors of a special type, manufactured in Toledo, after designs furnished by the company's engineer. Both companies expressed a preference for the same type of motor, and will place their future orders accordingly, unless the home-made motor should prove still more satisfactory. Both companies make their own electrical repairs, and the Consolidated manufactures a good many supplies, including switches, insulators, rheostats, etc. A large number of parts are kept in stock, which are sorted and stored in a well arranged store room. The repair shop of the same company has a good equipment of iron working tools and an ingenious machine for winding field magnets and putting on the binding course. This machine is driven by a friction wheel, which is brought into contact with a shaft pulley by means of a foot lever.

NEW APPLIANCES.

Among the new appliances recently adopted by the Electric company is an electric heater invented by F. B. Perkins, electrician of the company. These heaters occupy but very little space, being placed against the footboard of the seat on each side near the end of the car, and the four consume less than six amperes of current for heating a car. The Consolidated company employs a high wagon for making overhead repairs, which was designed by the company's electrician, and is illustrated in another column of this issue. It is in high favor with the management.

TRANSFERS.

A system of transfers is in vogue on both lines by which a passenger carried in on any line can take a car for another line in front of the company's offices. The Consolidated company put a transfer agent on the street to issue transfers, but on the other lines the conductor issues the transfer tickets, which, however, the holder has to have stamped at the office. An accurate time stamp machine is placed in the reception room, which automatically changes the time stamp every minute. The streets along the lines being lighted by electricity, the Consolidated company has discarded the headlights on its cars, and has only an electric lamp beneath the roof, which lights the platform and steps.

CARS.

Brill cars and trucks are employed on the Electric company's line, and cars manufactured both by Brownell and Brill on the lines of the other company. The light gray color in which some of the Brill cars on the lines are painted is not, we should judge, a desirable color for such smoky cities as Toledo, as the soot streaks it badly, and gives the cars an ancient look. Different patterns of McGuire trucks are employed on this line, and recently they have been improved by replacing the end spiral springs with elliptical springs.

The Mekarski air motor, which was operated during the early spring on the lines of the consolidated Company, has been withdrawn and the compressing machinery is idle. The specific difficulties that were encountered in the operation of this motor were not stated to us, except that it was difficult to keep the cylinders true, and under pressure the air leaked through the valves of the cylinders.

Superintendent Denman, of the Consolidated Company, has come up to the position through nearly all the lower grades, he having begun as hostler, then driver, transfer agent, conductor, assistant superintendent and superintendent.

Chicago, Ill.

The street car lines of Chicago are under the control of three separate companies which operate upon 381 miles of track, and transported during 1862 about 233,000,000 people. Of this number the Chicago City Railway, of which George H. Wheeler is president and M. K. Bowen superintendent, operates 148 miles, of which thirty-four are cable, and enjoys a patronage of over 90,000,000 people annually. The West and North Chicago Street Railway companies are controlled by a syndicate, of which Charles T. Yerkes is president, but are independent in operation, John B. Parsons being general manager of the West Side lines and J. M. Roach having the supervision of the lines of the North Side. The mileage of the West Side is 145, of which eighteen are cable, and the annual traffic at present reaches about 93,000,000. The North Side system embraces eighty-three miles of track, of which seventeen are cable, and transports about 50,000,000 people annually. Of course such a patronage with economical management renders the securities valuable, the latest quotations being 445, 209½, and 259½ for the Chicago City, West and North Chicago companies respectively.

The number of employes on the three systems is about 10,000. The Chicago City company pays conductors and gripmen on the cable lines about thirty cents (29.29) per hour. Horse car drivers and conductors twenty-one cents, and conductors on mixed cars, or cars which are hauled both by cable and horses, twenty-four cents. Trackmen are paid $2.25 per day, and ordinary day laborers $2.

The West Chicago company pays conductors twenty-one cents per hour for not less than ten or more than twelve hours, gripmen twenty-three cents and drivers twenty-one cents per hour. New men get seventeen cents per hour until they have turned in thirty trip sheets or have done thirty days' work, when they receive the full rate. The men are also allowed ten minutes calling time, so that a man may possibly earn as high as $2.80 a day. Both conductors and drivers of night cars receive thirty-five cents per hour.

The North Chicago company pays $2.25 and $2.50 a day respectively for conductors and gripmen. Neither the conductors nor drivers have to sweep or clean their cars.

CABLE LINES.

The cars on the cable lines are usually run in trains, and during the rush hours as many as four cars, including the grip, run, and on a very close headway. Three different styles of grip cars are employed. The South Side lines operate an open grip car with short cross seats. The West Side lines use open grips with both cross and side seats facing out on the Madison Street line, and a combination grip (both open and closed) car on the Milwaukee Avenue line. The North Side lines employ the combination grip, also two types of open grips, one of the ordinary size and one very short, not over eleven feet. This short type has the most favor with the management, as a train seems to start and get under headway more readily with them.

The cars on the South Side line were mostly built in the company's shop. There are some Stephenson cars, and recently eighty new cars have been ordered from the J. G. Brill Co., and the company is building twenty-five trail cars in its own shops, which will be mounted on the Ohlson truck. A large number of the closed cars on the West Side lines are also home-made, but there are a number of the American Car Co.'s make. The North Side company also builds a good many of its own cars, but has recently added thirty of Brownell's Accelerators, which are very much in favor with both the management and the public. The company is also making over some of its old cars and modeling them after the Accelerator. The same company also operates one of the Low adjustable combination cars built by the California Combination Car Co. All the companies have recently been increasing their car equipment in preparation for the World's Fair traffic.

THE LOOPS AND TUNNELS

are the chief characteristics of the Chicago cable lines. The city terminal of each line forms a loop, and the West and North Sides lines approach their loops through a tunnel under the Chicago River. The Wabash Avenue and the State Street lines of the South Side system formerly used the same loop which passed around a block between the two lines, the cable of which is driven by auxiliary machinery located in State Street and operated by the State Street rope. Last year a separate loop was made for the Wabash Avenue line, and on this the main cable runs without an auxiliary drive. It is not apparent why these two lines, which run the same number of cars, are operated separately. It would seem much more economical to abolish the loops and allow the cars to pass from one line to the other across one block and continue on to the end of their respective routes, the car signs being changed for the purpose.

The course of the rope which operates the loop of the West Side lines is shown in the accompanying illustration,

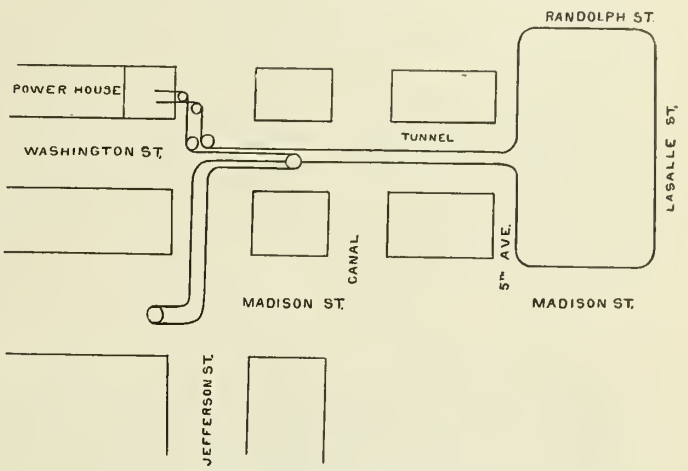


FIG. 1.—LOOP OF WEST SIDE LINES, CHICAGO.

Fig. 1. It is a $1\frac{5}{16}$ in. wire rope, about 10,000 ft. long. The loop turns ten corners, agregating 900 degs. of curvature. The tunnel portion is 900 ft. long, and the grades are about 9 per cent. About eighty trains per hour enter and leave the loop, and frequently there are thirteen trains in the tunnel at one time, six or seven of which are on the up grades. About 300 passengers constitute a train load during the busy hours, and should the grip of one train give out the next must push it out. The engine which drives this rope frequently develops 15,000 H. P., showing that the service imposed upon it is very severe, reducing its life to thirty days. The tunnel and loop of the North Side lines with the heavy trains (an eight wheel combination and three long cars) impose about the same service on the tunnel rope, but its life is a little longer. C. B. F.

Credit Where Credit was Due.

At a meeting of the executive committee of the Cincinnati Street Railway Co., held on October 24, 1892, the following resolution was adopted:

Resolved: That the thanks of this company are due to Superintendent John Harris for the very efficient manner in which he handled the cars on the various lines of the company during the three days of Christopher Columbus reception festivities, causing no interference with the parades, and at the same time accommodating the patrons of the street railways to the fullest extent.

THE street railroad business of to-day is conducted upon lines thought out by intelligent and progressive men, and not, as ten years ago, in the main by narrow minded, selfish men, who guarded with zealous care as so much individual capital stock anything for good or evil which they had met with in their experience.—*Cleveland Convention*, 1892.

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THE STREET RAILWAY JOURNAL

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

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The Single Trolley System demands the grounding of one side of the circuit, but opinion has been divided as to whether the positive or the negative pole of the generator should be grounded. The early rule was to make the earth the negative side of the circuit, and this method was generally followed in the roads at first installed. Modern practice has shown, however, some advantages in following an opposite course, and the opinions of well known engineers on the subject, given elsewhere in this issue, will undoubtedly be read with interest.

An Experiment in Insurance as noted elsewhere in this issue, is being made by a prominent street railway company, which has decided to set aside yearly from the gross receipts a certain sum to be known as the "Insurance Fund." From this fund all payments for accidents caused by the cars of the company will be made. As an incentive to the employes to operate carefully, any surplus remaining at the end of the year will be divided among those drivers and conductors who have operated their cars free from accident, the division being made according to the number of miles run by each man. The accident item in a street railway expense account is apt sometimes to be disagreeably large, and the experiments of the Montreal Street Railway Co. in dealing with this problem will be followed with interest on this side of the boundary line.

Chicago Real Estate Men believe very thoroughly and very enthusiastically in the future of the Western metropolis. At their recent banquet two weeks ago one of the speakers predicted that Chicago was bound to outstrip New York by the next census; still, we imagine that the residents of the latter city are little fearful of the loss of supremacy. They can generously allow Chicagoans to predict as bravely as their enthusiasm may dictate. While we may not share in the opinion that the financial center is to move Westward, we can subscribe very heartily to all the statements which were made regarding the necessity of good rapid transit systems, and the benefits that follow their establishment. Chicago is bound to grow, so it is doubtless true that the real estate man should encourage the street railway man and the latter "must lay out the streets, build the street cars, the electric cars and the surface and elevated steam railroads."

A Proper Organization of the executive force of every large street railway company is an important consideration regarding the wise and economic operation of the lines. The importance of this subject presses itself upon us more and more as we mingle with street railway men, for we sometimes find that a few men in a company are overloaded with work and hampered in their usefulness because of the want of proper organization and a proper distribution of labor. The responsibility for this state of affairs rests usually with the directors, but sometimes a manager tries to do too much, and fails to throw off a share of his work upon others. This is apt to be the case where the manager of a comparatively small line comes into a position by consolidation and extension, where he is required to control a large system, in which case, unless he broadens out to the situation, he will have but indifferent success. To meet these cases, and as a gentle reminder of what may be done, we present in another column a number of statements from street railway companies bearing upon this subject, and these will be followed with others in our January issue.

Unreasonable Criticism seems to be one of the inevitable accompaniments of a street railway company's existence. It is berated if it will, and berated if it wont. There is a striking illustration of what is, unfortunately, almost a general truth to be found in Chicago at the present time. The citizens have desired a change in one of the cable terminal loops, and permission was recently granted by the city authorities for the extension of the cable system. Note the result. No sooner was the work well under way than a cry went up that the enterprise should have been begun before, and that the company was not prosecuting the work vigorously. The critic exhausted his vocabulary in bitter attacks, and the cartoonist employed his pen to represent city streets in an impassable condition, with piles of dirt reaching mountainous heights, while citizens clad in tourist suits and armed with Alpine stocks made slow and painful progress. Now, as a matter of fact, the company instituted proceedings as soon as it was allowed to do so, and the delays encountered have been either necessarily incident to the work or of a nature for which the company was in nowise responsible. And yet the improvement was one for which the public had been clamoring! Truly, the lot of a company that wishes to accede to the demands of the people is far from an easy one.

Three Men, from their position in the street railway field, will be brought into prominent notice next year, because of the World's Fair. We refer to the men who now manage the operating department of the three great Chicago systems known as the South, West and North Sides lines. The bulk of the increased traffic will come to the lines of the Chicago City Railway Co., of which Mr. M. K. Bowen is superintendent, because of their proximity to Jackson Park; but the lines of the

West Chicago Street Railway Co., which are under the efficient management of Mr. John B. Parsons, will receive a large increase, as will also the North Chicago company's lines, now under the supervision of Mr. J. M. Roach. These men, we find, are keenly alive to the situation, and are making every preparation to handle the tremendous traffic that will be imposed upon their lines, and this they are confident they will be able to do expeditiously, their chief concern being the increased liability to accidents on account of the presence of a large number of strangers who will not be accustomed to the high speed and frequency of the trains which are characteristic of the service of this city. The whole world will be here next year, and those interested in rapid transit will give special attention to the various street railway appliances that will be on exhibition at the fair grounds. But by far the most practical exhibit of modern methods will be found in the every-day practice of the city lines, which embrace horse, cable, electric, steam and gas traction, as well as elevated lines. The street railway fraternity of the country are to be congratulated that the management of these lines, which are to come into such prominent notice, is in the hands of such able and experienced men, who will, we are confident, do honor to the profession, although the task will impose upon them much anxiety and a great amount of labor.

The Plans of the New York Rapid Transit Commission, it has recently been publicly announced, have been completed and the specifications prepared upon which capitalists will be asked to furnish the money to prosecute the undertaking. Aside from the engineering questions involved, which have been ably considered by the Commission and their professional advisers, it is interesting, at this stage, to inquire whether the requisite capital is likely to be furnished. A moderate estimate of the cost of the underground railway, as designed by the Commission, is not far from $100,000,000, or more than twice the entire capital of nearly forty-two miles of elevated roads which form the Manhattan Elevated Railway system. The report of the Manhattan Railway for the year ending September 30 last showed that the total number of passengers carried during the year was greater than in the preceding year, but not a very large percentage of increase. On the financial side it was shown that the earnings were such as justified but a fair dividend and left a surplus sufficient for contingencies. Upon what grounds are investors to be convinced that an expenditure of twice the capital of these elevated roads, which carried certainly for years not less than one-half the passengers likely to travel by rapid transit systems, will pay a dividend?

It is now being suggested by those who are in the counsel of the Commission that, in case capital shall not be furnished by private parties, the underground railway may be built under municipal authority and from the public moneys. So far in the history of the government of cities in this country this is a novel departure, and at present it is not possible under existing law. The Legislature will be asked to remove the restriction whereby the debts of a city shall not exceed a certain proportion of its taxable property. Perhaps $40,000,000 may be added to the debt of New York City before this limit shall be reached, under the law as it now stands. To repeal this condition will involve an entire change of municipal policy, the result of wise, persistent and continued effort of legislators who saw the necessity of preventing grave abuses affecting the control of the finances of large cities.

The Greeting and Invitation extended to the tramway managers and officers of European and foreign countries, asking them to attend the twelfth annual convention of the American Street Railway Association to be held next year at Milwaukee, was one of the most graceful and, perhaps, one of the most important acts that marked the proceedings of the recent Cleveland Convention, and we hope that all foreign papers interested in the development of transit facilities will give the invitation a wide circulation. Such a congress of street railway men from all parts of the world cannot but work to the advantage of all interested in this particular industry, and through them to the growth of hundreds of cities, the development of property, the comfort and improvement in the social condition of millions of people in every land, for these are the leading features that always follow in the wake of street railway development. Such a coming together will emphasize to the world what a power and what a factor street railways are in the development of a higher civilization. The conditions for such a meeting are opportune; for the attractions of the World's Fair at Chicago (from which Milwaukee is only eighty-five miles distant) and the reduced rates of fare incident thereto will make it possible for all countries to be represented.

* * * * *

While we boast of our superior transit facilities over those of foreign countries, there is, doubtless, much that we can learn from those who come from abroad. We have not yet reached, by any means, that high state of development to which it is possible to advance this industry, and unless we go on improving, the sharp eyed, imitative foreigner will transplant our methods into foreign soil, and before we know it outstrip us in growth and development as is sometimes the case with the transplanting of plants and flowers. In connection with the next meeting of the Association, every member should remember (in case the invitation is accepted, as it doubtless will be,) that a rare opportunity is presented for the exercise of a generous hospitality on the part of each individual member, that our friends from abroad may bear away with them to the ends of the earth this characteristic for which street railway men are proverbial.

The Present Number of the STREET RAILWAY JOURNAL closes the volume for 1892, which contains 786 pages. We leave our readers to judge from the files of the year how well we have kept the pledges made a year ago. We realize more than ever before the great responsibility that is laid upon us to make this paper a still greater power for good in the street railway field, and, counting on the aid of our patrons in the future as in the past, we shall endeavor, not only to keep abreast of the marvelous progress being made in transit facilities, but to lead on and encourage in the line of a still higher development. The credit for whatever benefits the STREET RAILWAY JOURNAL has conferred upon the business, is largely due to the liberality of many practical men who have put the results of their experience at our disposal, thus enabling us to present to our readers the best methods employed by our leading lines, for which aid we are profoundly thankful. Our practice of visiting the principal cities of the country and studying their street railway

systems we shall continue, and will give special attention during the next few months to the cities of the Northwest, extreme West and South from all which we know there is much to be learned.

* * * * *

While we flatter ourselves that our efforts are generally appreciated, and that we are doing a certain amount of good, it is apparent to us, as we visit from city to city, that there is a considerable number of street railway men who are not reaping all the benefits they might from the paper, because they are ignorant of its aims. In one case we find a manager who stands at the head of his profession who states emphatically that his success is largely due to the suggestions that have come to him through our columns. In another case we find a man who is conducting a very indifferent service and is ignorant of it, because he has failed to compare it with that found in other cities. It is this class that we expressly desire to reach during the coming year, so that every town in the country which may possibly be inspected by foreigners coming to our shores, may be a model in economical and efficient management.

* * * * *

We also wish to emphasize the benefits which a company may derive from putting the STREET RAILWAY JOURNAL into the hands of all the foremen and heads of departments. The expense will be many times returned by more intelligent and efficient service on the part of these employes. The business is constantly growing and improving, and all the men should grow with it; besides, with a number reading the paper, not many important matters, such as a description of new and important inventions and new advertisements, would be overlooked, and besides, many valuable suggestions would come up to the management from their men that otherwise would never have been thought of.

The Matter of World's Fair Transportation is considered in two different phases in this issue. In the first place the probable adequacy or inadequacy of the facilities by which the visitors may ride to and from the grounds is discussed, and second, the means of transporation within the Exposition enclosure are described. Both divisions of the subject are of interest. As Jackson Park, the site of the Exposition, is seven miles from the center of Chicago, the organization of exceptionally good transportation facilities is a condition precedent to the complete success of the great enterprise. If people are to be seriously delayed by waiting for cars, or if they are crowded and crushed while taking the trip they will speedily reach the conclusion that the Fair is a lamentable failure. When they arrive at the grounds visitors will to be whirled from one point of interest to another with the least possible delay. A vast number of persons will make it a point to "do up" the exhibits in the quickest possible time. It is useless to protest against the spirit of rush; it is bound to dominate a large proportion of the Fair attendants. These facts have been very thoroughly appreciated, both by the Exposition authorities and by those charged with providing transit qualities, and the recent dedication of the Fair buildings attracted such throngs that they were enabled to gain something of an idea of what may be expected next year. Just what the situation was is depicted by our correspondent in one of the articles referred to, and at first glance his statement would not seem wholly encouraging, for while the circumstances combined to make the transportation of crowds a much easier matter than can be anticipated for next year, still, the provision was entirely inadequate. It would be by no means fair, however, as our correspondent notes, to draw the conclusion that because the facilities were insufficient at this juncture, the transportation problem will not be solved, although a number of observers have recently seemed to share that opinion. One of the members, Chauncey M. Depew, has stated that while the people can be conveyed to the Park with relatively little trouble, a vast amount of difficulty will be experienced when it comes to transporting them from the Fair at night, as most of the attendants will wish to leave at substantially the same hour. It should not be forgotten, however, that at the time of the dedicatory exercises the roads were wholly unprepared to deal with a vast increase in their business; it was out of the question for them to double their facilities for a day or two. Not only are the plans for next season not yet carried into effect, but the very preparatory work already in progress hampered the companies very seriously. It seems to us that Dr. Depew and a number of friendly critics have failed to take into an account of the changes which will be wrought within the next year, changes which our correspondent outlines, and which will entirely change the aspect of things. While we do not regard the problem as one which lends itself to an easy solution, we are inclined, to believe in view of the splendid increase in facilities, that the Chicago railway managers, with the enterprise that has made them famous, will overcome the difficulty. They have a way of surmounting obstacles in Chicago that is as surprising as it is admirable, and we think that persons who are gloomily wondering how people can reach the Fair even after they are in Chicago, are borrowing trouble on a very generous scale.

* * * * *

The recent announcement that the gates will be closed at 7 P. M., except upon special occasions, has a particular interest in this connection. There is a multitude of weighty reasons for keeping the Exposition open during the evening, and these arguments have been advanced by the press and the public. We desire in this connection, however, to refer merely to the bearing which the hour of closing may have upon the transportation problem. Whatever may tend to facilitate the gradual movement of the people to and from the grounds is assuredly eminently desirable from the point of view of the railway man. If the gates were open until, say, 10 : 30, it is true beyond question that people would be starting cityward three hours before that time. On the other hand if the closing hour were 7 o'clock, certainly a vast majority of the people would be inclined to remain until that hour. All the conditions that lead to a congestion in traffic would be present. Here is a point which seems to be well worthy of the attention of the Exposition management.

* * * * *

As it has been stated, the intramural railway in the Fair grounds, by which visitors may travel from point to point, is described by our correspondent. The road is to be operated electrically on an elevated structure, and its successful operation will demonstrate the adaptability of the electric motor to elevated railway conditions. If successful, the electric motor will achieve another signal victory. A splendid power station is to be equipped, and the plant will constitute, perhaps, the feature of greatest interest to street railway men.

THEN AND NOW.

Within a few years we expect to find the New York and Brooklyn daily papers and the popular magazines vying with each other in their praise of the rapid transit system, including the trolley lines, which will at no distant day be in extensive operation in the two cities. We opine that in the left hand column below will be found a sample of the subject matter of leading editorials; but these same papers will, no doubt, neglect to state parenthetically what we quote in the right hand column from some of their recent issues.

"Our rapid transit facilities are now second to those of no city in the world. By our elevated, cable and electric lines our people can quickly, safely and pleasantly travel to and from their homes, or go to any part of the city. Not a single line is now operated by horse power, and in view of the superior advantages of mechanical traction we wonder how we endured so long the snail space of the horse car, or submitted to its dangerous, unsightly and unsanitary features. Not only has the advent of mechanical traction contributed to the advantage of the traveling public, but it has aided greatly to relieve the congested condition of our streets by removing the horses, and materially reduced the dangers to pedestrians and vehicles. It has abolished the stables which were an offense to many localities, and in their place we have the power houses, pleasing and attractive in outline, quiet, and free from any objectionable features.

"The cars are handsome and inviting, and the service so admirable that the people ride much more than formerly, and take pride in mentioning the system to outside friends. They are so delighted with the trolley, especially, that you could not hire them to return to the old system. The beauty of the streets is not marred, but rather enhanced by the graceful and neatly painted poles, and nobody ever thinks that the trolley wire is unsightly. By the use of the improved aerial ladders the wires offer no hindrance to the fire department, and by being provided with cut-outs a section of wire may be removed without seriously interfering with the operation of the line or cars.

Everybody has profited by the introduction of these improved facilities, and in a commercial sense their direct benefits are even more apparent than in the line of convenience and safety. Business houses are helped by the increase in the number of shoppers which the lines bring to their doors, and real estate by increased rentals (with no increase in rate of insurance). This is especially true in the case of suburban real estate which heretofore was worth little because not easily accessible by old methods of transportation but which is now brought into the market, so that not only the owners profit by the sale of building lots but the buyers in the possession of good, cheap, and readily accessible homes.

"In view of all these benefits we wonder that anyone should have ever objected to the introduction of the cable or trolley system of street railways on account of their alleged dangers as instruments of fire, of death to men and animals, and of property depreciation. It is not too late, however, for such papers as were misguided in the matter to make amends by doing honor to the men whose foresight provided for the introduction of these splendid facilities. They are worthy of all honor, not only for what they did, but for the courage, patience, faith and perseverance which they manifested in the face of bitter opposition and personal abuse. When we think of this bitter period in their lives, and see them mocked at by those whom they were trying to benefit, haggling with the prejudice of the city authorities and others for the privilege of bringing about a reform in transit facilities which they knew would bring solace to many a toiling one, and which their hard toil has now made common property; when we see this, we marvel how they bore up so well; nor could they, had it not been for their faith in the final result."

"Our citizens are beginning to make their aversion and hostility to the trolley system of electric propulsion seen and felt, and they have not made war on the proposed scheme to introduce this power on our street railways too early or with excessive zeal. On the contrary, there was some danger until within a few days that they might lose the battle by default, and even now a more general and determined opposition would be desirable.

"It could not have been imagined a year ago, when the fear and horror occasioned by the death of a lineman had culminated in a popular demand for the removal of overhead wires, that within so short a time projects for the introduction of the dangerous, disfiguring and delusive trolley in our streets would be tolerated by public officials, pushed forward with confidence by avaricious promoters, and regarded with comparative indifference by the people of this and our neighboring city, but the fact that this is so makes the duty of emphatic protests and condemnation all the more binding upon all.

"The trolley is universally indicted on numerous charges, but chiefly on these that it is obstructive, dangerous, inefficient and unsightly. That the overhead wires are an obstruction, firemen have repeatedly declared and proved to the dismay of numerous owners and tenants of burning buildings. Another obstructive feature in the use of the overhead system is the necessity of almost continually tearing up the streets in order to keep the tracks in repair, for the cars being heavier than those employed on horse lines, the tracks are subjected to a heavier strain and deteriorate rapidly. As a consequence, heavier tracks are recommended and being put in with the paving resting on a bed of solid concrete, and having the joints grouted with tar and gravel, the whole surface becomes as solid as a block of granite, making a roadbed that no one who cares for his horse would drive over, as an unyielding pavement will lame a horse sooner than anything else. For this reason and because they frighten horses and lead to many serious accidents, owners of horses in cities where electric cars are now operated do not care to drive near them, so that some of the streets that were formerly popular with horsemen have scarcely seen them since the electric cars began to run.

"But this is not all; the overhead system of wires is not only in the way in case of fire where the streets are narrow and the buildings high, but it is a source of constant danger to men and animals. A wire drops into a crowded thoroughfare, a man touches it, there is a flash, and another soul is ushered into eternity; or the wires may fall upon a team of horses, as was the case in a Western city lately, when three horses were killed, one of them with a startling display of blue and yellow fire accompanied by the odor of burning flesh. Not only is the trolley itself dangerous, but telephone or dead wires are liable to fall across the naked trolley wire which carries a current of 500 volts or more, and causes it to burn out the telephones or set fire to some office or home, or give a serious shock or cause death to some individual. The guard and guy wires, especially at the turns, form a network like a metallic spider web, and although they may be supported by strong iron poles they are apt to break or sag, so that the public never knows when a storm may not bring down the whole system.

"The dangers from the trolley cars are two: First, from the wires as noted above, and, second, from the cars. The first is not particularly great, and were that all no one would have reason to especially dread the trolley, but the second is a very different thing. It must be remembered, if one would understand this danger, that every moving thing takes more or less power in proportion to its weight to stop its movement, and since the weight and size of a horse car are regulated by the average strength of the pair of horses which pull it, the weight is not so great but that the brakeman can stop it quickly; but with the trolley system there is no limit to the weight of the cars, and the companies being anxious to carry as many passengers as possible make their cars large and therefore heavy. Consequently, they are too heavy for the brakeman to stop them quickly, and if a person gets in front of a car, although the brakeman puts on the brake, the car goes on, on, on, on, until bones are crushed, flesh torn and mangled, and life rolled out. This is the danger which is to be ever present in the streets of our city, so that to the men as they look upon this innovation there come visions of little children—their little children—brought home as shapeless masses of torn and mangled and broken and crushed flesh, looking like nothing human. To the women come the visions of the husband covered with a sheet, and of pitying hands restraining the wife that she may not bear the memory through the coming days of the look of the thing that is all that is left to her after the trolley has passed. No wonder the men and women of the city look with horror on the project, and censure the unscrupulous aldermen who have made this thing possible. All this because the powerful corporations do not care to go to the expense of building a safer but more costly system.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

The $350,000 Cable Road and the $46,000 Electric Road.

IV.

The mile of cable railway, the cost of which was exhibited in my last letter, was an average one made out of 16.48 miles (as their cost stood on the books within about six months of opening) of the 75.22 miles of the ten cable railways of Census Bulletin No. 55. It fairly represents the $350,000 cable road of that treatise. It was built at a time and place of high prices. If we take off "Discount and Commission on Bonds," "Cost of Extending Franchise," "Grading Streets" and "Old Horse Railroad," there remains for the cost of this mile $210,000. If "Bridges and Viaducts" are omitted, the figure is about $200,000. With later details, lower prices on all materials, and better handling of construction, the thing could be done to-day, at a reduced cost.

As to the electric side of the same exhibit, I would gladly have made it unimpeachable; but, of course, that was not possible. As it was, I relied too long on friends better able than myself to bring many of the items closer to the truth—even until the printer waited for copy. Apparently an electric road on such a scale is not easily thinkable. At the last any attempt at extreme accuracy was abandoned for the time being; the more cheerfully because the question so far is really not one of a difference of 5 per cent. or 20 per cent. in cost. On one side is the often repeated assertion that for this cable road, which "cost" $350,000, an electric costing "one-seventh" ($50,000) or "one-tenth" ($35,000) might have been substituted. And the question is, *how*? On the other side is my claim that you could not save one-third of the $350,000, or $116,000. *Can you?*

There is only one way of doing either of these things—the common way—the folly of which my parallel columns must make apparent. You may, with a writer in the JOURNAL for November, 1891, and some others, figure girder rails at $33.00 per ton—but the cable road paid $50.00 to $55.00. And with another in the JOURNAL for March, 1892, you may allow for the power plants for the same work (3,300 car miles on three miles of line in that case) $62,000 for the cable and $27,000 for the electric, or in that proportion—but—but—. And with another in the *Car* for June 1892, you may estimate $1,500, "per mile of double track for cities, assuming four minutes' service," for a "Brick building, iron trussed roof, traveling crane, stack, etc.;" or about enough on a three mile line for a brick smokestack; or an iron stack plus a coal bin, for an electric road. And reading too carelessly a good paper on electric track, of the October Convention, you may estimate the excavation for "eight inches below the bottom of the cross tie," and (if you are not careful) overlook the twelve inches or so immediately above it. And you may figure such excavation, with the same writer, at twenty-five cents per yard—but sixty-six would be about in proportion to the cable prices under contemplation. And you may put broken stone at "three and a half cents" per cubic foot or ninety-five cents per yard, in place—but most of it used on this cable road cost from $1.25 to $1.50, dumped on the ground. And you may figure all track straight, and leave out the crossovers, and the car house tracks and other odds and ends; and put boilers in at $10.00 per horse power, inclusive of erection, and steam pipes and pumps and stokers if you like; and you need not allow a scrap of "waste" on anything, or any reserve in the plant or any surplus of power or cars for the big days needed to make the yearly average—all this you may do with a plenty of precedent, and *at last* you will have to assume with the writer in *Engineering Magazine* for May, 1892, for instance, that the electric road can do this 1,200 mile business with 2.93 cars inclusive of those in the shop.—But still there seems to be an eternal barrier to the step which would bring the electric side down to one-seventh or one-tenth of that $350,000, in over $125,000 worth of the item "Franchises, etc.;" and I think the attempt may as well be abandoned, even on paper.

Going back to my *Comparative Estimate*, the figures stand thus:

	CABLE.	ELECTRIC.
"Franchises, etc."	$140,466.60	$140,466.60
The rest	209,858.00	193,724.00
Grand Total	$350,324.60	$334,190.60

The difference shown is $16,134 in favor of the electric, and on revision I cannot swell this to a *possible* difference of $30,000, the two roads being "*of like capacity*," "*similarly equipped, in the same place, at the same prices.*" I do not exhibit these figures as the "average" cost of cable and electric roads, or as showing the necessary investment for either. But, I think, on candid criticism of my parallel columns, it must seem probable that the electric road equipped for the business of the "$350,000" road of the "Bulletin," with which comparison has so long been challenged, will cost *within* $30,000 per mile as much as the cable road.

But if the difference can be swelled to $50,000, the money can be had on 5 per cent. bonds for just $6.85 per day, a little over half a cent per car mile on 1,200 car miles.

And I nail up this thesis: Given a business calling for from 1,000 to 2,500 car miles per mile of line per day, if the electric can handle it for N cents, the cable can for N — 6 cents.

Six cents is probably small measure of the difference, except at the bottom of this scale, but it is enough, 'twill suffice. Six cents per car mile amounts to this:

On 1,000 C. M., $ 60 per day, or 5 per cent. on....$ 438,000
" 2,500 " 150 " " " " 1,095,000

And you must *save* $400,000 a mile by adopting the trolley in one case and $1,000,000 a mile in the other; and toward that $400,000 you *cannot* save $50,000, and of the $1,000,000 you cannot save one cent, for your electric will cost more than your cable road. If you choose the trolley for "a cable railway business" you will, *every day* on *each mile* of your line, throw away

On 1,000 C. M., $ 60 in operating expenses, to save, possibly, $7.00 in interest.
On 2,000 " 120 in operating expenses, and save nothing in interest.
On 2,500 " 150 in operating expenses, and increase your interest charges.

If you have the horse railroad property, with a reasonable prospect of the average business of the Bulletin, *you cannot afford to take a trolley road, fully equipped for the work, as a gift, with a very large bonus thrown in.* (I am contemplating the trolley in comparison with the *cable*, on "a cable railway business." The trolley would, of course, for *any* business, be a good investment as compared with your "old horse railroad," and it is this that makes ten good places for the trolley to one for the cable.)

As to the relative cost, and roughly the actual cost of a mile at present prices, in most large cities (but barring three or four), supposing each to be double tracked and fully paved with granite, and the "cable" to be of the deep tube type, I submit this, in which the items heretofore lumped for convenience under "Franchises, etc.," and also such accidents as "Bridges and Viaducts," are not included on either side:

RELATIVE COST PER MILE OF DOUBLE TRACK.
On the assumptions made above.

FOR A YEARLY AVERAGE BUSINESS PER DAY OF	CABLE.	ELECTRIC.
200 C. M.	.....	$ 80,000
400 "	.....	93,000
1,000 "	$175,000	135,000
1,500 "	185,000	170,000
2,000 "	195,000	200,000
2,500 "	205,000	235,000

For 200 car miles, and perhaps for 400 car miles, something *may* be saved of my $80,000 or 93,000 on the initial investment by wiring the old horse car track, if it be a fair one. But the day of reckoning is only deferred a little while. And the double track is not essential for 200 car miles on the electric road. At that point we are far below possible competition from the cable road, and it is too early to begin comparison of the systems, but I give the electric a double track from the start, and a fairly good one, that what I think to be nearly the law of the development of its cost, from the point where electric writers leave it up to and well into a cable railway business, may be quite apparent.

If there is a gross inaccuracy in either column it ought to be easy to show it. It is time to stop this exploiting of a mile and a quarter of unpaved or partly paved and not half built track and its 2.93 cars and 177 car miles, as a possible competitor for the business of such cable roads as the averege one of the Bulletin. And it is time to stop talking of this $350,000 on one side and $46,-000 on the other as if the last dollar of the important item "Franchises, etc.", were not *in* on one side and *out* on the other in the document that almost every writer on this subject has drawn upon since April, 1891. And here it may be said, by way of illustration of the "cost" given for the cable railways of the Bulletin, in one case positively, and in another almost certainly, over 60 per cent. of the alleged cost is what I have called for convenience the item "Franchises, etc." and neither of the cases alluded to is that of the "$684,000" cable railway.

It will be seen by this time that the important question is one of Operating Expenses, the difference in interest being likely never to *exceed* $7.00 per day in favor of the electric road, on "a cable railway business."

The Census Office contribution to the study of the "*Relative Economy*," *etc., as analyzed in my letter No. II*, must be admitted to have thrown some light on the subject.

I waited patiently for the *Report of Committee on Relative Cost of Operation of Horse, Cable and Electric Roads* to the Cleveland Convention. Expecting much, I find a hardly respectable attempt to throw any real light on the the subject. I am reminded of the painter who advertised "work done at the lowest prices estimates furnished," and being called in looked the house over and said :

"Sevenandsixarefifteenfourintoeleventhreetimesyoucant,

I'll paint your house for $149.90." The details are of little apparent worth, and not obviously pertinent, but the conclusion is satisfactory to the gentlemen of the house—"*until all rivals are distanced and only one method of rapid transit is recognized, the electric car.*"

A hasty examination of the Cleveland report shows, indeed that some side lights may be got from it by those "taking it home with them and studying the figures analytically." My first twenty minutes on it gave these results among others : Cables Nos. 1 and 2 have operating expenses of 8.81 and 13.70 cents respectively. No. 1 is a singularly well managed road, but its *environment* places it at a disadvantage as compared with No. 2, which also is well managed. Until you know that No. 2 (like No. 3) operates only eight wheel cars and that its 13.70 should be 6.85, against the 8.81 of cable No. 1, you puzzle in vain. (This ignoring of the difference between eight wheel and four wheel cars pervades the document, and in the case of No. 8 *probably* the "20.05" cents stand for *train mile* expenses, but I have not yet got as far as that. Persons who are in the dark on "names, location, and other marks by which a road might be identified," should use such figures gingerly).

No. 1, by-the-by, well illustrates the enormous capacity of the cable system, having with about half of the "miles of line" of the elevated railroads of New York City transported in one day more people than daily ride on all of New York's elevated roads put together; and this not in the air, on a clear track, but on the surface of the ground, through streets jammed to an extraordinary degree with vehicles and people.

No. 6 of the cables operated for 6.75 per car mile, on about 9,000 car miles per day, according to the *Report*. One of the finest of opportunities for comparing cable and electric traction was missed when the Committee failed to get, or at any rate failed to print, the operating expenses of the electric line of the same company side by side with its figures for cable No. 6. There is enough of the electric road in this system to make the writer in *Engineering Magazine* for May, 1892, whom I have several times quoted, mark this street railway company "electric" in connection with a display of its rather high priced stock—in seeming unconsciousness of the fact that two-thirds of its gross earnings and most of its net earnings come from the cable part of its system. Here are a large cable and a large electric road working under conditions nearly parallel, and the Committee has missed an opportunity. If there is less than six cents difference in their operating expenses, I will take down my *thesis*.

Naturally, one of the first things sought by the writer was light on Electric No 1, of the Bulletin in Electric No. 7, of the Cleveland Report. In my letter No. II, I alluded to "an electric whose operating expenses properly speaking, were 17.55 cents in six selected months of 1890, and 19 79 cents for the year 1891" which "turns up in the Bulletin with 13.53." Turning to a copy of the *Car* for November, I find it still 13.53 in what purports to be a copy of the Cleveland report. Seeking light in the column "Fixed Charges" I find a blank, which it would seem the Committee could have filled. The STREET RAILWAY JOURNAL prints 18.53; the figures in the *Street Railway Review*, again, are not easily distinguishable from 13.53. And this difference of five cents a car mile is only explained by an "Advance Copy" of the Report. In *my* copy the question can only be settled by noting that the 3's of the "old style" font used drop below the line, and the 8's rise above it, and this is a case of a bad 8 which is easily read 3. And unless the plates were stereotyped, for instance, and an error was corrected by cutting away a part of the 8, I think the operating expenses of this road "exclusive of fixed charges" were meant to read 18.53 instead of 13.53 as in the Bulletin. *But* the *details* in this Report are as follows :

Maintenance of roadbed and track	cts. 2.50
" " line work including underground wiring	.52
" " power plant, repairs on engines, boilers, etc	——
" " plant, in general, buildings, etc	——
" " rolling stock, car bodies, trucks, etc	2.36
" " motors, inspection and shop work, electrical and mechanical	2.38
Cost of power—fuel, oil, waste, etc., wages of employes	2.84
" " transportation, wages of conductors, motormen, dispatchers, etc	6.90
General expenses—salaries, legal, accidents, etc	2.21
Gross operating expenses exclusive of fixed charges	cts. 19.71

So that the operating expenses of this electric railway which so persistently turn up as 13.53 cents per car mile really appear to be about 19.71 cents, or not very far behind the 19.79 of my letter No. II.

I note, merely as a curiosity, cable No. 4, with "receipts per car mile 15.10 cents" and "gross operating expenses, exclusive of fixed charges, 41.00 cents." Unless the damages are recouped by a beer garden at the top of the incline, it is hard to guess "what it was begun for" or why it was continued. For want of such details this case and some others are shorn of most of their usefulness as data towards the study of the "*Relative Cost of Operation*," etc.

It may be said, though it hardly seems necessary, that it would have been difficult for the Committee to show any relation between its electric conclusion and the fifteen "culls" of reports it takes the trouble to display.

I venture one exhibit myself :

OPERATING EXPENSES PER CAR MILE, EXCLUSIVE OF NOTHING (BUT INTEREST ON BONDS).

CABLE ROADS.			ELECTRIC ROADS.		
NO.	NAME.	OP. EXP.	NO.	NAME.	OP. EXP.
1	.....	6.60	1	W. E. Ry.....	22.89
2	.....	6.40	2	Ho. V. S. Ry....	16.58
3	.....	6.00	3	F. S. & P. V.....	19.79

For this table I claim that it proves nothing—as it stands. On the cable side I have "omitted all marks by which a road could be identified," but I may say that the figures given are nevertheless "cold facts." On the electric side my authority for No. 1 is the JOURNAL, for a few months of 1891, with 1.40 per car mile thrown in by myself as a reasonable allowance for the high taxes under many names levied on this company. The expenses of No. 2 I take from a Blue Book of a Parliamentary Committee of Sydney, Australia (Appendix p. 61) because it comes handy. For No. 3 I am indebted to the report of its treasurer, as given, with doubtless its usual accuracy, in the STREET RAILWAY JOURNAL for March, 1892. And it is obvious that having, like the committee, but eight cases to make on one side and seven on the other, or like the Census Office, but ten on one side and nine on the other, I could show anything—or nothing.

I leave my *thesis* hanging on the door for the present: Six cents a car mile in favor of the cable road "for a cable railway business." And I repeat that you cannot afford to take an electric road as a gift with a very large bonus thrown in "*for a cable railway business.*"

The stock of a certain street railway quoted at 194 in my second letter and 255 in my last is now over 260, and I have followed it long enough to demonstrate that a "cost" of even $684,000 per mile is not necessarily fatal in the case of a cable railway. CABLE RAILWAYS.

(*To be continued.*)

Division of Executive Duties.

The question of the best disposition to make of the executive force of a street railway company and the duty which each officer should perform, is an important one. To define clearly the work of each, making him responsible for its proper performance, and at the same time not to assign so much work to any one individual as to prevent its proper fulfillment, is the task of every board of directors. The STREET RAILWAY JOURNAL, with the object of learning the division of duties in force upon several railways in different parts of the country, recently sent a letter to such roads, requesting information upon this point. Some of the replies appear below:

THE CITIZENS' TRACTION CO.

PITTSBURGH.

GENTLEMEN:—The executive force of the Citizens' Traction Co. consists of the following officers: President, vice-president, treasurer, secretary and general superintendent.

The president does not give all his time to the business of the road, but attends to all financial and political matters concerning the road, and consults with the general superintendent as to the general policy of operating the road; he also consults with the secretary as to his book accounts, and signs all the checks and vouchers.

The vice-president acts in the absence of the president.

The treasurer keeps the stock books and receives the deposits from the secretary, and also makes up and pays the dividends.

The secretary has charge of the company's books, receives the money from the receiver and accounts for it to the treasurer. He also prepares a report once a month, showing the financial condition of the road, which is read at the meeting of directors, held the second Monday in each month.

The operation of the road is under the general superintendent. His official force consists of a mechanical engineer, civil engineer, electrical engineer, paymaster, trackmaster and two assistant superintendents, together with necessary clerks, receivers, dispatchers and aids.

The office hours of the general superintendent are from 8:30 A. M. to 11:30 A. M., and are divided as follows: 8:30 to 9, consults with and receives reports from the mechanical engineer and trackmaster; 9 to 10, receives applications for positions as conductors, gripmen and motormen, and makes appointments of such when needed, and receives business calls; 10 to 11, receives reports from and consults with the assistant superintendents and arranges with them for the proper running of their respective divisions; 11 to 11:30, attends to the general office work and consults with the paymaster and civil engineer. He meets the secretary at his office at 12 o'clock and the president at his office at 12:30. The afternoon is devoted to the inspection of the different departments of the road and attending to any special matters which may come up. All record books, except the regular set of account books, are kept at the office of the general superintendent, and he draws all orders for the purchase of supplies and approves all bills for the same; he also attends to all accident reports and adjusts damages, investigates all violation of rules by conductors, gripmen and motormen or any other of the employes.

There are two shops for the repair of cars, and one machine shop for the repair of grips, cable track, machinery, etc.

There is no master mechanic. The power houses and machine shop are in charge of the mechanical engineer. There are two boss carpenters and a boss painter who attend to the repairing of cars. The trackmaster has the care of the track and all conduit machinery. There is a rope splicer who takes entire care of the rope; he also acts as master gripman and instructs all new gripmen.

It is the effort of the general superintendent to define each under official's duties so that all may work in harmony and not conflict with each other. They are expected to have absolute control of the men under them and to hold all to the strict performance of their special duties.

As to the reports which are required from subordinates, the trackmaster makes a daily report of the kind of work done each day, the number of men employed and the price paid per day, as well as the exact amount of material used. The mechanical engineer makes a monthly report showing all material used in the machine shop, and the kind and cost of all work done; he also makes a full report of oil, coal, water and waste used in the power house. The electrical engineer makes a monthly report of all electrical expenses, and a full account of the working of the electrical department.

The civil engineer has in his charge the laying out of all new roads and the building of the same, also the erection of any new buildings or changing of old ones, and all the general work which properly comes in his department. He reports daily to the general superintendent, and his accounts and the operation of his department are included in that of the general superintendent.

The paymaster is also storekeeper and keeps a record of the taking in and going out of all stores; he also distributes and classifies the expense in the different departments, etc.

The assistant superintendents are in charge of the running of the different lines, and are accountable for the promptness and regularity of the service. They have charge of the schedules, attend to the assignment of men to the cars in the customary order, and direct the cleaning of the cars and the proper care of the buildings in their department. They make a written report to the general superintendent once a month on the working forces of their department, etc.

The number of men employed is about 300, distributed as follows:

Car crews, 180 men; shops, 26 men; power house, 18 men; track department, 30 men; dispatchers and aids, 8 men; shedmen and stable forces, 25 men; office force, 5 men, and under superintendents and bosses, 8 men.

OMAHA STREET RAILWAY CO.

OMAHA, NEB.

GENTLEMEN:—According to our by-laws the president signs all contracts, stock certificates and other obligations of the company. He may appoint and remove all inferior officers and employes, subject to the approval of the board of directors, and may temporarily suspend any employe until the board shall meet and pass upon the matter.

The vice-president, in the absence or disability of the president, performs all the duties of the latter.

The secretary keeps a record of all the proceedings of the meetings of stockholders and directors, and has charge of the stock book, corporate seal, etc.

The treasurer is the custodian of the money and the securities belonging to the company. Disbursements are made by him upon vouchers approved by the president, board of directors or an executive committee. The treasurer also countersigns the certificates of shares of stock and is required to give a bond of some $25,000 for the faithful performance of his duties.

This brings us to the practical executive heads, *i. e.*, the general manager and general superintendent. The former, with u , is the main man and guiding spirit of the whole concern. The president and board of directors look to him to carry out their general policy in all directions. They are his advisors and counselors, but with him rests the power to handle all problems of operation and construction. All important contracts for equipment and supplies are made by or through him, and the general interests of the company, both with the municipality and private individuals, are looked after by him.

Our general superintendent occupies a position much in the nature of an assistant to the manager. To the superintendent come daily reports from each power station, car house or other stations, showing in detail the day's operation of the system. He hires and discharges all men, makes orders for all ordinary supplies, frequent inspection of power houses, line and track, and has in general a watchful eye over the whole, keeping the general manager well advised in all particulars.

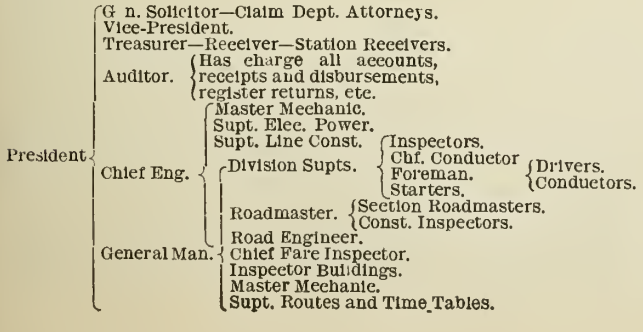
Foremen of power stations and car houses report each day, showing in detail the men in service and the work at which they are employed, the cars, in and out of service, and if out of service, the cause. Through the superintendent come the reports from engineers, blacksmiths, etc., showing the condition of the engines and machinery, mileage of cars, change of any gearing, wheels or trucks, etc. The foreman of line work reports daily to the superintendent of all repairs to the line system or any new work done. The foreman of electricians also reports daily to the superintendent of all gears, pinions, armatures and any other electrical work on which he, or the different employes, may have been engaged. The foreman of paint shop as well as the foreman of car repairs in wood work, also reports to the same department.

The claim department is an adjunct of the superintendent's office, and to this all reports of accidents come, through station and house foremen each day. The claim clerk is always called on in emergency cases to give his personal attention to the matter. After all information possible is obtained regarding accidents, the facts are submitted to the general manager to pass on, and he may refer them to the attorney and also to the president and board of directors according to the importance of the case.

WEST END STREET RAILWAY CO.

BOSTON.

GENTLEMEN:—In reply to your letter of the 3d inst., we would say that it would require a very long letter to fully describe the mode of operation of the executive force of this company. We have, therefore, drawn up a table with the president at the head, showing the minor officers, and think from this table it will be easy to ascertain as to which officers different reports are submitted.



The company employs on the average from 4,500 or to 4,600 persons. We have no general superintendent or secretary.

The following extracts from our by-laws show further the parts taken by a number of the different officers in the management of affairs:

"The president shall be charged with the general oversight, care and management of all the property and business of the company in all its departments, and of the officers, agents and servants of the company.

"The vice-president shall assist the president in the performance of his duties.

"The treasurer shall have the custody of the seal and of the funds of the company, and shall receive and hold all moneys and make disbursements thereof. All vouchers or bills, excepting only payments for dividends and interest, and such other payments as shall be directed by the board of directors, before being paid by him, shall be duly certified to and approved for payment by the auditor, whose approval shall be endorsed thereon.

"The general manager shall be the chief executive officer of the company, and have charge of the operation of the road, the purchase of supplies and material, the superintendence and care of all the motive power, tracks, horses, stables, car houses, repair shops, equipments and stores of the company, shall collect the revenue, arrange the time tables, make the rules and orders, and shall have the power of appointment and removal of all his assistants and employes of the road in his department, and shall fix the compensation of all such assistants and employes subject to the approval of the president. He shall have authority to order machinery and tools for the shops, and materials for repairs of the equipment, tracks, roadbed and property of the company. Current supplies for his department shall be purchased by the purchasing agent on a written requisition made or approved by the general manager or such other officer as may be specially designated in writing by him."

"The auditor shall have charge of all revenue and expenditure accounts of the company and shall keep a set of books showing in detail its earnings and expenses. He shall examine all pay rolls, bills or demands rendered against the company, shall see that they have been incurred with due authority, that they are properly approved by some person authorized thereto, and that the clerical computations are correct. He shall see that vouchers are prepared in proper form, and that the same are duly recorded and distributed to their proper account. He shall have charge of all shop, stable, track department or other accounts of material and property, shall prescribe the methods by which they shall be kept and shall require such returns of material used and labor performed as shall be necessary for the due protection of the company and information as to its expenditures. He shall see that conductors' collections are properly audited by returns of such punches and registers as are in use, and that all checks, tickets, materials and personal property sold are duly accounted for and the cash turned in to the treasurer. He shall have the power of appointment and removal of all clerks and subordinates in this department and shall fix their compensation, subject to the approval of the president."

CONCORD STREET RAILWAY CO.

CONCORD, N. H.

GENTLEMEN:—The officers of the Concord Street Railway Co. consist of a president, general manager, treasurer, secretary and cashier.

The president has the general supervision of all matters relating to the general welfare of the road, the making of contracts, the looking after financial matters and the line of policy to be pursued by the corporation, also the signing of certificates of stock.

The general manager, who is also the superintendent, has the entire charge of the operating, traffic, and general business affairs of the corporation. He has the control of all of the help, repairs, improvements, purchasing of supplies, constructing of extensions, and the auditing of bills.

The cashier of the corporation receives all moneys, and deposits the same to the credit of the corporation, returns thereof being made to the treasurer, daily.

The treasurer makes all disbursements by check, when authorized to do so, by an order drawn upon him by the cashier and approved by the general manager, the orders showing the proper heads under which such disbursements are to be charged. Such orders are the treasurer's vouchers for the issuing of the checks; and the receipted bills on file in the office of the cashier are the vouchers of that officer for the orders drawn upon the treasurer, as aforesaid. Books of the cashier and treasurer are checks upon each other. The treasurer has also the charge of the seal of the corporation and issues all certificates for the transfer of stock.

The secretary keeps the records of the stockholders' meetings, also the records of the meetings of the board of directors.

We believe in a one-man power (in our case the gen

eral manager) so far as possible, and have found it to work most successfully with us. The present management of the company took charge of affairs in January, 1891, and found the rolling stock and equipment in a most unserviceable and unsatisfactory condition. None of the rails in the roadbed exceeded twenty-five pounds in weight, and were badly worn and twisted out of place. The track was in such condition that it was absolutely impossible to run a car over the road; hence, during the month of January the road was substantially closed up. The finances at such time were in such a condition that the company was absolutely without credit, and could not have borrowed $1,000 upon the paper of the corporation.

Since that time substantially the entire length of the road has been put in first class style so that it will bear the closest inspection. A fifty pound rail has been laid in place, new cars have been added and the entire property has been rebuilt and reconstructed. The credit of the corporation has been fully established, and the company has become very popular with the citizens of Concord and the city government.

From this you will see why, in a corporation no larger than ours, we believe in a one-man power when that one man is made up of the right material and has plenty of knowledge and push in him.

GALVESTON CITY RAILROAD CO.

GALVESTON, TEX.

GENTLEMEN:—Our organization has the following heads: First, president; second, superintendent with an assistant; third, secretary, who is also treasurer; fourth, chief engineer and electrician; fifth, track foreman; sixth, line foreman.

The president of the company has personal supervision over each of the heads of the various departments and gives his personal attention to all of the details through the various heads of the different departments who report directly to him.

The superintendent of the road and his assistant have immediate control and supervision of the movement of cars, motormen and conductors. Our experience is that the undivided personal attention of this officer and his assistant is required to look after the operation of the cars and the discipline and efficiency of those employed thereon, and in our opinion we get better results by relieving him almost entirely of the details connected with the other departments.

The chief engineer and electrician employs his own assistants, such as engineers, oilers, machinists, firemen, etc., and in the power house has entire control, subject only to the president.

The secretary who, as stated, is also treasurer, has charge of the office records, cash, etc., and is provided with the necessary assistants in the way of bookkeeper, and other clerical force for the operation of the office.

The track foreman and line foreman, each, have charge of gangs of men who have their respective works to look after. Besides these heads of departments we have a storekeeper.

All supplies necessary for the operation of the road in the different branches are furnished by the storekeeper on requisitions which are first made out and signed by the respective heads of departments, and are then submitted for approval to the president. It is proper to add that after our work of construction is finished, we expect to merge the duties of foreman of tracks and overhead work into one.

We carry a regular repair force of car builders, or more properly speaking, car repairers, car painters, and blacksmiths who are also under the personal supervision and direction of the president. Nearly all communications between the president and the heads of the various departments are required to be in writing. Every morning the secretary makes up a written report of the earnings of the various lines per car, and the mileage made by each car, and a comparison is kept up with the corresponding day of the preceding year, showing the increase or decrease in the daily earnings, and the earnings for the month, and at the end of the month a comparative statement for the month which is afterwards consolidated into months. Every evening the secretary submits to the president a statement of the cash deposited and cash on hand in bank.

When we first commenced to operate electrically the president endeavored to handle all of the business outside of the office through the superintendent. It was found upon trial that this method worked unsatisfactorily, because in the multitude of duties which devolved upon him in matters outside of the operation of cars his attention was diverted from the main question, the all important question, viz., the operation of cars and supplying of same with motormen and conductors who would efficiently and *honestly* perform their important duties. The number of employes of our company is 147.

ATLANTA CONSOLIDATED STREET RAILWAY CO.

ATLANTA, GA.

GENTLEMEN:—The duties of the president are those usually pertaining to that position, and, also, a general and close supervision of the operation of the road. The vice-president takes no active part in the local operation of the road; neither does the secretary and treasurer, the local duties pertaining to that office being performed by the assistant secretary and treasurer, who also has charge of the purchasing. The duty of the superintendent is the operation of the road.

The following shows what reports are submitted and by whom:

Chief bookkeeper—Statements, etc.
Storekeeper—Reports of material received and used.
Master mechanic—Condition of cars and everything pertaining to repairs of same.
Chief engineer—Report of operation of power house.
Inspectors—Reports on conduct of men, etc.
Starters—Register readings, time, etc.
Conductors and motormen—Reports of all delays and accidents.
Head lineman—Condition of line and reports of result of monthly test and inspection of line.

We employ in the operating department 200 men.

WASHINGTON & GEORGETOWN RAILROAD CO.

WASHINGTON, D. C.

GENTLEMEN:—The following extracts from our by-laws will define the duties and powers of our different officers:

"The president shall have the chief management, control and supervision of the affairs of the company. All purchases, repairs and contracts shall be made under his authority; but he shall make no purchases and order no repairs not needful for the daily supplies and ordinary business of the road. He shall appoint conductors, starters, drivers, mechanics, roadmen and stablemen, and may suspend or remove them at his pleasure.

"The treasurer shall receive all moneys belonging to the company and disburse the same on such vouchers as the board of directors may prescribe, and keep correct accounts thereof.

"The secretary shall keep the minutes of the board of directors and of the executive committee, and have the custody of all books and and documents belonging to the company. He shall preserve, in a manner convenient for reference, all the books and papers of the company. He shall keep the accounts of the company and keep an accurate record of all the persons in the employ of the company, their compensation and the dates of their appointment and employment.

"The superintendent shall have the charge of the track and cars, and of the repairs and running of the road, and of the stable and workshops, snbject to the direction of the president.

THE street railroad has been and is one of the mightiest agents in the unparalleled development of this country. No city is without street railroads, for the simple reason that, but for them, it could never have become a city. They are the arteries running from its throbbing heart center and carrying life and nourishment to its extremities. Because of them, pleasant homes, pure air, the meadow's sweet expanse and blooming flowers are within the reach of every honest and industrious man. Wherever their rails extend, houses spring up, lands are reclaimed and the value of property is enhanced. —*Cleveland Convention*, 1892.

St. Louis Notes.

The Chicago & St. Louis Electric Railway Co. is becoming more prominent before the public than ever, notwithstanding the great mystery which surrounds all its actions. Six miles of the double track roadbed are now completed, running north from Edinburg, Ill. One of the power stations is to be located at the latter point. Track laying or wiring has not yet commenced. Inquiries at the office of the company were cordially met with mysterious and dubious replies. We were told that the motors are to be made somewhere in Germany. They are to be of the multiphase type, and thus the suits pending in the courts, of Dr. Wellington Adams, electrical engineer of the company, against the Edison and Thomson-Houston companies, will not interfere with the operation of the road, as has heretofore been stated.

Nearly all the stock has been subscribed, at the rate of $4 per share. The investments are, as a rule, in small amounts.

Rumors have been afloat lately that the car building companies of St. Louis were to consolidate. It was said that they were to be under one management, have one capital stock, and make a special issue of bonds. Henry E. Scott of this city, and Wm. H. Thomson were said to be back of the scheme. There are four companies building street cars in St. Louis. The St. Louis Car Co. is capitalized at $88,000, and has a surplus of $187,000; the American Car Co. has over $600,000 invested in its new plant; the Brownell company has a capital of $100,000, but employs double this amount, and the Laclede company a capital of $80,000, or one-half of that employed. The car building industry of St. Louis, now supplies cars to New York, Chicago, Philadelphia, Boston and Baltimore, not to mention smaller cities such as Pittsburgh, Cincinnati, Cleveland and many others. With such a thriving trade as this, the many advantages of consolidation are apparent. Doubling the capacity of all the works would be one of the first acts of such a consolidation. However, the consolidation has not yet been effected, and most probably will not be, as we were informed by the vice-president of one of the companies. There is no question but that all the companies would like to see a consolidation, but to overcome the many real and apparent obstacles would be a task which very few men would care to undertake.

There were rumors recently that the conductors and motormen of the Lindell Railway were going on a strike. On inquiry the rumors were found to be false to a certain extent. It is true that the employes are compelled to wear their light caps far into the winter season, but on account of the unsightliness of the winter caps, the management has deferred a change to the latter until a cold snap assures a continuance of cold weather. The men were also dissatisfied with having to wait until five o'clock for their dinners. Such cases are isolated, however, and the Lindell Railway is known to be very lenient with its men. This company is at present laying a very superior roadbed on its Washington Avenue line from Eighteenth Street to Twenty-fourth Street, and on the Fourteenth Street line, from Market Street to Clark Avenue. The rail used weighs eighty-one pounds to the yard and was made by the Johnson Co.

The ties are being laid fourteen to the rail, and are the largest ever used in St. Louis for street railway construction, being square sawn and of the size used in the best railroad construction. The joint plates have six holes, and the joints are supported by three ties, one at the point directly under the fishplate and one at each end of the latter. No chairs were used, as in the other girder construction on the company's lines, but the Johnson brace tie plate. This track is replacing the old horse road stringer construction, in which a sixty-five pound tram rail was used. The work is being done under the company's own supervision. The Lindell company has been trying very hard lately to get permission from the city to run across one of the viaducts spanning the railroad tracks in the Mill Creek Valley, so as to complete the track laying on its southwestern line which will pass the new Union station. Its efforts so far have not met with much encouragement, as a great deal of outside pressure exists, presumably from a certain road now running in the vicinity of the new station, and from other companies which desire the use of the Eighteenth Street Bridge. The city will eventually be compelled to allow the company the use of the viaducts.

During the last month the Council has granted a franchise to the Manchester Road Electric Railway Co. This company is to operate a line out the Manchester Road from within the city limits to Kirkwood, in St. Louis County, a distance of about ten miles. It will connect all the suburban towns between the city limits and Kirkwood, and enable residents in those places to reach the heart of the city by connection with the Fourteenth Street line of the Lindell Railway.

The Delmar Avenue & Clayton Electric Railway bill has been passed by the City Council. This road commences at Delmar and DeBaliviere Avenues within the city limits, where it connects with the Lindell Railway, and terminates at the town of Clayton, the county seat of St. Louis County, altogether a distance of three miles.

The East St. Louis Electric Railway will soon have a new power house, a new 500 H. P. Corliss engine, and additional generators. The business of this company has grown very rapidly, and the management has found that more power is necessary for the present lines and for proposed extensions. The plant has thus far cost $157,000 and when the new power house and equipment will be finished the company will have expended $300,000 up to date.

The Midland Electric Railway Co. has abandoned the use of its power house and car shed in St. Louis County, and now houses its cars in the sheds of the St. Louis & Suburban road, and obtains power from the station of that company with which to propel its cars.

The St. Louis & Suburban Co. has just completed its loop in Forest Park at the Union Avenue entrance to the latter. The tracks of the company cross those of the Wabash Railroad just before entering the park. No trouble was encountered with the latter as to putting in crossings, heavy steel T rail, built up crossings being provided to enable the cars of both companies to cross smoothly.

The Citizens' Railway Co.'s Grand Avenue line is to be operated by electricity in a short time. This line has never paid under the cable system. The grip cars and trailers used on the road will be transferred to the Easton Avenue cable division of the same company. The cars of the Grand Avenue line will receive their power from the Cass Avenue & Fair Grounds Railway Co.'s power station.

The St. Louis & Suburban Railway has finished its new car shed, which measures 500 × 150 ft., and can accommodate about 100 eight wheel cars of the length at present used by the company. Nearby the car shed are the company's paint and repair shops, just finished. Both the car shed and the shops were burned last spring, and the present buildings replace them.

Postmaster Harlow has at last succeeded in putting into practice his long cherished scheme, the utilization of the street railways for the rapid delivery of the mails. Chas. H. Turner, president of the St. Louis & Suburban Railway, has entered into an arrangement with the postmaster, whereby a mail car runs from the post-office to Cabanne several times during the day, and delivers the mails at the numerous sub-stations along the route, and collects letters on each return trip to the general post office, which have been left there by the postmen. The latter receive the letters left by the car and deliver them to the various addresses. The plan is working very satisfactorily, and it is only a question of time before the other companies will meet the postmaster for the adoption of the delivery system on their lines. Great credit is due Mr. Turner for being the first to adopt the new scheme. The car used is fitted up with mail racks and all the conveniences of a railway postal car.

S. L.

World's Fair Transportation Problem.

The transportation of persons to and from the World's Fair grounds in Chicago has been regarded as a matter of surpassing importance from the very inception of the Exposition enterprise. It was at once realized that the existing facilities were wholly inadequate to provide for the immense crowds of people who would daily visit the grounds. No sooner had Congress selected Chicago as the site, than the matter was brought up for discussion, and the railroad managers immediately set to work to devise plans for meeting the demands upon them. For these reasons both the Fair authorities and those charged with providing means for transporting the public looked forward to the date of the dedication of the World's Fair buildings with no little anxiety. The fact was keenly appreciated that on that occasion a test would be applied which would determine how well prepared the companies were to accommodate the people. Just what the result was, and just what the prospect is, it is the purpose of this article to state.

It is perhaps unnecessary to mention that the Fair grounds are about seven miles distant from the center of the city, and that they are reached by trains of the Illinois Central Railroad, by the cable cars of the Chicago City Railway Co. and by steamers on Lake Michigan. On the day of the formal dedication, October 21, the people began to patronize the several lines at an early hour in the morning, and filled the coaches of the elevated roads, although the present terminus is a mile distant from the grounds. Throughout the day all the roads had all they could possibly accommodate. One estimate states that not over one person in every four was able to secure a seat in the cars of the cable and steam roads; another estimate makes the list of lucky passengers about one-third of the total number. These statements are necessarily the result of a superficial observation, and cannot be taken literally. The fact remains, however, that roads of all kinds were greatly crowded, and the statement is not surprising when the figures showing the number of passengers carried are presented. The Chicago City Railway Co. collected on October 21, about 575,000 cash fares. This does not represent by any means all those carried. Many persons, specially children, rode free, and on account of the crowded condition of the cars the conductors were unable to make and collect fares as closely as usual. In addition, a vast number of transfers were issued which are not taken into account in the total given above. The aggregate, the officials are inclined to believe, is much nearer 1,000,000 than two-thirds of that number.

In the case of the Illinois Central the number of World's Fair passengers is figured, in a conservative estimate, to have been about 150,000. The steamers carried about 23,000 passengers.

It is believed by those best qualified to judge that as great a number visited the grounds on October 21 as will collect there on ordinary days during the Fair. The daily attendance is usually estimated at 1,000,000, with 50 per cent. added for gala days.

It is plain that people cannot, during the Fair, be subjected to the crowding and inconvenience which they were obliged to undergo in October, so that a great increase in facilities must be provided. At the same time the conditions were such that the crowds assailed the cars in even less numbers than will storm them after next May, and for this reason: Most of the persons who visited the Park had in their possession admission tickets which did not entitle them to reserved seats. As a consequence, vast throngs started for their destination early in the day. The movement of people southward began as early as seven o'clock in the morning. After the crowd had assembled a vast majority found they were out of the range of the speakers' voices, so they started homeward without great delay. The companies, therefore, were called upon more gradually than would be the case if the people had merely been bent on going and returning at a convenient hour.

The statement is true, therefore, that while the conditions were wholly favorable, the facilities were entirely inadequate. Were the subject to be dropped at this point a wholly erroneous impression would be gained. The fact is that the projects planned by the companies for accommodating the people have by no means been completed. The Chicago City Railway Co., for example, was unable to put into service all its rolling stock, for the simple reason that it did not have the men to put in charge of it. It would have been both unsafe and uneconomical for it to have hired men to operate trains during the three days of the Columbian festivities. Before the Fair opens an army of new gripmen and conductors will be employed, and the number of cars at the service of the public will be doubled. At the present time the electrical system which will provide rapid transit on crosstown lines leading to the Park has not yet been put into operation. The Illinois Central was badly handicapped. It is now engaged in the great enterprise of elevating its tracks, and was unable for this reason to operate as many trains as were necessary. When the eight tracks are built on the elevated structure, two will be used exclusively for World's Fair business. At the same time it did not have sufficient rolling stock, but was compelled to borrow coaches of other roads. The new rolling stock will be completed before the opening of the fair.

As has been already stated, the alley L road has not yet been extended to the World's Fair grounds. At the present time the terminal is at 55th Street and west of the grounds; but 63d Street and the Park grounds will be reached in all probability some time next month. The downtown terminal facilities of the road are woefully deficient. It has to depend upon a stub switch, but the officers are hoping that in the course of events a way to secure a downtown loop may be opened to them. In any case the number of engines will be increased from twenty to forty within the next few months, and the number of coaches will be doubled. This increase in rolling stock will enable the company to inaugurate a two-minute service, while at the present time there is a four-minute interval between trains. Despite all difficulties the company collected 114,000 fares on Otober 21, and carried a great number of passengers in addition, who in the rush passed the ticket boxes without depositing their tickets.

The facilities will be still further increased by material additions to the fleet of World's Fair steamers. Just what their carrying capacity is is necessarily problematical, as the number of vessels is likely to be very much larger than is at present estimated. Given good weather, and it is safe to assume that the steamers will play quite an important part.

The Baltimore & Ohio took no part in transporting passengers to the grounds, as its tracks are not yet in position. Its entrance to the Park will include three tracks, but the route will not be a popular one as it is long and indirect; still it is estimated that 10,000 persons could be carried daily.

The South City Chicago Railway Co. and the Calumet Electric Railway Co. will both contribute to the solution of the transportation problem. Each of the systems is equipped with electricity. They will carry to the grounds passengers from districts south of Jackson Park.

It may be judged from this hasty statement of the splendid increase to be made in the facilities of all the companies that the situation will be entirely changed when the Fair opens, but there is one other factor to be taken into consideration. Some fifty odd hotels are being erected in the vicinity of the Park, and it is estimated that from 50,000 to 100,000 persons will be quartered in the neighborhood who will walk to and from the enclosure.

Will the provision be sufficient to accommodate the demands? Those who have noted the figures and statements presented above are in a position to express an opinion, and no one in the light of present developments can do more. The writer, however, may assert that as a result of his observation the companies will meet all reasonable requirements. The transportation problem is being studied by men dominated by the true Chicago spirit, and their ability to solve it is almost beyond question.

The New Plant of the Biddeford & Saco Railway Co.

The readers of the STREET RAILWAY JOURNAL will remember a series of articles published in these columns from the pen of Wm. Lee Church, entitled "Points on Power Stations," in which Mr. Church sought to show the proper proportions of boiler, engine and generator capacity in a well designed power station, specially devoting his attention to stations of moderate capacity. These articles elicited considerable discussion, and were widely read by experienced electrical engineers, who doubtless, though perhaps differing from Mr. Church in his practice, will now be glad to read a description of a power station, the steam plant of which was entirely designed by Mr. Church, and which may be looked upon as a working example of the lines laid down by him. Such a plant has recently been installed at Saco, Me., for the Biddeford & Saco Railway Co., Messrs. Westinghouse, Church, Kerr & Co., acting as engineers for the plant, and having entire charge of the installation of the steam plant, and the General Electric Co. furnishing all the electrical apparatus. Though the plant is not a large one, it bears out in a wonderful way the conclusions reached by Mr. Church in his arguments, and has achieved such a success as an economical producer of power, that an account of its construction, and a few details of the results of extensive tests will be found interesting.

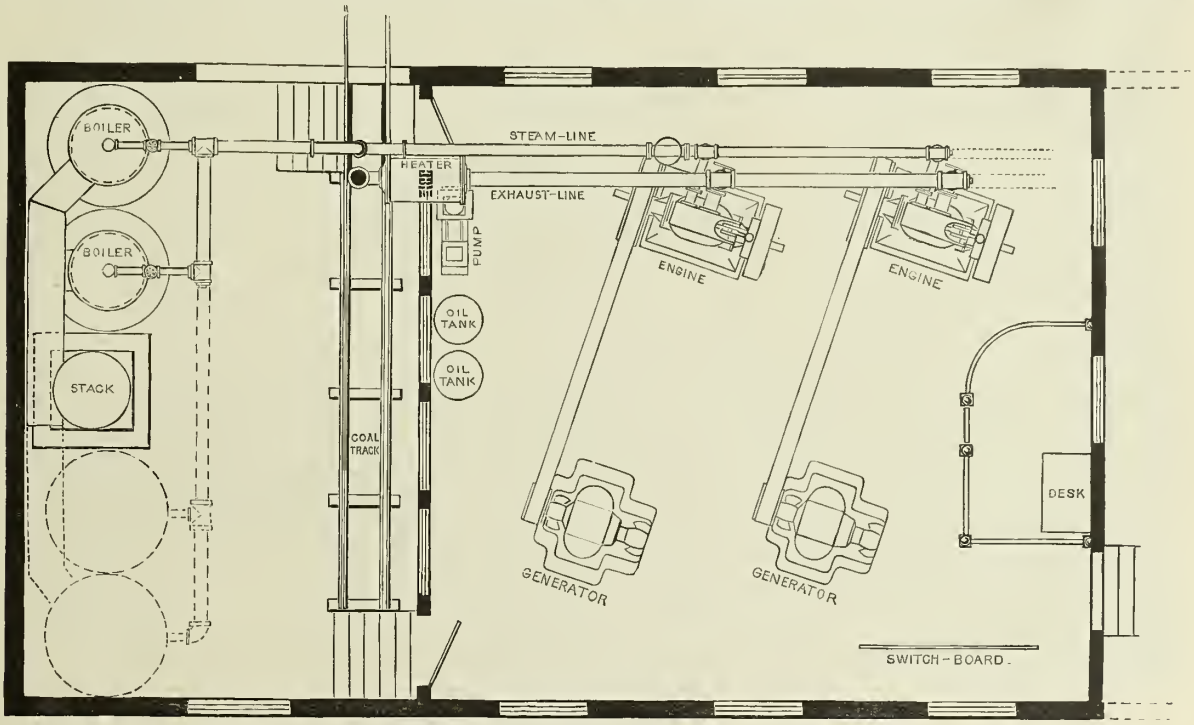


FIG. 1.—PLAN OF STATION—BIDDEFORD & SACO RAILWAY.

The building is of brick on granite foundations, and measures 62 ft. long by 36 ft. 6 ins. wide, with ample ground facility for increasing when desired. The engine room (see Fig. 2) is 37 ft. × 34 ft. 6 ins. and contains two Westinghouse compound, non-condensing engines, each of 130 rated horse power, at 125 lbs. steam pressure. Each engine has two cylinders 12 ins. and 20 ins. diameter by 12 ins. stroke, one driving pulley 60 ins. diameter by 14 ins. face, and is belted direct by means of a 12 in. double ply leather belt to the generators, the distance between the center of the engine and generators being 18 ft. These engines are guaranteed to develop their indicated horse power non-condensing on a consumption of 25 lbs. of dry steam per hour at 125 lbs. pressure under full load, and 28 lbs. under one-third load. As will be seen by looking at the plan, the engines and generators are set obliquely to the line of the walls, the chief reason for such setting being to economize space. By such an arrangement the main shaft of each engine can be removed at any time, should it become necessary, without interfering with the other engine. It also places the commutators of the generators in such a position that the attendant can never be in danger of coming in contact with an adjacent generator, and gives generally more space about the engines and generators. The two generators are of the regular Thomson-Houston, M. P., 90 type, of 120 H. P. each, furnished by the General Electric Co. The switchboard, which is of the usual skeleton type, stands in one corner of the engine room, and is built of Southern pine. It contains the usual voltmeters, ammeters, circuit breakers, lightning arresters, and other necessary apparatus. In the engine room is also situated a No. 4 Deane boiler feed pump, and two Hancock inspirators, and one Locke damper regulator.

The boiler room, which is 22 ft. × 34 ft. 6 ins., contains at present two 100 H. P., Manning, vertical boilers, built by the Bigelow Co. of New Haven, Conn., of the best steel plate, rolled in a single sheet, without circular seams and fitted with shaking grates, pop safety valves and extra heavy gun metal mountings. The boilers are 48 ins. diameter in the waist and 65 ins. diameter at the furnace, and have a total height of 23 ft. 6 ins. The grate area is 18 sq. ft., and there are 112 tubes 2½ ins. diameter and 15 ft. long, having a heating surface of 791 sq. ft., the total heating surface being 1,138 sq. ft., equivalent to 11 sq. ft. to the horse power.

The chimney is of iron, 54 ins. diameter and 60 ft. high, and rests on a cast iron plate on a granite foundation. It is connected to the boilers by the usual smoke flues, fitted with dampers, and is supported by iron guy rods. From each boiler runs a five inch wrought iron steam pipe, connecting with an eight inch, wrought iron steam main, which is carried horizontally over the engines, and which is sufficient for double the present capacity of the station. This main passes through a horizontal separator at the point where the connection is made to the first engine. From this main drops a vertical copper bend five inches in diameter, to each engine, having a long sweep curve to provide for expansion and contraction, and tapering in its length to bring the proper reduction of size. All steam piping is equipped with long, turn fittings, and stop valves are placed in the boiler supply pipes, and at the junction of each copper main with the overhead main steam pipe, in addition to the throttle valve on each engine. All the water of condensation, primage and entrainment which is collected in the separator is automatically returned to the boilers at boiler temperature by means of a steam loop, avoiding the use of traps altogether, and keeping a constant circulation,

insuring dry steam. The exhaust steam from each engine is carried vertically by a seven inch pipe to a ten inch exhaust main which runs horizontally, at the same level as the steam main, through a 200 H. P., National feed water heater, set horizontally in the boiler room, where it passes vertically up through the roof and exhausts into the atmosphere through a Woodbridge exhaust head.

The tracks of the company, which cover a distance of six miles, are practically the same as when horses were used, the ordinary thirty five pound steel T rail being still in service, while a tram rail laid on stringers is used in the vicinity of the city. These rails have been bonded with galvanized iron wire, and connected to an underground return wire also of galvanized iron, laid at the side of the track, as the work was done when the road was being operated by horses. In addition to this ground return, old gas pipe has been driven vertically into the ground at short distances along the track wherever the ground was soft enough to permit it, and the ground wire firmly soldered to it. Plates attached to the ground wire were also sunk in streams wherever such were crossed, and everything done to make the return circuit as efficient as possible, the advantage of such methods being amply borne out by the remarkably good tests which have been made on the road. The poles for the overhead construction, in the vicinity of the city, are of squared Southern pine, and on the part of the road running through the country between Saco and Old Orchard, round cedar poles are used. The poles are set six feet in the ground, and extend twenty-two feet above the surface of the road. The span wire is of silicon bronze, and the trolley wire of No. 0 hard drawn copper, held in place by the regular form of Thomson-Houston insulators. Two feeders, triple braided, run from the power house, one No. 0000 wire going to Old Orchard, and one No. 000 wire to the Biddeford end of the line. At present the company has sixteen cars for service, four being twelve foot closed cars, six twenty-five foot open cars, and six twenty-five foot trailers. Each motor car is equipped with two twenty-five horse power, W. P. motors, built by the Thomson-Houston Electric Co., and the new type J controller, it being of interest to know that this is the first road completely equipped with these controllers. It is also a matter of general interest that, notwithstanding the unfavorable financial condition of the company when operated by horses, as soon as the road had been operated electrically during one summer, it gave capital so much faith in the enterprise that the issue of $50,000 in bonds to cover the electrical construction was immediately taken up by local banks, and that in fact there was considerable competition to secure them.

Quite recently a most complete and exhaustive set of tests to determine the operative efficiency of the mechanical and electrical equipment of the station was made by the Massachusetts Electrical Engineering Co. of Boston, a few details of which will be found interesting to our readers. The test lasted for two days, and embraced careful readings of the coal consumption, the amount of water evaporated, the indicated horse power of the engines, the electrical output of the station, and at the same time careful readings were taken by voltmeter and ammeter on the cars.

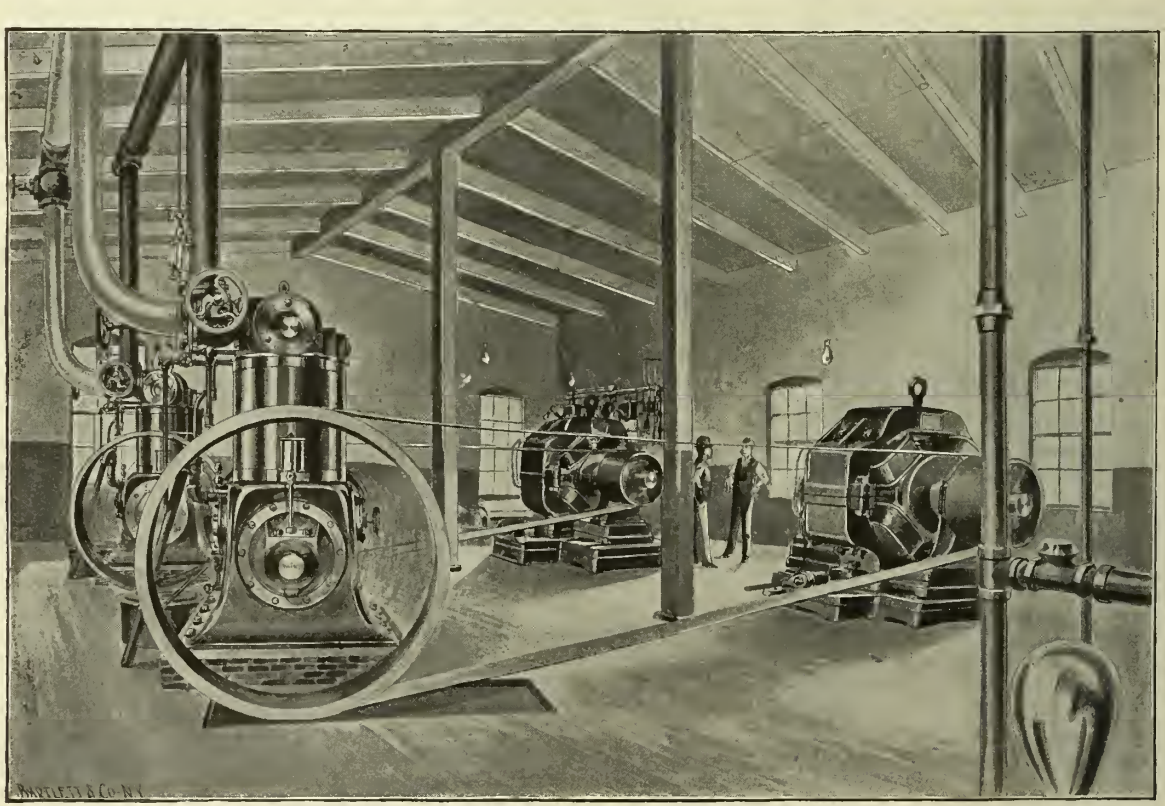


FIG. 2.—ENGINE ROOM—BIDDEFORD & SACO RAILWAY.

The net result of the two days' test may be noted as follows:

Cost of coal per car mile (with coal at $4.75 per ton)	1.51c.
Pounds of coal per car mile	7.26
Pounds of water evaporated per pound of coal, actual conditions	8.92

The engines, dynamos, and station equipment were in excellent shape, but the plant was not working under conditions favorable for the best economy in coal consumption, for the reason that the average load was just sufficient to make it necessary to run two engines and dynamos, but not enough to load them to good advantage. The results in detail are as follows:

	Average of two days.
Total car miles per day	701.
Mean electrical horse power output	50.
Maximum electrical horse power output (reached only once during two days' run)	171.
Pounds of coal burned perday	5,080.
" " water evaporated per day	45,300.
" " water per pounds of coal	8.92
" " coal per car mile	7.26
Cost of coal per pound	0.208c.
Cost of coal per car mile	1.51c.

The total rated capacity of the various parts of the plant is as follows:

Boilers 200 H. P. at 100 lbs. steam pressure
Engines 260 H. P. at 100 lbs.
Generators 240 electrical horse power.

This is nearly in the ratio of boilers 80, engines 104, generators 96.

The actual mean output during the test was only fifty electrical horse power, which is but 20 per cent. of the capacity of the plant.

The maximum observed electrical load was 171 H. P., which is about 242 per cent. above the average load, and but 71 per cent. of the capacity of the station.

As stated before, the most favorable results could not be expected under these conditions.

In order to determine the economy of operation under different conditions, records have been kept by the superintendent in charge of the station of the coal burned and car miles run each day. These records show that though the mean cost per car mile when running on the average of about 700 car miles a day is 1.51 cts., yet when on Sundays the traffic increased to about 1,000 car miles a day, the fuel cost was reduced to a fraction less than one cent per car mile, a result which has not only pleased the designers of the station, but which has given the most eminent satisfaction to the Biddeford & Saco Railway Co., who accepted and paid for the power plant before the maturity of the term under contract. As for the financial returns on the investment, it is stated that in the month of July alone they earned their full annual dividend on the capital stock, assuming the road to pay only current expenses for the remainder of the year.

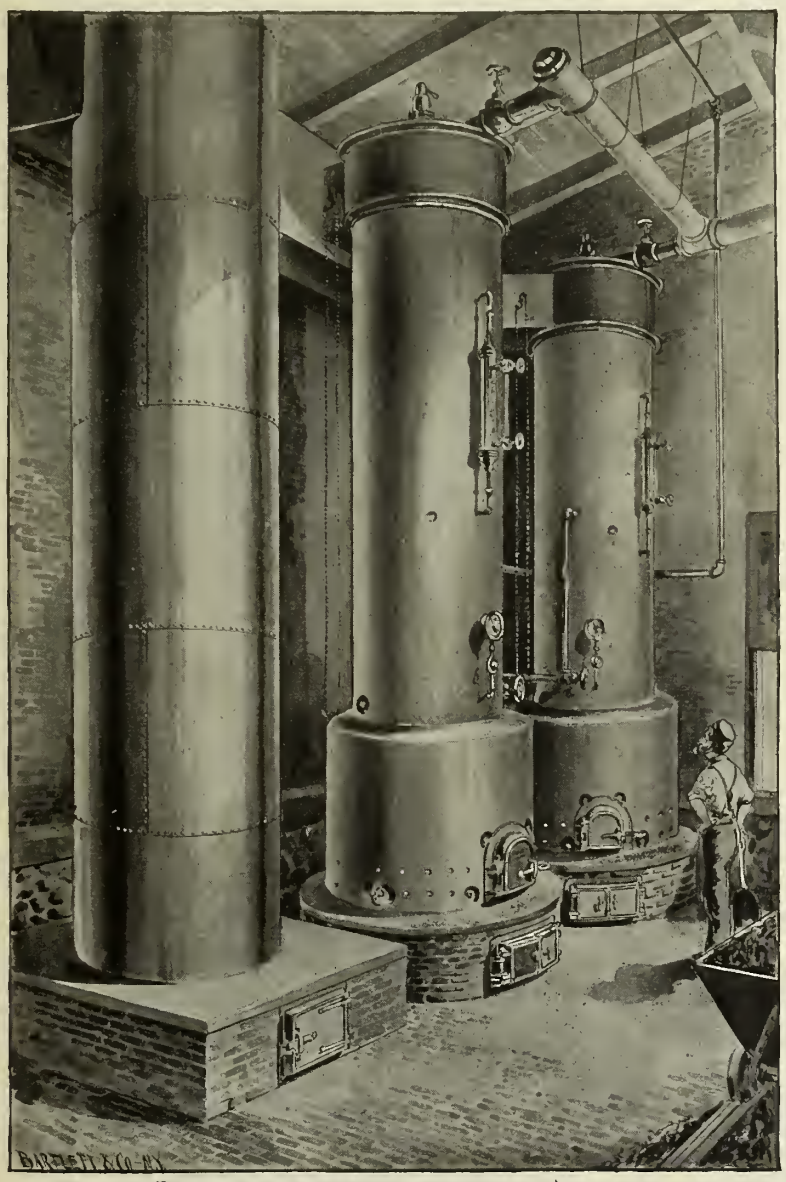


FIG.—BOILER ROOM—BIDDEFORD & SACO RAILWAY.

H. H. LITTELL and other capitalists of Cincinnati, Louisville and Buffalo have purchased the Leonard Avenue street railway of Columbus, O.

The Siemens & Halske Electric Co's American Works.

As we have previously noted, the Siemens & Halske Electric Co., of Vienna, has established an American house, and through its representatives, Messrs. Wright & Meysenburg, has erected a plant and begun the manufacture of electrical supplies, including generators, motors and lamps, which are modeled after their designs already in extensive use on the continent of Europe.

The new plant is located on South Wood Street near Blue Island Avenue, on grounds adjoining the Wells & French Co., extensive builders of steam cars, in which firm Wright & Meysenburg are also interested. The two buildings, occupy a ground space 200 × 200 ft., and are virtually one structure, having in common a partition wall, one half being one story in height and the other two. The construction is of brick with iron trussed roof. The machine shop has side galleries for light machinery, and in the front a second floor which is divided into offices, draughting room and store rooms. The foundry is a one story structure and is provided with an electric crane, as is also the main floor of the machine shop, one being of ten tons capacity and the other five.

The tool equipment is all new and is very complete, embracing the latest designs from such well known builders as the Niles Tool Works, Bement & Miles and Lodge & Davis, while the cranes were manufactured by the Morgan Engineering Co.

The castings for the generators and motors will be made in the foundries of the Wells & French Co., of which there are two, one being 265 × 100 ft., and the other 140 × 80 ft.

The present power equipment consists of two Heine safety boilers of 150 H. P. capacity, and a vertical, compound condensing engine of 300 H. P., manufactured at the Lake Erie Engineering Works, of Buffalo, N. Y. The crank shaft is coupled direct to a 148 K.W., Siemens & Halske slow speed generator, which supplies current to eight Siemens & Halske stationary motors, each of ten horse power, which are located at convenient positions about the shop, and belted direct to the shafting.

The buildings are warmed by hot air, which is heated by being driven, by means of a Sturtevant fan, over a nest of steam pipes, located above the floor of the boiler room from which it is conveyed about the building through large galvanized pipes having openings and branches leading to registers in the floors of the second story. An abundance of light is admitted through a large area of glass in the roof, and large and frequent windows in the side walls. Steam railway sidings lead into each building, offering excellent shipping facilities, and to the boiler room where coal is delivered direct from the cars.

The direct current railway generators of the Siemens & Halske type, which the firm proposes to build, were illustrated and described in the October STREET RAILWAY JOURNAL, to which number our readers are referred for further particulars.

Dr. Berliner, electrician of Siemens & Halske, is general superintendent of the new works, and will be assisted by H. M. Kibby, already well known to our readers.

The buildings above described are only a part of the proposed plant, plans for duplicating the present buildings being already prepared.

THE work of assigning space to the thousands of exhibitors in the various World's Fair buildings has been entered upon and will be pushed to a finish as rapidly as possible. As much more space has been applied for than is available, it will be necessary to scale down the requests of a majority of the applicants.

The Security Register.

The accompanying two engravings show a new register, for which a number of important advantages are

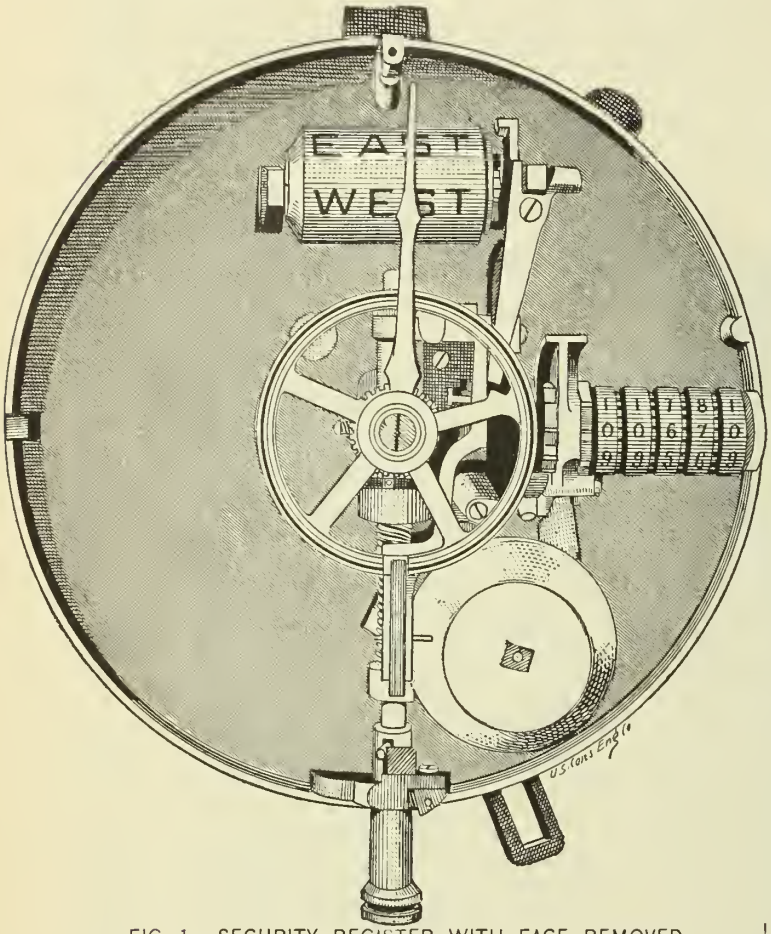


FIG. 1.—SECURITY REGISTER WITH FACE REMOVED.

claimed, which has recently been put on the market by the St. Louis Register Co. The general interior arrangement of the register is shown in Fig. 1, which is one-third the exact size. The register indicates on the face the

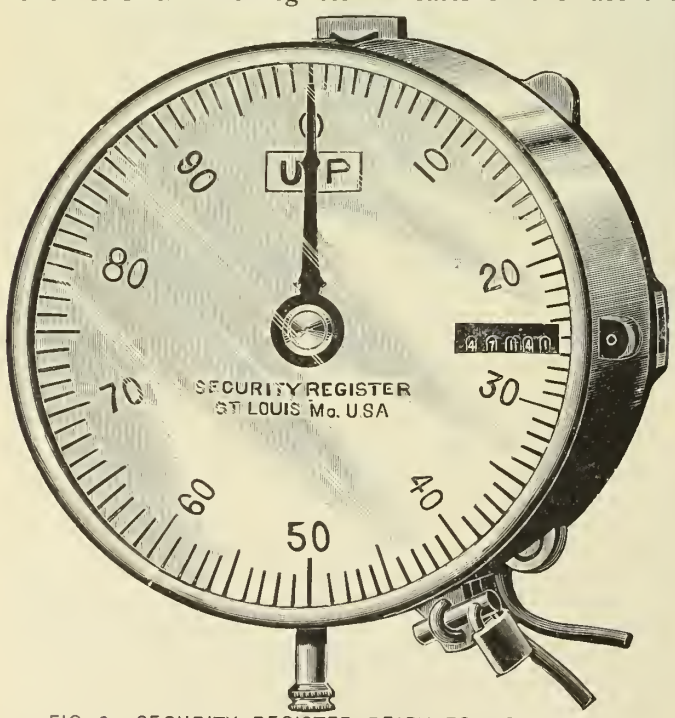


FIG. 2.—SECURITY REGISTER READY FOR OPERATION.

direction of the trip and fares up to 100, at the same time being arranged to totalize fares up to 99,999. The mechanism is extremely simple, there being but five compression springs employed. At the same time the greatest accuracy is secured, since the register is worked by the movement of one shaft, to which all parts are geared. This feature makes it impossible for the machine to fail to register a fare when the cord is pulled. The face of the register is twelve inches in diameter, the frame is brass, and in thickness it is three and a half inches.

At the base of the instrument is a knob by which the indicator is returned to zero. The only operation required to accomplish this is to push the knob upward, when, after the hand has been taken away, it will drop of its own accord. Before it was regularly put on the market, the company tested the register for a year, to learn whether it could be improved in any particular. Since it has been on sale it has been adopted on a number of roads, where it has given good satisfaction. The People's Railway Co., of St. Louis, among others, testifies to its merits.

Sectional Water Tube Boiler.

The new sectional water tube boiler illustrated herewith has recently been put on the market by the New York Safety Steam Pipe Co., of 30 Cortland Street, New York. As will be noted, the tubes are arranged in transversely inclined series of several tubes per section. The movement of the water contained in the boiler is then as follows: From the steam and water drum located above the tubes, into which water is fed, it descends the water legs, four in number, placed outside the furnace, to the water and mud drums at the base; thence it passes, via the tube connectious into the lower series of headers; thence through the tubes, over the fire, into the upper series of headers and into the steam and water drum again. The proportion and combination of parts throughout the boiler is such that expansion and contraction, due to changing temperatures, can occur without straining or disturbing the position of any part or system of parts. Every tube employed is straight, lap welded and expanded into the headers, which are of steel or iron according to the service required, and the tnbes being short the tubular expansion is very small.

Outside of the furnace, opposite each end of each tube, a hand hole of proper size to admit a tube or tube expander is provided, fitted with a cap held in place with a cross bar and bolt. Upon removal of this cap the in-

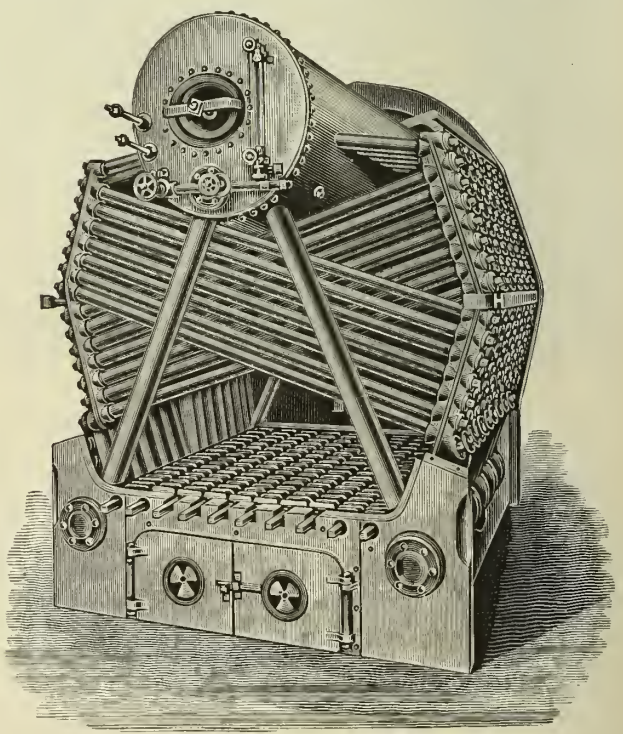


FIG. 1.—SECTIONAL WATER TUBE BOILER.

ternal condition of the tube is open to inspection and cleaning, or in case of leakage in an expanded joint, to re-expansion. In case of accident to a tube, or depreciation through long use, a new tube can be substituted with but little trouble and delay. In fact, every part and detail is

readily accessible from the outside for examination, cleaning or repair.

The furnace extends under the entire boiler, and is of proper height to admit of the use of any fuel. An-

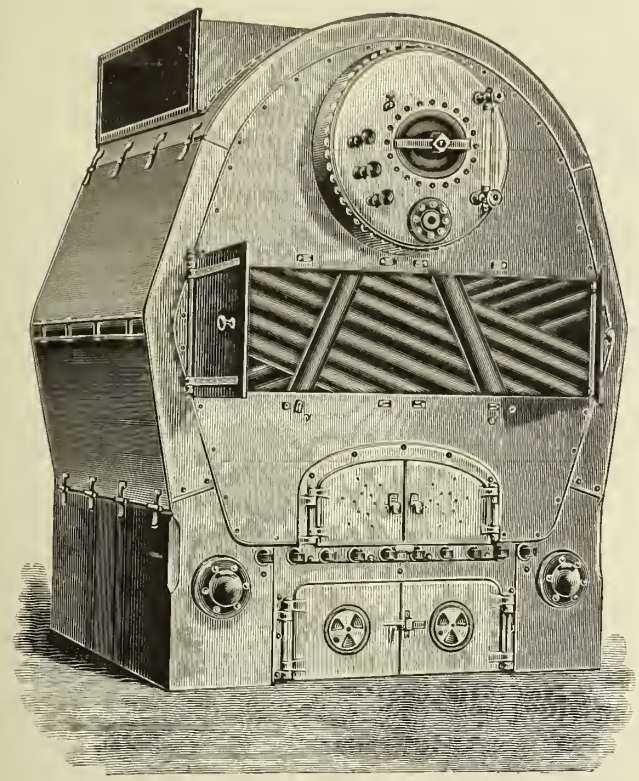


FIG. 2.—SECURITY WATER TUBE BOILER.

other important feature of the boiler is that it is compact, and at the same time of liberal proportions in grate area and heating surface. A boiler of 200 H. P. can be passed through a 4×4 ft. door, window or sidewalk opening.

Every tube connection is expanded, and there are no screw joint connections in this boiler. The furnace is lined with firebrick. The only other brick work required consists of two foundation walls of proper depth, rising above the floor level about twelve inches.

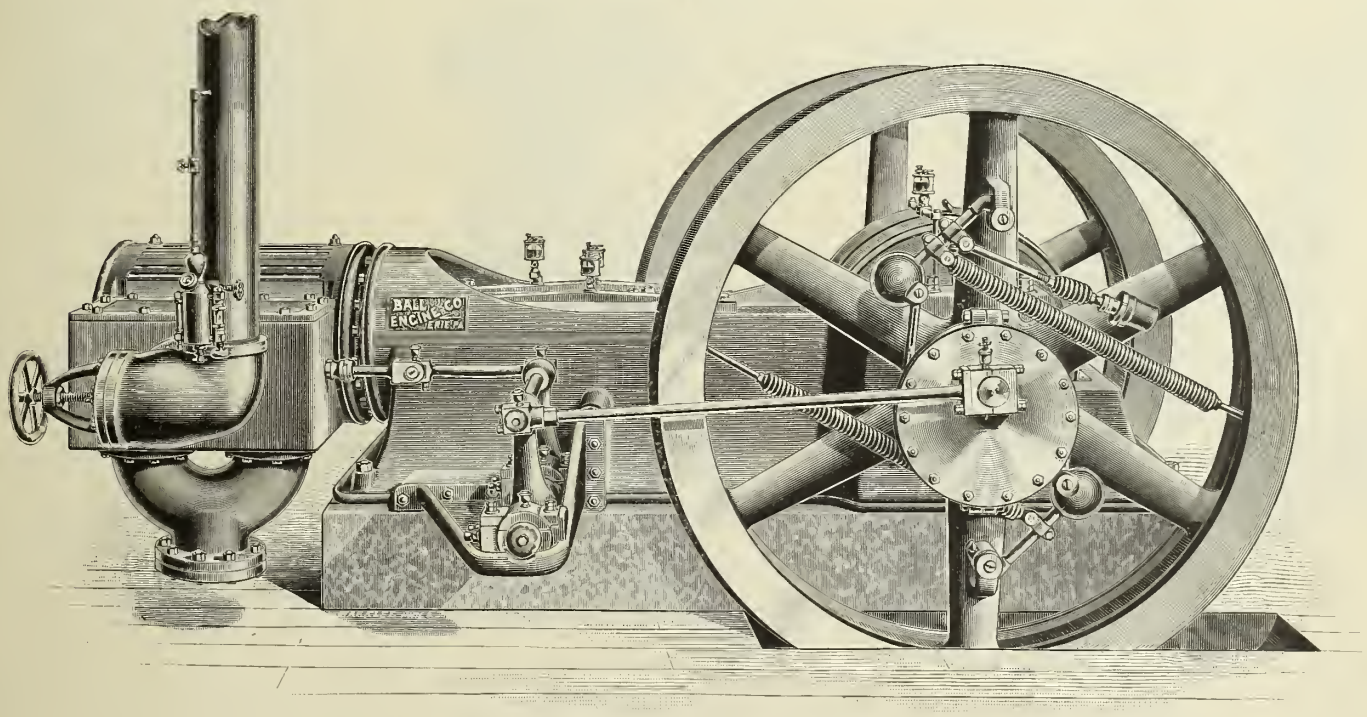
Each section of tubes and headers is tested under 500 lbs. hydrostatic pressure in the manufacturer's works, and is known to be sound and perfect before being incorporated in a boiler. The main steam drum is made of open hearth, homogeneous flange steel plate, having a tensile strength of not less than 60,000 lbs. per square inch of sectional area, and the plate employed is of proper thickness to enable the boiler (under government standard of pressure allowable) to carry a working pressure of 250 lbs. per square inch.

New Heavy Duty, Electric Railway Engine.

In selecting an engine for electric railway service, the character of its duties should be carefully considered. It will be found that the work is very exacting and severe, and the engine should be adapted for heavy duty, varying load, and long, continuous runs. It should, therefore, have great strength and weight, with sufficient metal so distributed as to receive the various strains and thrusts of moving parts without deflection or vibration.

The engine shown in the illustration was designed by the Ball Engine Co., of Erie, Pa., especially for electric railways and electric welding, and possesses the above requirements to an admirable degree, as may be seen by the view and the following description :

The frame of the engine is massive and heavy and internally ribbed so as to give the greatest attainable stiffness. The crank shaft is forged out of a solid steel ingot of the best quality, and is of large diameter and great strength. The connecting rod and straps are forged out of steel ingots, and are of a new design, combining strength with efficiency. The main bearings are unusually large, and are so arranged that both the vertical and side wear of the liners may be taken up. The main bearing liners are genuine babbit, carefully scraped and fitted, and as they are made removable they can be quickly and easily taken out and replaced with new ones if necessary. The crank pin boxes are lined with genuine babbit. The crosshead boxes are made of pure copper and tin. The crosshead is a steel casting with very large bearing surfaces, and is babbited on the four faces with genuine babbit. The crosshead pin is tool steel, and the piston rod a fine quality of crucible steel. The oiling devices are of the most improved form, and all fittings are complete and of the best description. The regulation, by means of the improved governor, is such that the engine is said to have shown in practice perfect regulation under conditions where the variation in load on the generator, from zero to the full capacity, has occurred in less than five seconds of time.



HEAVY DUTY, ELECTRIC RAILWAY ENGINE.

Improved Power Transmission Machinery.

The accompanying engravings show several improved appliances manufactured by the Hill Clutch Works for the transmission of power by belts. Fig. 1 represents a

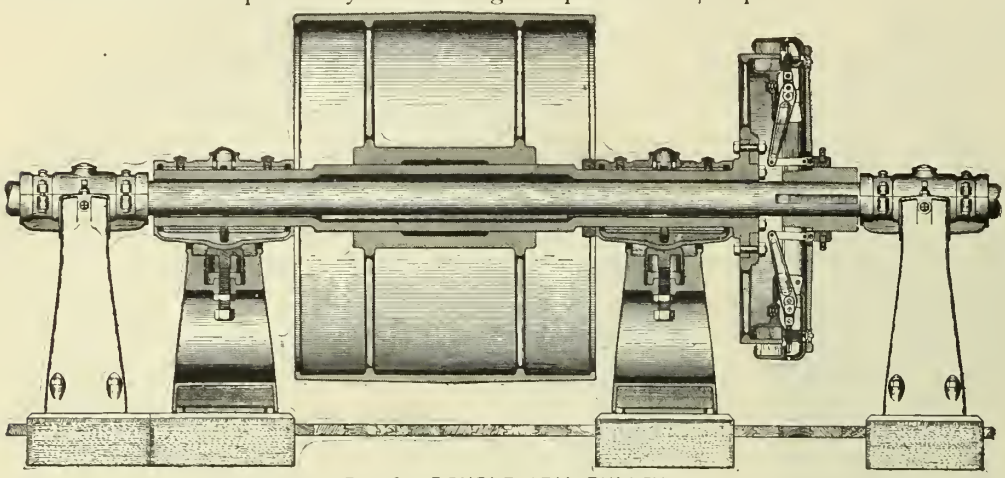


FIG. 1.—DOUBLE ARM PULLEY.

large double arm receiving or driven pulley on a quill which surrounds the line shaft. As the line shaft rests in bearings at each end, and as the quill rests in its own bearings, both are independent of each other. To one end of the quill is securely bolted a clutch coupling ring, the clutch mechanism being keyed tight to the line shaft. When the clutch is disengaged the engine driving the quill can be stopped or started without interfering with the running of the line shaft. To transmit power from this engine to the line shaft, the clutch is thrown in, clamping the clutch ring on the quill and making the connection rigid. By this arrangement two or more engines can be used to drive a line shaft and either stopped or started without interfering with the others.

Fig. 2 shows a belt tightener with a lateral screw adjustment. By disengaging the gear on one end of the

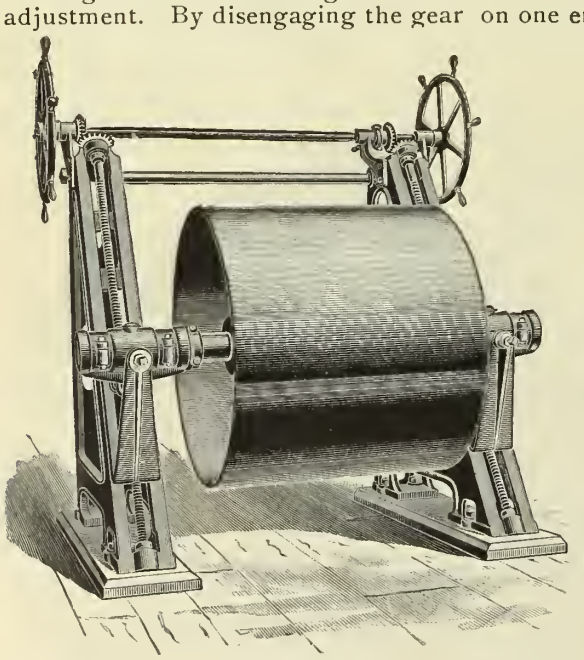


FIG. 2.—BELT TIGHTENER.

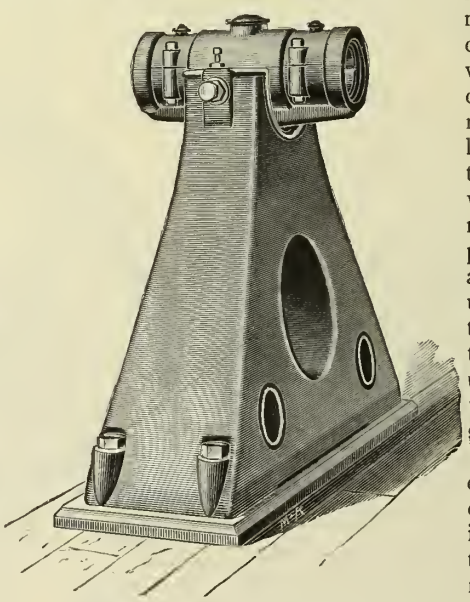


FIG. 3.—BALL AND SOCKET BEARING AND STAND.

hand wheel shaft one side may be raised or lowered independently of the other, but when the gear is thrown in, both sides are made to work alike, insuring a perfect alignment. The pulleys are turned on the inside as well as on the face, thus insuring an accurate running balance, and the shaft rests in ball and socket, self-oiling bearings.

Fig. 3. Illustrates a ball and socket, self-oiling bearing and floor stand. In the bottom of the bearing is a large reservoir for holding the oil, which is conveyed over the shaft by means of a chain and afterwards flows back into the reservoir.

When the oil becomes dirty it can be drawn off, filtered and used over again. Besides the ball and socket adjustment, there is both a lateral and vertical screw adjustment, enabling the user to easily align his shaft and keep it so aligned. Another feature and one of great importance is that the bearing can be removed without disturbing the stand, or moving anything on the line shaft.

Improved Patton Motor.

Since the illustration and description of this motor in our October, 1891, issue, important improvements have been made in the details of construction, and recently the motor has been adopted by the Pullman company to operate its line at Pullman, Ill., the tracks of which are to be extended so as to be connected with the Calumet Railway Co.'s line. A number of double decked cars are now being constructed at the Pullman car shops for the equipment of this line. A car has also recently been in operation on the lines of the Louisville Terminal Railway Co. at Louisville, Ky.

The motor cars for the Pullman line are to be mounted on six wheel trucks, having independent equalizers for the carriage of the machinery, and will be propelled by an electric motor of special design, which will be geared to the middle axle only. The intermediate wheels are thirty inches in diameter and will act as drivers, while the outer wheels, twenty-four inches in diameter, will serve for distributing the weight, and the prevention of the teetering of the car bodies.

The Patton system, it will be remembered, employs a gas engine which burns gasoline and runs continuously, being coupled direct to a generator of special design, which furnishes a current to operate the motor, and which is supplemented by a certain number of storage battery cells, depending upon the voltage employed. These cells take up the surplus current when the motor is doing light work, and return it automatically to the motor when additional power is required, and also furnish power to start the engine after the cars have been laid up. This is done by leading the current to the generator, which acts as a motor until the engine begins to work, when it becomes a generator.

The system requires no central power station, as each car is a generating station in itself. The total weight of the fully equipped Patton motor is from 15,000 to 25,000 lbs., according to the towing power and speed required and the style and mechanism of the car body.

The long tests which have been made with this motor have convinced the company that there is considerable economy in operation over other electric systems, and they have persevered in the face of adverse criticism until the results have proven, to their satisfaction, that their faith in the system was well founded and it was worthy of development.

THE Third Avenue division of the Brooklyn (N. Y.) City Railroad is now operated by electricity down to Fulton Ferry.

Telescoping, Iron Tower Wagon.

A telescoping tower wagon, which presents a number of novel points, and is manufactured by Hill & Welles, of Lafayette, Ind., is illustrated in the accompanying engravings, Fig. 2 showing the tower lowered, and Fig. 1 the tower raised. Iron is used entirely for the construction of the tower, with the exception of the platform, which is of wood, thoroughly insulated with rubber strips where the wood joins the iron, and with hard rubber bushings where the bolts pass through. This construction makes it practically impossible to get a "ground," even if a ground connection were made from the lower part of the tower, and the wagon has been employed in wet weather without the slightest trouble from this source.

The tower is raised or lowered at will by means of four pinions working in racks at each corner, the pinions being keyed to a shaft running across the lower section. A crank is attached to each shaft at diagonally opposite corners, making it very easy for two men to raise or lower the tower, and allowing them also to slide side bars over the square part of the shaft and so hold the upper section rigidly in position at any point desired. The extreme height of the tower when raised is sixteen feet, and when lowered twelve feet.

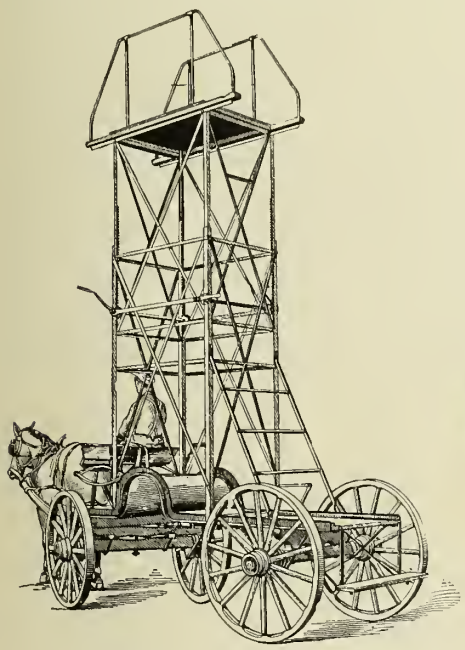


FIG. 1.—TOWER WAGON RAISED.

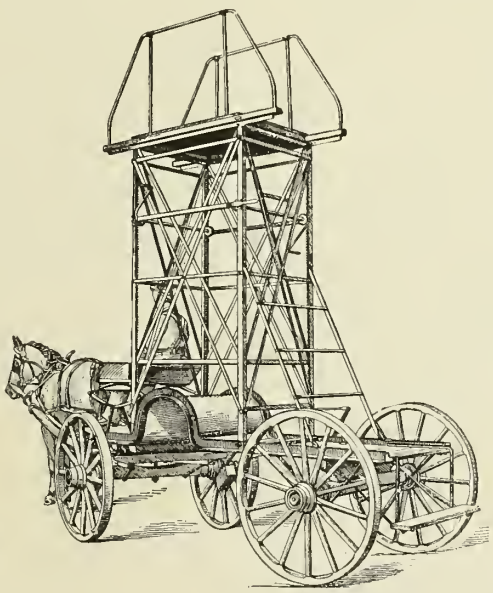


FIG. 2.—TOWER WAGON LOWERED.

The wagon running gear is of the O'Brien type, with extra wide tires on the wheels. The frame of the wagon is of T iron with an arched turn, allowing the wagon to be turned around in the smallest space without upsetting. There is plenty of room on the frame for carrying tools, wire reels or other appliances.

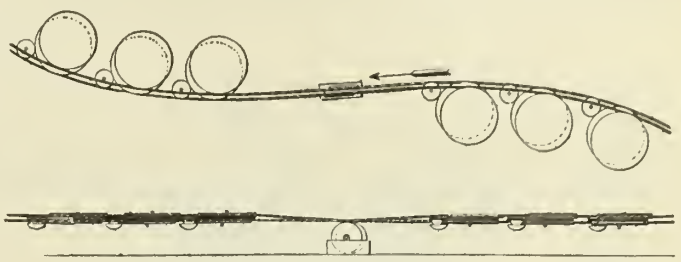
Underground Conduit System for Washington.

About two miles of the Love conduit system is now being laid in the city of Washington by the Rocky Creek Railway Co. The yokes weigh 260 lbs. each, the slot rail fifty pounds, and the track rail, which is grooved and of the Johnson type, sixty-two pounds to the yard. Cast iron shields are used for the sides of the conduit and concrete for the bottom. The depth of the conduit will be eighteen inches, and sewer connections will be made every 100 ft. for drainage purposes. The conductors are copper, three-quarters of an inch in diameter, and will be furnished by John A. Roebling's Sons Co. The contractors for the work are Christie & Lowe, of Chicago.

From the corner of Eighteenth and W Streets, outside the center of the city, to Chevy Chase, the terminus of the road, the trolley system will be used, and through cars will be run. The special work on the line includes a cable crossing, 200 ft. of curves, three turnouts, and a number of crossovers and surface track crossings.

Cable Traction System.

A new method of constructing S curves in the duplex cable system has been recently invented by George Muller, of Hoboken, N. J. By the invention either cable does not interfere with the other, and the invention consists principally of mounted pairs of pulleys for carrying the two in yokes, which are adapted to swing for the purpose mentioned below.



FIGS. 1 AND 2.

Figs. 1 and 2 respectively give plan and elevation views of the position of the cable in an S curve. The two cables are carried at the same level in the straight part of the conduit, but are located one above the other on entering the curves, as shown. On ordinary quarter curves the two cables remain in the same relative position throughout the curve, but on an S curve the position of the cables is reversed at or near the middle, so that the cable which is uppermost during the first half of the curve becomes lowermost during the last part of the curve. The cables leave the S curve in this position, and are then brought gradually horizontal on the straight track. At the point of crossing, the two cables pass over vertical pulleys, as shown. The regular curve pulleys are mounted horizontally by pairs in yokes, the lower one being set slightly in advance of the upper, as shown in the different engravings. These yokes are mounted in bearings, and are adapted to be tilted. In front of each pair of pulleys is arranged a small pulley in the shape of an inverted cone, provided with a semi-spherical base and top flange, as shown in Fig. 4. This small pulley is mounted on a shaft secured in a frame, and is arranged to slide upward and outward with the tilting of the yokes. When the cables are in their normal position, the upper cable passes over

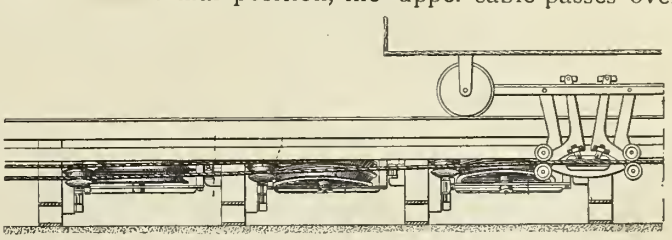


FIG. 3.

the top flange of the small pulley, and the lower cable rests on the top of the base.

The operation of the system will now be readily understood. When a car enters an S curve operated by the upper cable the grip moves the cable out of the groove of the upper pulleys as it approaches them, but as the pulleys in each set stand in a horizontal position the cable is readily passed back into its proper pulley. When the grip passes the center of the curve the cable which has been uppermost is now lowermost, and as the car proceeds

is moved out of the first lower pulley ahead of the grip. In doing this the cable exerts an upward pull on the upper flange of the curve pulley, the jaws of the grip being located a suitable distance above the pulley, as shown in Fig. 3. In pulling upward on the pulley the yoke carrying the pulleys is tilted so that the front parts of the pulleys swing upward to assume the position shown in

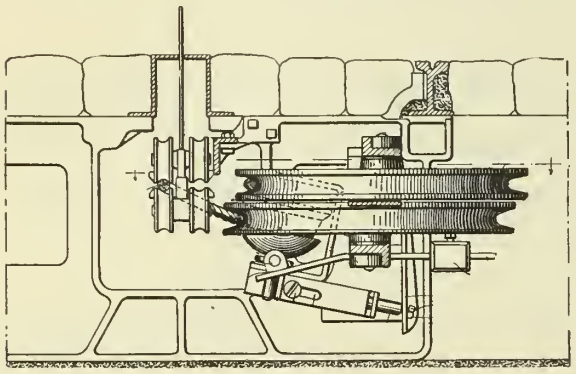


FIG. 4.

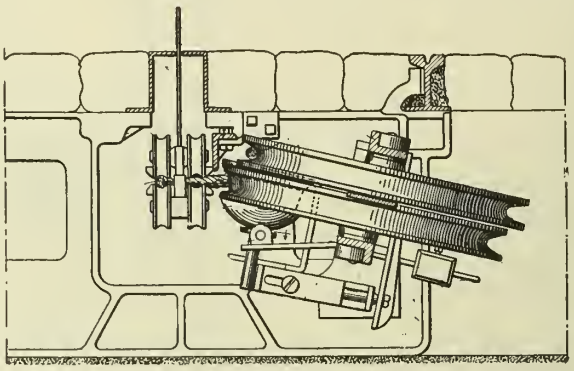


FIG. 5.

Fig. 5, and at the same time the connection between the yoke and the cone shaped advance pulley causes the latter to slide upward on its shaft into the position shown in Fig. 5 by the dotted lines. As soon as the grip has passed the set of pulleys the cable is returned to its groove, as shown in Fig. 5, and by its tension and weight acting rearwardly and downwardly on the cone shaped advance pulley it swings the set of pulleys to their normal position, when all strain is taken by the main pulley.

Figs. 6 to 10 show a new pick-up and throw-off mechanism for cable also designed by Mr. Muller. The grip is adapted to the duplex system of cables, and its general arrangement is shown in Figs. 6 and 7, in side elevation and cross section respectively. The grip consists principally of a fixed lower jaw, G, and a movable upper jaw, G^1, which latter is actuated by the two pivoted levers carrying the grip pulleys, G^4, G^5. Above these are arranged pulleys, G^6, G^7, which are mounted to turn on fixed spindles secured to the same frame which supports

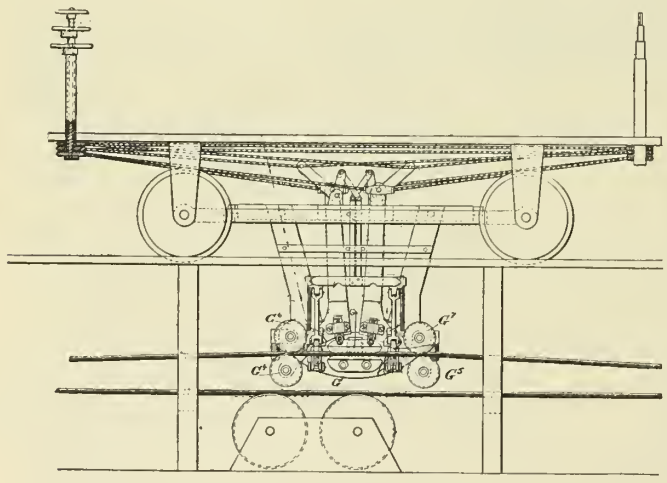
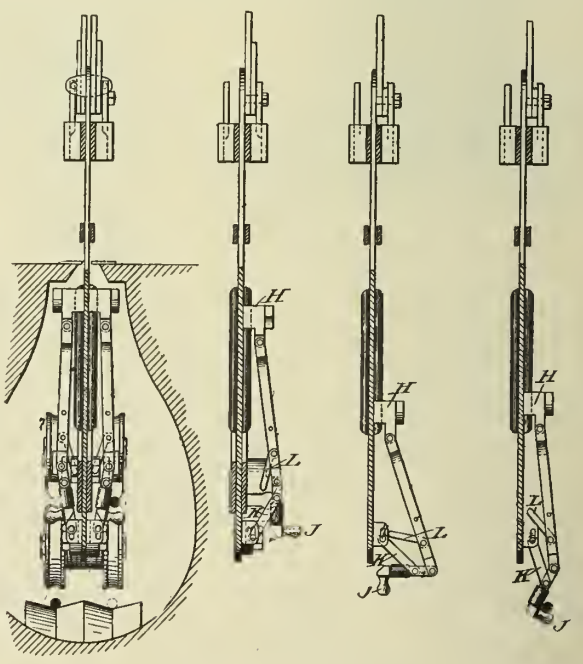


FIG. 6.

the lower jaw, G. The upper movable jaw, G^1, is operated through the levers, carrying the lower gripping pulleys, G^4 and G^5 by means of endless chains passing over pulleys fixed to rods at both ends of the car. Turning the upper hand wheel on either rod will simultaneously lower the jaw, G^1, and raise the gripping pulleys, G^4 and G^5, gripping the cable. The lower wheel handles are for operating the pick-up and throw-off which will be described later. In order to release the cable from the grip, the upper wheel handle is turned in an opposite direction. It will be seen from this that the pulleys, which are of cast iron or steel, lined with brass, are grippers, as well as the jaws, so that by reducing the tension of the grip so as to allow the cable to pass through, the car can be operated at a less speed than the cable, and the gripman can even stop his car on a curve without losing the cable.

The pick-up and throw-off mechanism are also shown in Fig. 6, but in greater detail in Figs. 7 to 10. As the mechanism is similar on each side, it will be necessary to describe only one side. When the jaws are relaxed the cable will run on the side rollers of the grip as before described. The operator now turns the middle hand wheel on the platform, causing the bar, H, to slide downward, so that the arm on which the roller, J, is mounted swings outward, moving the cable from the fixed jaw and the gripping pulleys, the cable resting simply on the roller, J. By a further movement of the hand wheel the bar, H, slides further downward until the pawl finally engages with the bearing, K. At this time a further downward motion causes the angular arm carrying the roller, J, to assume the position shown in Fig. 9, thereby causing it to disengage the cable, the latter falling to its normal position on the main carrying pulley. When the operator desires to pick up the cable again he reverses the movement of the wheel handle, disengaging the pawl, L, from the bearing, K, and permitting the angular arm to assume the nearly vertical position shown in Fig. 10. Raising the bar, H, will now carry the cable back to its position in the grip, the cable resting on the friction rollers, J. The operator now actuates the grip again so as to close the gripping pulleys and cause the jaws to firmly grip the cable.

Should the angular arms of the friction rollers, J,



FIGS. 7, 8, 9 AND 10.

come at any time in contact with the carrying pulleys, they will swing slightly inward and upward to the position shown in Fig. 10, thereby easily riding over the cable pulley without losing their proper position relative to the cable. The lower wheel handle on the platform is for operating the pick-up or throw-off for the cable on the other side. It will be seen that this pick-up and throw-off enables the gripman to take up a cable and throw it off at will. This is important at cable crossings, and also in case of accident to the cable when the gripman can throw off the injured cable and pick up the other one in the manner described.

Electrically Operated Track Switch.

A method of operating track switches from the platform of an electric car by means of the same current which propels the car has recently been invented by Charles A. Stone and Edwin S. Webster of Boston, Mass. The class of railway switch employed is that in which the switch tongue is moved by the action of electro-magnets upon their armatures, or solenoidal coils upon their cores, the magnets or solenoids being placed below the surface of the street; and the invention primarily consists in providing near the location of each switch, short sections of trolley wire which are electrically connected to the main trolley wire only through the magnets of the switch.

In Fig. 1, which shows the method of connecting the switch magnets with the main circuit, D, is an insulating frog, provided on one side with a guide rod, *d*, for directing the trolley wheel to the left when the special switching arms, H, H, (Fig. 2) of the trolley are open. These arms are operated by the driver from the front platform of the car by means of the cord, *h*.

The operation of the device is then as follows: Assuming that the electric current is coming over the conductor from the right (see Fig. 1), in order to reach the switch section conductors it must pass down the conductor, *a*, through the coils of the magnets and thence up the conductors, a', a^2. As soon as the car approaches the switch section the driver pulls upon the cord, *h*, thus drawing the arms, H, into the position shown in Fig. 2, and when the trolley arrives at the plate, D, the arm, H, bearing upon the guide rod, *d*, will direct the trolley onto the lower or left hand switch-section conductor. The current will flow down the conductor, *a*, through the coils of the lower magnet in the switch box, up the conductor, a', to B′, and thence by the trolley and the conductor, connecting it with the motor, through the motor, to earth. The passage of the current through the lower magnet will

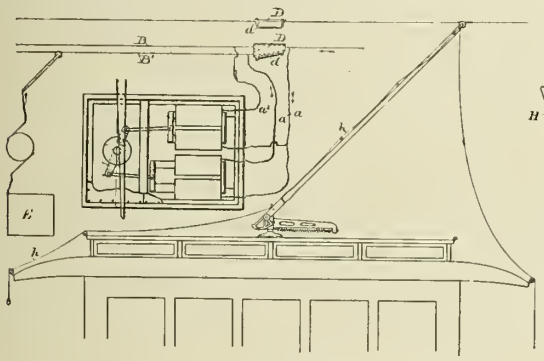


FIG. 1.

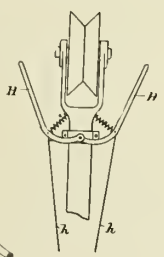


FIG. 2.

magnetize it and cause its core to be drawn in, and thus move the switch tongue and direct the car upon the left hand track.

If, on the other hand, the motorman wishes to continue the car upon the right hand or main track, the arms, H, are allowed to remain against the trolley harp, and the trolley will then move straight across the plate, D, onto the conductor, B, and thus, drawing the current through the other magnet turn the switch tongue so as to direct the car accordingly.

Improved Cable Grip.

A new type of cable grip, containing several novel features has recently been designed by J. H. Robertson, of New York and is illustrated herewith. The objects of Mr. Robertson's improvements are twofold: First, to provide a method by which the gripping dies can easily be adjusted to compensate for any wear, and, second, to supply a simple and prompt acting mechanism for throwing the cable out of the grip when occasion requires.

As will be seen from Figs. 1 and 3, which show, respectively, a side elevation and cross section of the grip, the dies in the upper or stationary jaws are held fixed as usual, while those in the lower jaws are secured within their sockets by four screws each. The heads of these screws rest upon the lower flange of the jaw, and the die is held in position by means of jam nuts on each screw, which lock the die to the jaw frame. As the dies become worn they may be raised independently of the jaw by the screws, the pressure upon the die when forced into contact with the cable being then transmitted through the screws to the flanges of the jaw. By this means it is possible to adjust either of the dies with great accuracy independently of the other die and without disturbing the relative positions of the stationary and movable jaws, while a worn out die may be readily replaced whenever occasion requires.

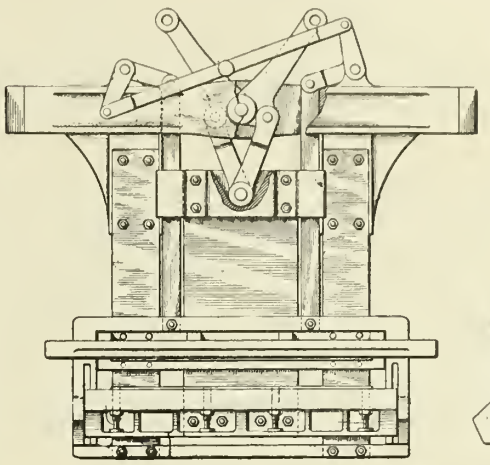


FIG 1.

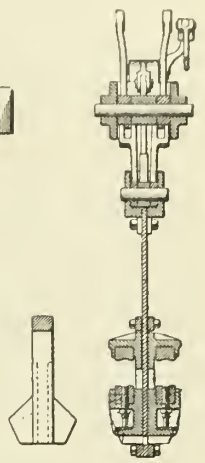


FIG. 2. FIG. 3.

The device for throwing the cable out of the grip is shown clearly in Figs. 2 and 3. Between the central plate and the side hangers of the grip are located strips which have a vertical movement independent of the movable jaw, the ends of the head frame being arranged to embrace the strips and form guides for them. The upper ends of these strips are connected by short operating levers with a rod, as shown, for simultaneous operation. To the lower ends of the strips there is secured a frame provided with outwardly flaring wings (see Fig. 2), which when the cable is running between the jaws are located below the cable and out of contact with it. When, however, the gripman desires to throw out the cable he simply moves the lever rod, thereby raising the frame and wings, and forcing the cable out of place. This construction of throw-out obviates the difficulty which has heretofore arisen by the cutting of a groove in the throw-out under the continuous action of the cable, and the consequent liability of the cable becoming caught in such groove when the throw-out is brought into action. Moreover, it provides for distributing along the entire slanting top of the wings such slight wear as may take place so that there will be no danger of cutting a groove.

Combined Ticket Punch and Bell Cord Mender.

It is always desirable to have a ready and convenient means for mending register or bell cords, other than by knotting the ends together, should they break while the cars are *en route*. A tool for this purpose is manufactured by the National Fare Box Co., of Chicago, which firm also manufactures the improved fare box which was illustrated in our July issue.

To repair a cord, a brass sleeve or shell about one and a quarter inches long is placed over the abutting ends, when by means of a punch, triangular portions of the metal are cut and forced into the cord, forming barbs which point inwardly from the ends of the sleeve, thus holding the ends of the cord firmly together, so that any outward strain on the cord serves to lock the ends more tightly.

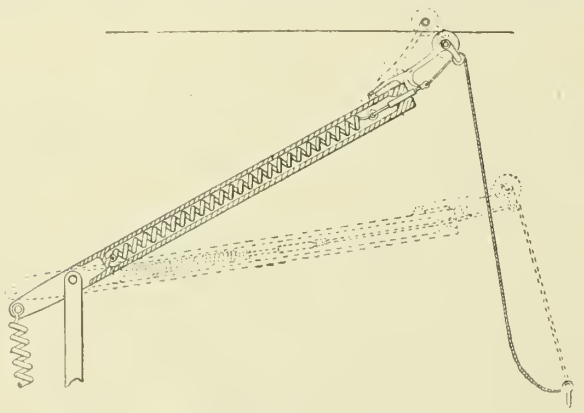
The punch with which the metal is cut and clinched serves also as a ticket punch, there being a separate die for this purpose, which is used by the conductor for punching transfer tickets or for any other purpose for which a

punch is employed. The sleeve die is placed in a concave chamber, so that it does not interfere with the ticket die, and the sleeve when in place on the cord does not interfere with its passage through the supporting eyes or blocks.

Trolley Catcher.

The accompanying engraving shows a novel trolley attachment recently patented by John J. Hoppes, of Springfield, O., and by him assigned to the General Electric Co. The object of the invention is to automatically lower the trolley pole of an electric car in case the trolley wheel should accidentally slip or jump off the overhead wire.

As will be seen, the harp or frame supporting the trolley wheel is not rigid to the pole, but forms an extension to the latter, being at the same time pivoted so as to be capable of an independent movement, as indicated by the dotted lines in the upper part of the engraving. Located between this extension and the trolley arm is a small spring, which will throw the extension up in case the pressure is removed from the wheel. Another feature is that the trolley cord, instead of being connected directly to the arm, is carried over a pulley supported in brackets



TROLLEY CATCHER.

just below the wheel, and is then connected to a movable plunger. This plunger is connected at the other end to a spring within the arm, which is hollow, and extending almost its entire length. A small projection is provided on the auxiliary frame or trolley extension, so that in its normal position it will engage a shoulder on the end of the plunger, and thus hold the spring in an extended position, as shown in full lines in the engraving. The cord is secured as usual at its lower end to the car, with just enough slack to permit the trolley wheel to rest slightly above the trolley wire.

The operation of the device is then as follows: should the trolley wheel leave the wire, the independent movement of the auxiliary frame caused by the small spring, will withdraw the projection from the plunger. The spring within the trolley pole is thus released, taking up the slack of the cord and drawing it into the trolley arm. By this means the arm is forced down to the position indicated by the dotted lines, the increased leverage at the outer part of the trolley arm being sufficient to overcome the tension of the main trolley spring.

ON being asked what *one* street railway appliance was most needed at the present time to render the service more efficient, President Henry M. Watson replied: "A proper safety guard or fender;" Charles Hathaway answered: "An honest conductor;" George G. Mulhern, "An efficient safety brake."

"No manager can furnish seats for all his passengers and pay dividends to his stockholders. I allow the same principle to control me in the management of street railway affairs as I practise in private affairs—always to spend less than my income each month, no matter how small or how large it may be."—A SUCCESSFUL MANAGER.

A Brooklyn Railway Changes Hands.

The Atlantic Avenue Railway Co. on November 17, sent out the following notice, signed by the president, William Richardson, to the 140 stockholders in that company: "The directors of this company have agreed with Mr. W. A. Read, acting for Messrs. E. W. Clark & Co., of Philadelphia, and Messrs. J. & W. Seligman & Co., of New York City, and their associates, to sell the stock owned by each of them, respectively, at the rate and price of 250 per cent. of the par value thereof, being $125 for each share of $50 of the stock of the Atlantic Avenue Railroad, payable one half on December 16, proximo, and the remainder on January 16, 1893, and have secured the same privilege for every stockholder of the company who shall on or before the 15th day of December, 1892, signify in writing and by filing the same in the office of the Atlantic Avenue Railroad Co. his acceptance of said price and terms of payment for the stock owned by him. Deliveries of stock should be made on or after December 16, proximo, to Messrs. Vermilye & Co., Nassau and Pine Streets, New York, who will at once make the payment of 50 per cent. of the purchase price, and will issue receipts for the stock, calling for the final payment as stated above. It will, therefore, be necessary, if you accept the same, to sign and forward to the office of this company the enclosed notice."

Legal.

COLLISION—INSUFFICIENT BRAKE—EVIDENCE—CONTRIBUTORY NEGLIGENCE—ARGUMENT OF COUNSEL—NOTICE.

1. In a suit against the defendant railway company whose car had run down a steep grade, and collided with a hearse at the head of a funeral procession, it was error to permit witnesses who had driven street cars to testify that the car might have been stopped if the brake was in good order, and had been applied, in the absence of evidence that they knew what brake was on the car, or that they had ever driven a car down the incline.

2. Where, on the first trial the driver of the hearse testified that he saw the car when it was twenty-five or thirty feet away, and that it was going at about twelve miles an hour; on the second trial he testified that he had since measured the distance, and found that when he first saw the car it was 180 ft. from the crossing, and that when he was crossing the track it was about 100 ft. distant, and coming at a "terrible" rate of speed. *Held*, that the court properly submitted the question of his contributory negligence to the jury.

3. Shortly before the trial there was great excitement and anger of the populace, which culminated in mob violence against defendant. *Held*, that an allusion to defendant as "the unfortunate city railway, whether driven through the streets by the mob or driving along its usual course," in the argument of plaintiff's counsel, was ground for reversal. Further, that judicial notice will be taken of the fact that such ill feeling had been engendered against defendant the same being a matter of current history. Reversed. *Geist et al.* v. *Detroit City Ry. Co.* Mich. S. C., May 6, 1892.

INJURY TO PASSENGER—EVIDENCE—STANDING PASSENGER—WARNING—INSTRUCTION—DUTY OF CONDUCTOR. Plaintiff brought this action against the defendant street railway company to recover damages for personal injuries wherein it appeared that the car was stopped for a passenger to alight, and the passenger alighted while plaintiff was walking from her seat, making no effort to attract the attention of the conductor.

Held, that the question whether the conductor was negligent in not warning plaintiff before starting the car was for the jury, and that the court erred in instructing the jury, as a legal proposition, that the conductor had no right to start the car before warning plaintiff, if she had left her seat or was standing for any purpose. Judgment for plaintiff reversed. *Losee* v. *Watervliet etc. Ry. Co.*, N. Y. S. C., Mar. 15, 1892.

Note: A conductor of a street railway car should

give passengers a reasonable opportunity to alight, and a failure to do so is negligence, (so held in *Poulin* v. *Railway Co.*, 61 N. Y. 621). He is only bound, however, to afford a reasonable time. A party wishing to alight must not hesitate or loiter. On street railways the conductor only stops when signaled by a passenger. It is true that when he stops for one passenger who signals him another may take advantage of the opportunity to leave the car; but, to establish negligence on the part of a conductor the circumstances must be such that his attention was or should have been called to the intent of the standing or walking passenger to alight. Especially is this true where the car is not started hastily.

City Ordinance Regulating Time of Running Cars—Reasonableness of—Evidence. Where the law (see laws 1860 c. 512) and the company's charter provides that the said street railway company shall run cars as often as the convenience of passengers may require, and shall be subject to such reasonable rules and regulations in respect thereto as the common council may prescribe; and when the latter passed an ordinance requiring the street surface railroad companies to operate their roads as frequently as public convenience may require, and not less than one car every twenty minutes between the hours of twelve midnight and six o'clock A. M. each and every day, both ways, for the transportation of passengers.

Held, in an action to recover a penalty of $100 for a violation of the ordinance, that evidence of such facts as would establish, or tend to establish, that the convenience of passengers or the public did not require the running of defendant's cars during ordinance hours specified, was relevant on the question of the reasonableness of the ordinance in defendant's case.

2. *Held*, that it is not a ground for objection that such evidence related to a period of time subsequent to the date when the ordinance went into effect.

3. *Held*, that the question of the reasonableness of the ordinance is not controlled by considerations of expense to defendant company, or that such operation would be unprofitable. *Mayor etc. City of New York* v. *Dry Dock, etc., Ry. Co.* N., Y. C. A. Mar. 31, 1892.

Street Railways—Child on Track—Coasting—Amount of Damages. In an action by an administrator under the statute to recover damages for injuries caused by the alleged negligence of the defendant company and resulting in the death of the intestate, wherein a verdict of $2,300 was returned, the defendant appealed.

1. *Held*, that the duty of watchfulness rests upon the driver of a street car approaching a street crossing where he has reason to suppose that young children may be engaged in coasting or sliding down a neighboring hill and across the car track, although such conduct on the part of the children is unlawful.

2. *Held*, that the parents of a child about six years old were not chargeable with negligence in allowing him to go out of the house to play within their own premises; neither is the amount of the verdict for an act of negligence causing the death of such a child excessive. That the evidence even justified the jury in finding that the driver saw the boy coming on his sled, that he applied his brake and brought the car under control, but neglected to stop it, which he could have done within five feet and prevented the accident. Judgment affirmed.

Strutzel, Admr., v. *St. Paul City Ry. Co.*, December 22, 1891.

Legislative Grant of City Streets—Authority of City Councils. In an action to enjoin the defendant city, the court, on appeal,

Held, that under the act of May 1, 1861, authorizing complainant railroad company to build its railway on any of the streets of the city of Harrisburg then opened or which might be thereafter opened, that such grant was not conditioned on the assent of the city councils, and that, when the city officials interrupted and stopped such company from extending its tracks, the company was entitled to an injunction. *Harrisburg City Passenger Ry. Co.* v. *City of Harrisburg et al.*, Pa. S. C. April 18, 1892.

Invitation to Enter—Stoppage of Car—Sudden Jerk. Where a passenger was invited to enter a car by the conductor in response to his signal to stop for him, and the car had stopped, or, in the act of stopping, was moving very slowly, to enable him to take passage, and, while he was in the act of so taking passage in a careful and prudent manner, the car was suddenly and unexpectedly started, whereby he was thrown off and injured.

Held, that the street car company was liable.

Sahlgaard v. *St. Paul City Ry. Co.*, Minn. S. C., January 19, 1892.

Injuries to Passengers—Action by Husband—Negligence—Damages. Action by husband and wife. Judgment for plaintiff. Defendant appealed.

Held, 1. That an action by husband and wife for injuries to the wife alleged to have been caused by defendant's negligence, if, by reason of the injuries to the wife, the husband was deprived of the wife's services, compensation therefor may be given.

2. Where a passenger on a street car is injured without fault of his own, there is no legal presumption of negligence on the part of the carrier.

3. The fact that plaintiff, a passenger on a cable train, was riding on the dummy when there were seats in the trail car, where she would have been in safety, does not establish contributory negligence.

4. Where plaintiff at the time of the accident was with child, and before delivery the child died, to recover damages therefor she must show some additional injury to herself arising from such fact.

Judgment reversed.

Hawkins et al. v. *Front St. Ry. Co.*, Wash. S. C., January 21, 1892.

Certificate of Incorporation—Tracks of Other Companies—Use of Electricity—Elevated Roads—Termini. In an injunction proceeding to enjoin the defendant from constructing its road on certain streets, on appeal it is

Held, that where the code (art. 23 sec. 159) provides that the certificate of incorporation of a railroad company shall specify the termini of the road and the counties or cities through which it shall pass; and, where the certificate of a street railway company, incorporated under the said act, specifies that the entire road is to be located in a certain city, and the termini are to be therein, and the legislature afterwards, by special act, recognizes the company as a valid existing corporation by authorizing its consolidation with another company, the effect of such legislation is to dispense with a more specific mention of the termini, if any were needed.

Injuries to Passengers—Poles in the Street—Contributory Negligence—Charges—Negligence Compared. 1. Where it appeared that the plaintiff in this action, in boarding one of defendant's cars while in motion, was knocked off the platform by a telegraph pole near the curb of the street, and was thereby injured. Defendant requested the charge that, where a man gets on a horse car while in motion, it is such proof of contributory negligence that he cannot recover.

Held, that such charge was properly refused, as the question of contributory negligence was for the jury.

2. The track being so close to the curb of the street as to be dangerous for those getting on and off the cars, the charge that defendant was not guilty of any negligence was properly refused.

3. Where the jury was charged that, if plaintiff knew the condition of things at the point in question, he was required to use more than ordinary care to avoid accident, and if he failed to do so, he could not recover, there was no error in refusing defendant's request to charge that if, when plaintiff stepped on the car, he knew the

location of the track and its distance from the telegraph post, he assumed the risk of any injury he might receive, and could not recover.

4. Where it was admitted that the car was in motion, and no claim was made that the driver or conductor refused to stop the car when plaintiff boarded it, the court properly refused to charge that, under a city ordinance, the company had no right to stop its cars except on the further crossing of street intersections.

5. Where the jury were instructed that for plaintiff to recover there must have been negligence on defendant's part and ordinary care on plaintiff's part, defendant was not injured by refusal to charge that negligence of defendant was not of itself sufficient to justify a recovery. Neither was there error in refusing instructions as to comparative negligence.

Judgment for plaintiff affirmed.

North Chicago St. Ry. Co. v. *Williams*, Ill., S. C., January 18, 1891.

NOTE: The erection and maintaining of poles in the street for the use of wires is the source of many suits for damages. Since the introduction of electricity these suits have multiplied with increasing rapidity.

RECEIVERSHIP—CONTEMPT OF COURT—APPEAL. The petition asking for a receiver to be appointed for the Citizens' Street Railroad Co. alleged among other things that by reason of differences between the employer, the president thereof, and the employes, a strike had taken place; that no street car service was, or had been given for a period of nine days; that the city authorities had first refused to protect the company in its effort to operate its cars; and that a subsequent effort to protect such operation was, by reason of the universal sympathy of the community with the striking employes, and the united determined strength of the strikers such as to render such operation by the president extremely hazardous to life, limb and the destruction of property; that the citizens were suffering great inconveniences and loss of time, that business was stagnated and expenses increasing, etc., etc.

Upon said petition a receiver was appointed and qualified, but upon demand the agents and employes refused to deliver the property, cars, mules, etc., to said receiver, and upon affidavit setting forth such refusal by said company to deliver the property to the receiver, the president was arrested, charged with contempt of court.

Upon filing a complaint to set aside the receivership and for an appeal to a higher court with the adequate bond, the court held that the company by its president had no standing in court until after he purged himself of the charge of contempt.

The president alleged in his answer, that no demand had been made of him for the possession of the company's property by the receiver, and that he had not intentionally disobeyed the orders of the court. Thereupon the court discharged the president as acquitted of the charge of contempt and granted the appeal, whereupon the property was restored to the president pending the appeal.

In re. W. P. Fishback v. *Citizens' Street Ry. Co.*, Marion Co., Ind., Sup. Ct., March 4, 1892.

STREET RAILWAYS—COLLISION WITH VEHICLES—CONTRIBUTORY NEGLIGENCE—INSTRUCTION. In an action for trespass whereby plaintiff's team and wagon was alleged to have sustained injuries the court

Held, that where a driver of a wagon reaches a street along which run electric cars, and drives directly on the tracks without stopping or looking for a car, and his wagon is at once struck by an approaching electric car and the horses injured, he is guilty of contributory negligence, and no recovery can be had.

Judgment reversed.

Carson v. *Federal St., etc., Ry. Co.*, Penna. S. C., January 25, 1892.

NOTE: The trial court charged that there was no rule of law that required the driver to "stop, look and listen," but that it was only for the jury to determine what it was his duty to do, and whether he actually did it on that occasion. This charge was held to be erroneous. The movement of cars by electricity or cable along crowded streets is attended with danger, and renders a high measure of care necessary on the part of the company and those who use the streets in the ordinary manner. One approaching a crossing must take notice of these facts and exercise a reasonable measure of care to avoid contact with a moving car. It may not be necessary to stop, but it is necessary to look before driving upon the track.

ELECTRIC RAILROADS—RIGHT TO USE OVERHEAD WIRES Where section 3,595 of the general statute provides that the mayor and common council of a city may permit and regulate the use of any improved motive power for drawing cars on any horse railroad, does not allow an electric company, even with the permission of the mayor and council, to propel its cars by the use of overhead wires, where the charter of the company declares only that the company may propel its cars "in any mode that does not involve" the use of such wires. *Farrell* v *Winchester Ave. St. Ry. Co.*, Conn. S. C., April 10, 1892.

Terms for New York Rapid Transit.

The New York City Rapid Transit Commissioners, on November 15, gave out the terms of sale and specifications for the construction of the rapid transit railroad which they plan to have built. The route of the road was published in the STREET RAILWAY JOURNAL for December, 1891, and the sale will take place on Thursday, December 29, at noon, in the rotunda of the City Hall, Eugene L. Bushe, the secretary of the board, acting as auctioneer.

The lease will be for 999 years, and the buyer will be required to pay over on the spot ten per cent. of his bid and to deposit with the Comptroller, within five days, the sum of $1,000,000 as a guarantee of of his full compliance with the terms of sale. The balance of the bid must be paid in thirty days. In addition to these amounts, the purchaser must pay $89,247.15, which is the amount the Commission has spent since its organization. If these sums are not paid on time, the purchaser will be considered to have abandoned the bid, and the auction will be held again.

The company to build the road must be organized within two months. The capital stock must be $50,000,000, divided into 500,000 shares at $100 a share. The company may mortgage its property for $50,000,000. The limit of fare permitted to be charged is five cents, and the maximum rate for freight twenty cents a ton a mile by the car load and five cents a hundred pounds in less quantities. Work shall be at all times under the supervision of engineers appointed by the Commission, whose salaries must be paid by the corporation, and the company must give a bond of $2,000,000 to protect the city and property owners from damage.

The articles of incorporation must be signed and acknowledged by not less than twenty-five persons. Books of subscription to the capital stock of the company must be opened at once. The capital stock must be held by not less than fifty persons, and the stockholders must choose thirteen directors. The company will not have to pay any tax on any part of the road until the whole is finished and in operation.

Work on the road must be begun within four months from the time the contract is awarded, and the road must be finished and in operation within five years of the date of commencement. Other parts must be finished earlier, however, as follows: The part between the City Hall and Fourteenth Street must be finished in two years; the part south of the City Hall and the parts between Fourteenth and Fifty-ninth Streets and between Fourteenth and Forty-third Streets on the east side branch within three years.

The method of construction from South Ferry to Thirty-fourth Street along Broadway and in Fourth Avenue above Thirty-fourth Street is to be by tunnelling without disturbing the surface of the street. Excavations along Fourth Avenue below Thirty-fourth Street, and in all streets and avenues below Thirty-fourth Street, east aud west, may be made from the surface, and this may be done in case of necessity in Broadway at Canal and at Beaver Streets. Where there is a rise of over twenty feet from the station platform to the street, elevators must be provided.

The cars must be propelled by electricity, or by some form of power not requiring combustion within the tunnel. The motor must be sufficiently powerful to readily start a train of eight cars, each weighing, in addition to its load of passengers, not less than 30,000 lbs., on a gradient with a rise of one and one-half feet per one hundred feet of distance, and the motor must also be able to maintain the same train at a speed of not less than forty miles per hour on a level.

Each car must be provided with suitable arrangements for heating and lighting, and must have ample and comfortable seating capacity for the number of passengers to be carried by the car. The platforms and stations and the stairways, hallways, galleries, approaches and passages must be of ample size. In concluding the list of specifications the commission says:

"It is understood that under these plans and specifications a railway is to be built of the best possible construction and having the high-

est efficiency. The constructing company, must, therefore, use materials and provide workmanship of the best quality, and shall, as far as possible, introduce an artistic effect, so that the stations, waiting rooms, platforms, cars, columns, girders, roofs, walls and other visible portions shall have a pleasing appearance. All steel, iron, rails, ties, wood, stone, brick, cement, concrete, mortar, glass, paint and other material used in the construction of the railway shall, in their respective ways, conform to the best standard of excellence and be subject to tests and inspection approved by the said Commission."

A Decision in Favor of the Trolley.

An important decision was rendered last month in the New York Court of Appeals in the case of the Hudson River Telephone Co., respondent, *vs.* the Watervliet Turnpike & Railway Co., appellant. The decision settles the right of the electric railway company to propel its cars in public streets, even though it may injure the service of the telephone company. Judge Maynard delivered the opinion of the court.

The first question considered was whether the railway company had the right to use electricity, when under the act of 1862, before the electric trolley system had been developed, it was granted the right to use any motive power except steam. The court on this point held that the railway company was not even impliedly limited to motive powers known at the time of the grant. The primary and dominant purpose of a street being for public passage, the use of it by electric cars, it held, is in furtherance of the purpose to which it was originally devoted. On the other hand the use of the streets by the telephone company is not the one to which they were dedicated as public highways. The incovenience of loss, therefore, which the plaintiff may suffer from the adoption of a mode of locomotion authorized by law which is carefully and skillfully employed, and which does not destroy or impair the usefulness of a street as a public highway, is not a sufficient cause for a recovery, unless, there is some statute which makes it actionable.

Another plea of the plaintiff's considered was that the system of its communication was only partly established in the public streets, its telephones being located upon the premises of its subscribers and patrons, and upon a central exchange which is upon private property. But as a grounded return circuit was used, the court considered it immaterial whether the connections were made on private property or elsewhere, and while it considered that it would be a grave question whether the injuries to which the plaintiff is subjected could not be imposed without compensation, provided the parties were occupying the streets upon equal footing, the court is spared the task of discrimination by reason of the legal attitude which the plaintiff has assumed in its occupation of the streets. There is, therefore, no more just reason on the part of the telephone company to complain of the injury in question, than if by the jarring of loaded vehicles on the highway, its delicate and sensitive instruments were displaced, and their beneficial use impaired or destroyed. The order of the General Term granting a new trial was therefore reversed, and judgment rendered on the report of the referee affirmed with costs in all courts.

Annual Report of the West End Street Railway, Boston.

The annual meeting of the West End Street Railway was held in Boston, November 10. The following directors were elected for the ensuing year: H. M. Whitney, president; G. T. W. Braman, Prentiss Cummings, E. C. Fitz, Walter Hunnewell, Samuel Little, Nathaniel Thayer, J. T. Burr, J. S. Fay, Jr., H. D. Hyde, E. D. Jordan, W. P. Mason, D. N. Richards and W. S. Swan.

The fifth annual report of the president at the meeting shows the following principal items:

Gross earnings	$6,317,205 17
Operating expenses	4,477,783 02
Net earnings	$1,839,422 15
Fixed charges—taxes, rentals and interest	509,701 54
Balance available for dividends	$1,329,720 61

Against this balance, dividend charges are:

8 per cent. on preferred stock	$512,000 00	
5 per cent. on common stock, January 1	357,112 50	
5 per cent. on common stock, July 1	454,250 00	
		$1,323,362 50
Balance of net income carried to surplus account		$6,358 11

At the close of the year about two-thirds of all the mileage, namely, 1,000,000 miles per month, was being run by the electric system. It is hoped that by January 1, about 200 cars will be added, bringing the electric mileage up to 16,000,000 miles per year.

It is expected that the power houses will be practically completed by the first of January, and a sufficient number of large dynamos then installed to supply all demands for power. Up to this time, the company has had comparatively little advantage from the large engines, due to the fact that, until the first of October, but one of the large dynamos had been delivered. The company has, within a short time, received eight large dynamos, and it is believed that the remainder of them, twenty-five in all, will be delivered within the next three or four months.

A large sum of money has been expended upon the track during the past year in order to prepare for the extension of the electric system. By the first of January, all the track in habitual use in the city proper will have been rebuilt. Considering the infinite number of curves, switches and crossovers required in the city proper, and especially in the downtown part of it, the rebuilding of one mile in this district is equivalent to at least three miles in the suburban districts. Having now so large a proportion of the mileage of the road electric, it feels that the remainder of the track can be rebuilt gradually, from time to time, as the wants of a growing community may require.

There are certain places where the electric system cannot probably be introduced at present, and therefore the year 1893 should see the substantial closing of all the construction and reconstruction work. After this or, say, from the first of January, 1894, all future expenses connected with existing lines, should be borne by the surplus earnings as a credit to depreciation account. If the earnings per mile of the electric system are equal in the future to what they have been during the past, this surplus will be amply sufficient for this purpose.

The auditor's report showed the earnings of the year to be composed of the following:

From passengers	$6,237,646 28
" rental of track	13,422 63
" rental of real estate	21,509 48
" advertising and miscellaneous	44,626 78
	$6,317,205 17

The operating expenses were:

For general expenses	$363,716 49	
Maintenance of track	238,790 31	
" " buildings, cars and vehicles	273,289 15	
" " horse equipment	222,409 69	
" " electric equipment	256,921 87	
Transportation expenses	2,782,702 77	
Damages, snow, etc.	339,952 84	
		$4,477,783 02
Net earnings		$1,839,422 15

244.47 miles of track were owned September 30, 1891. The additions for extensions during the year amounted to 6.722 miles, and the reductions 3.360 miles, giving a net length of track owned September 30, 1892, of 247.832 miles. The round trips run during the year were 2,259,858; the revenue miles run were 17,498,660; revenue passengers carried, 126,210,781; passenger receipts, $6,237,646.28; average receipts per passenger, 4.942 cts. The length of tracks fully equipped with the overhead electric system was, on September 30, 148.045 miles. The revenue miles run during the year were as follows: Double motor electric cars, 5,598,090; single motor electric cars, 2,775,106; trail cars, 137,087; total mileage of electric cars, 8,510,283, or 48.63 per cent.; mileage of horse cars, 8,988,377, or 51.37 per cent.; total, 17,498,660, or 100 per cent.

The passenger receipts for the year were divided as follows: From electric cars, $330,549.29, or 53.39 per cent.; from horse cars, $2,907,096.99, or 46,61 per cent.; total, $6,237,646.28.

The length of tracks rebuilt with heavy girder rail during the year amounted to 36.9553 miles, the rail mainly used weighing 72½ or 78 lbs. to the yard. The total cost of this work was $706,446.32. The cost of this work was provided for as follows: Charged to construction account for betterment of tracks, as per permission granted by the railroad commissioners, as a part of the expenditures necessary for the equipment of the road with electrical power, 36.9553 miles, at $7,500 per mile, $277,164.75; balance charged to surplus account, $429,281.57. The total length of track constructed with girder rail September 30, 1892, was 116.81 miles.

The general balance sheet shows that of the assets permanent investments figure as follows:

Construction, $5,920,585.82; real estate, $7,342,904.07; equipment, $556,917.04; horses (3,754), $503,036; cars (1,226), $919,130; electric cars (1,028), $3,238,227.64; electric line equipment, $973,437.88; electric car house equipment, $99,989.57; power station equipment, $1,441,041.62; total cost of road, equipment and real estate, $20,995,269.64.

Street Railway News.

General.

Asheville, N. C.—The Asheville Street Railway went into the hands of a receiver last month. Louis Maddux, president of the Western Carolina Bank, is named as receiver by United States Judge Dickman.

Atlanta, Ga.—The Metropolitan street car line was sold November 1, under an order of court. H. M. Atkinson, representing Boston capitalists, bought it for $121,000.

Beatrice, Neb.—On October 30, the power plant of the Beatrice Rapid Transit & Power Co. was destroyed by fire.

Birmingham, Conn.—The affairs of the insolvent Birmingham & Ansonia Horse Railroad have been wound up by the Superior Court at New Haven. The company has been in the hands of a receiver since 1870, when the Farmers' Loan & Trust Co. brought a foreclosure suit against it. The road has been bought by H. Holton Wood for $1,000. The total dividends declared to the stockholders of the insolvent concern was 2¾ per cent.

Brockton, Mass.—The number of passengers carried on the Brockton Street Railway for the year ending September 30, 1892, was 3,198,718 and the receipts $143,506.74. The East Side road during the year carried 592,219 passengers.

Buffalo, N. Y.—In consequence of the outcry against the "deadly trolley," the Buffalo City Council has limited the speed of all electric cars to four and six miles per hour. The consequence is that there is a popular demand for more rapid transit.

Chicago, Ill.—The North Chicago Street Railway Co. for several years has awarded prizes to gripmen who have made the best records as far as accidents are concerned. This year's prizes were awarded recently. The rewards are $100, $75 and $50, but as it was found that five gripmen had escaped accidents altogether, it was decided to award $75 to each man. Seven others who followed in the list had made such close records that no distinction could be made and each one was presented $25.

THE North Chicago Street Railroad Co. recently secured an injunction restraining the city authorities from interfering with the use of the Belgian steam motor on the North Side.

ON the evening of October 29 fire damaged the plant of the Q. & C. Co., dealers in railroad supplies, to the extent of $5,000.

Columbus, O.—All the lines of the Consolidated Street Railway Co. were tied up November 8, on account of a strike of the conductors and motormen. The trouble arose over the discharge of a conductor who had refused to receive a mutilated coin from a passenger. The men demanded his reinstatement by a stated time, but the company refused to do so until the investigation of the case was completed.

Dayton, O.—A number of Cleveland capitalists are endeavoring to purchase and form a consolidation of all the street railroads of this city.

Des Moines, Ia.—The Des Moines Street Railway Co. has filed amended articles of incorporation.

Indianapolis, Ind.—Report says that an Eastern syndicate, headed by J. C Shaffer, of this city, has purchased the entire street railway system. It is stated that the selling price was $2,750,000. S. W. Allerton, one of the Chicago owners of the system, is quoted as saying that while nothing definite has been done, the directors have named a price, and that a sale is likely to be effected.

Lebanon, Pa.—The Lebanon & Annville Street Railroad Co. is building a sweeper. The power will be furnished by four motors of sixty horse power each.

Marlboro, Mass.—The report of the Marlboro Street Railway Co. shows that during the year ending November 1, 1892, 420,000 fares were taken, an increase of 100,000 over the number collected during the previous year. 60,948 fares were taken in July, which month's return exceed those of any other in the twelve.

Mobile, Ala.—On November 14, the foreclosure sale of the Mobile Street Railway took place. The first and only bid was $225,000, and the road was knocked down to the Fidelity Trust company, or really to the bondholders who had in effect bid in the property. The street railway company has already secured from the city the privilege of changing the lines to electricity.

Negaunee, Mich.—At a recent meeting of the stockholders of the Negaunee & Ishpeming Street Railway Co. and the Ishpeming Gas & Electric Light Co., the consolidation of the two companies was agreed on. The capital of the street railway company will be increased from $120,000 to $200,000.

New Westminster, B. C.—The New Westminster & Vancouver Electric Railroad Co. has loaned two of its spare generators to the National Electric Tramway Co. until the machines of that company arrive from Peterborough, Ont. The Victorians will have been for six weeks without the trolley service and they have been clamoring steadily for all haste to be made in its renewal. Two new passenger cars fitted with smoking compartments have just arrived from Philadelphia.

Newport, R. I.—The Newport cottagers who, at the time of the agitation of the electric street car question, organized under the name of the Newport Improvement Association, but with the purpose of opposing the introduction of that method of travel, are now preparing to formally disband their society. They fought the proposed establishment of the street car lines without success, and then fought the road after it was started, but with equal lack of success.

Orange, N. J.—The contracts for the building of the power house of the Orange Mountain Cable Co. have been signed, and the work will begin at once. The contractors are William H. Baker, mason, and Charles McCloskey, carpenter.

Pittsburgh, Pa.—The Federal Street & Pleasant Valley Railway Co. has been absorbed by the Pittsburgh, Allegheny & Manchester Traction Co.

THE West End Street Railway Co. will build a new power house. The structure is to be three stories and entirely fireproof, and will cost $30,000.

Rockland, Me.—The Briggs Carriage Co. is now at work upon a combination baggage and passenger car, to be used on the new railroad at Rockland, Me. The car is about twenty-eight feet over all, and differs in appearance from the regular street cars in having the sides perfectly straight like steam cars. In the center of the car is a partition which divides it into two parts, one to be used exclusively for the baggage, the other will be like any street car for passengers. On each side of the baggage apartment are doors similar to those on steam cars, for the reception of freight. There are also two other doors, one on the end to the rear platform and the other in the center of the passenger department. The car is about ten feet longer than the average street car. President E. P. Shaw, of the Haverhill & Amesbury Road, has ordered two cars of the Briggs company, similar to this one, which will be of the same dimensions.

San Francisco, Cal.—Negotiations have been on foot for some time looking to a consolidation of the Omnibus Cable Co. and the North Beach & Mission Railway Co., a horse line.

Scranton, Pa.—The formal transfer of the lines of the People's Street Railway Co. to the Scranton Traction Co. was made November 11, the lease executed giving the latter company control of the system for a period of 900 years.

IT is reported that there is a plan under project whereby there will be a consolidation of the Carbondale Traction Co., the Scranton Traction Co. and the Wyoming Traction Co. running between Wilkesbarre and Pittston, making a continuous line between Carbondale and Wilkesbarre. It is further stated that it is proposed that the syndicate having the deal under contemplation buy out the Scranton Traction Co. There are Harrisburg, Carlisle and New York capitalists behind the deal.

Seattle, Wash.—The street railway companies are making a great effort to have their franchises extended for a period of fifty years.

Troy, N. Y.—The Troy & Lansingburg Co.'s lines were formally leased, November 7, to the Troy City Railroad Co. The latter company will increase its stock to $2,000,000 and will pay an annual rental of $74,000 to the Troy & Lansingburg Co. By this action all the street railroads of this city, Green Island, Lansingburg, Cohoes and Waterford are consolidated under one management.

Vancouver, B. C.—As an instance of the flexibility of the electric system, it may be mentioned that recently one of the connecting rods of the largest engine broke. As this engine drives all the generators, the service was stopped, There is, however, another service running from the neighboring town into Vancouver, the distance from the feeder ends to the power house being nine miles. With this service a temporary connection was made, and although it created quite an overload, sixteen cars and seven miles of extra circuit were put in operation and a very satisfactory service for the remainder of that day given.

Victoria, B. C.—It is proposed to increase the capital stock of the National Electric Tramway & Light Co. from $250,000 to $1,000,000.

THE above company has at considerable expense constructed a tunnel 225 ft. long, five feet high and three feet wide through the Bay, so as to have a never failing supply of water for their condensers. The street railway service was commenced once more on Saturday, November 24. A temporary wooden shed covers the machine.

Wilkesbarre, Pa.—The Wyoming Valley Traction Co. has adopted a new system of wages for its men. For the first three months the men receive $1.50 per day; from three to six months, $1.60 per day, and after six months $1.70 per day. The reasons therefor are these: The system insures new men sticking to their positions and becoming experienced, and is a discouragement to transient work; it is a recognition of better capability from an experienced man. The scheme works well wherever it has been tried.

York, Pa.—There was recently a large sale of horses and mules by the York Street Railway Co. The harness, stable tools, etc., were also sold. Forty-six horses and eleven mules were sold. the prices for horses ranging from $34 to $109 apiece. The amount of money realized was $1,867.94.

Extensions and Improvements.

Akron, O.—John L. Seiberling, who owns the street railway system of the city, has announced his intention of extending that system to Cuyahoga Falls in the spring.

Archbald, Pa.—The Carbondale Traction Co. has begun work on the Archbald extension of its line. The work will be pushed to completion as rapidly as possible.

Ashland, Mass.—The Natick Electric Street Railway Co. has petitioned for a location for its tracks in certain streets.

Baltimore, Md.—The City & Suburban Passenger Railway has passed into the hands of the Baltimore Traction Co. The contemplated improvements to the City & Suburban include the conversion of the entire system from a horse car line to a trolley line. It is said that the work of erecting trolley poles and wires will be begun just as soon as the actual transfer of control takes place.

Beatrice, Neb.—The sale of the track, franchise, cars, etc., of the Beatrice Street Railway Co. to the Rapid Transit & Power Co., was concluded recently. The consideration was said to be $5,000. It is the intention of the Rapid Transit Co. to at once electrically equip all the street car lines of this city.

Billerica, Mass.—The Lowell & Suburban Railway Co. has petitioned the Selectmen for license to extend its tracks from its present terminus on Gorham Street to Billerica Center. The Billerica people are greatly in favor of the extension.

Chicago, Ill.—The Chicago City Railway Co. will erect a large power house for its crosstown electric lines. The proposed structure will cover 130 × 147 ft, and will be located on Wabash Avenue between Fifty-second and Fifty-third Streets. The same company has petitioned for the right to substitute the trolley electric system for horse power on Archer Avenue, Halsted and other South Side streets.

Cleveland, O.—An ordinance has been passed granting the East Cleveland Railway Co. the right to extend the Euclid Avenue branch of its road along and upon Mayfield Street, from Euclid Avenue to the easterly limits of the city, and to operate by electricity.

Detroit, Mich.—The Jefferson Avenue (Grosse Pointe) Street Railroad Co., the East Detroit & Grosse Pointe (Mack Avenue) Railroad Co., the Gratiot Avenue Co. and the Detroit Electric (Dix Avenue) Railroad Co., of which George Hendrie, Strathearn Hendrie and Cameron Currie were the principal owners, have been sold to a new company composed of the directors of the Citizens' Railway Co. The name of the new company is the Detroit Suburban Railroad Co. The price was said to be very close to $400,000. The new company will proceed to improve the equipment and service of the four lines and extend the Gratiot Avenue line through Macomb County to Mount Clemens, if a franchise can be secured.

East Milton, Mass.—The residents of East Milton have petitioned the Quincy Street Railway Co. to extend its tracks to East Milton depot.

Flatbush, N. Y.—The Brooklyn City Railroad Co. has begun the erection of trolley poles from the Brooklyn city line at Prospect Park, to the end of the route on Flatbush Avenue, Flatbush.

Fort Wayne, Ind.—An ordinance permitting the Fort Wayne & Belle Isle Street Railroad Co. to extend its tracks from Baldwin to Van Dyke Avenues has been passed.

Harrisburg, Pa.—The East Harrisburg Passenger Railway will shortly be extended to Paxtang.

Helena, Mont.—The Helena Rapid Transit Co. is making a large extension of its lines.

Hopkinton, Mass.—The selectmen have been petitioned by the Natick Electric Street Railroad Co. for a location of tracks.

Indianapolis, Ind.—A meeting of the citizens of the South Side was recently held, at which a memorial was prepared addressed to the Mayor, Council and Board of Public Works, urging these officials to assist, in every possible way, the hastening of means for procuring rapid transit for the South Side.

Kansas City, Mo.—A meeting of residents near Woodland Avenue was lately held in regard to changing the electric line now located on Vine Street and Woodland Avenue and other streets, to Woodland Avenue, making a direct line south of Lynn Avenue. A committee was appointed to obtain the necessary franchises.

Kingston, N. Y.—The Kingston City Horse Railroad Co. will sell its horses and run its cars by the trolley electric system as soon as the change can be made. A new line of street railway is building, almost parallel to the old line, and will also be operated by electricity on the trolley plan.

Jacksonville, Fla.—The Main Street Railway Co. has applied to the City Council for permission to operate by electric power.

Kingston, Ont.—The City Council is negotiating with the Street Passenger Railway Co. for an electric service for twenty years.

La Salle, Ill.—The electric street railroad will soon be equipped with better cars and more efficient and prompt service. A new motor car has been ordered.

Lafayette, Ind.—The Lafayette Street Railroad Co. has contracted to extend its tracks between now and July next through the Snoddy and Bone and Throckmorton additions.

Lancaster, O.—The street railway company is likely soon to change its motive power to electricity.

Lewiston, Me.—At the annual meeting of the Lewiston & Auburn Horse Railroad Co., a committee was appointed to investigate the matter of substituting electricity for horse power.

Lincoln, Neb.—The Lincoln Street Railway Co. is preparing to build a number of new lines, besides the one under way. One extension will be from University Place to Havelock, two miles in length.

Memphis, Tenn.—The East End dummy line will probably use the Short electric system in the proposed conversion of motive power on the road.

Meriden, Conn.—The newly reorganized street railway company is planning to put in an electric system next spring and extend the line through Yalesville to Wallingford.

Milwaukee, Wis.—The Milwaukee Street Railway Co. has decided to extend its Clybourn Street line across the Menominee Valley as far as Calvary Cemetery.

THE directors of the Milwaukee & Wauwatosa motor line have agreed to extend their line to North Greenfield from the state fair grounds for a bonus of $10,000.

Mt. Vernon, N. Y.—The Union Electric Railway Co., of New York, and the Yonkers Electric Railway Co. are both trying to get a franchise from the city. The Union company has already laid its tracks from Woodlawn to the Catholic Church at Williamsbridge and has only a few miles more to lay to get into Mount Vernon.

Muscatine, Ia.—The Muscatine City Railway Co. has been purchased by W. H. Seevers, of Seevers & Seevers, of Oskaloosa, Ia., who is also owner of the gas, electric light and power plant here. The road will be equipped with electric power, and is to be in operation by May 1, 1893.

Natick, Mass.—The request of the Natick & Cochituate Railway Co. for a franchise to lay the tracks to the Wellesley town line has been granted by the Natick Selectmen.

New Bedford, Mass.—The Selectmen have voted permission to the Union Street Railway Co. to extend its tracks to Riverside Cemetery.

New Brunswick, N. J.—A petition signed by over 250 citizens has been presented to the City Council, asking for permission for the Street Railway Co. to change the motive power from horses to electricity.

Newark, N. J.—The New Jersey Traction Co. is laying a double track through Clay Street to connect with the Kearney horse car line.

Newburgh, N. Y.—The street railway has been sold to a company of gentlemen, of whom M. H. Hirschberg is president. It is understood that horses will be replaced by electricity.

Norwood, R. I.—A public meeting has been held by those interested in the extension of the Union Railroad to or beyond this village. W. E. Harrington was chairman of the meeting.

Oakland, Cal.—The Highland Park & Fruitvale Co. has applied for a franchise to substitute electric for horse power on its lines.

THE Piedmont Cable Co. wants a franchise for an electric line on Fourteenth and Adeline Streets.

Owensboro, Ky,—The street railway is to be equipped for electricity.

Parsons, Pa.—The Wyoming Valley Traction Co. proposes to connect this place with Miners' Mills, by an electric line via Main Street.

Riverside, Cal.—The Riverside & Arlington Street Railway Co has obtained a franchise to extend its railway on Magnolia Avenue beyond Van Buren Street.

St. John, N. B.—Charles D. Jones, vice-president and managing director of the Consolidated Electric Co., states that a portion, if not the whole, of the street railway will be operated by electricity this fall. Work with that end in view is now being pushed vigorously.

St. Joseph, Mo.—An ordinance has been granted to the People's Street Railway, Electric Light & Power Co. to relay the Messanie Street line with forty pound T rails from Thirteenth and Jule to Twenty-second Street.

St. Paul, Minn.—The St. Paul Assembly has passed an ordinance directing the construction of a horse car line from Front Street to Como Park and also an electric line from Charles Street to Minnehaha, as was decided on a little time ago.

Salem, Mass.—The Aldermen have granted the Lynn & Boston Railroad Co. a location for an overhead single trolley line over Loring Avenue, from the Swampscott line to Lafayette Street. This will make a direct electric line from Salem to Lynn. The line is to be completed by April 1.

A PETITION for the extension of tracks in Canal Street, of the Lynn & Boston company, made by the residents in that section, has been sent to the aldermen.

San Antonio, Tex.—The managers of the San Antonio Street Railway Co. write us that they would like to receive propositions for covering the boilers and steam pipes in their plant with best quality of steam saving covering.

San Francisco, Cal.—Arrangements are being made to extend the San Francisco & San Mateo Electric Railway from its present terminus at Holy Cross Cemetery to Baden.

BEHREND JOOST, of the San Francisco & San Mateo Electric Railway, has petitioned for a forty-nine year franchise for an electric railway, beginning at the junction of Clayton and Ashbury Streets and ending at the junction of Market and East.

San Jose, Cal.—The San Jose & Santa Clara Railway Co., by J. P. Burke, vice-president, has asked for a franchise for an electric single track railway over Santa Clara and other streets.

Sandusky, O.—The People's Electric Railway Co. will purchase two additional cars before May 1, 1893.

Springfield, Mass.—The Springfield Street Railway Co. has petitioned the Board of Aldermen for power to make a number of extensions.

Taunton, Mass.—It is stated that an offer has been made for the Taunton Street Railway by a company which proposes to increase the capital, equip the road with modern electric motive power and extend the track into outlying sections.

Toledo, O.—An ordinance permitting the Toledo Electric Street Railway Co. to double track the line on Ontario Street, from Stickney Avenue to Galena Street, has been passed.

THE Consolidated Street Railway Co. has received a twenty-five year franchise to double track the Dorr Street line.

Tonawanda, N. Y.—The Tonawanda Street Railroad Co. has increased its capital from $75,000 to $250,000, for the purpose of equipping the road with the single trolley electric system.

Toronto, Ont.—A new street car line is proposed from the foot of York Street to Queen, then up University Street, through Queen's Park, passing the new Parliament Buildings.

Weymouth, Mass.—The Quincy & Boston Street Railway Co. has asked the Selectmen for a location from the North Weymouth Depot to East Weymouth.

THE Selectmen have been petitioned by the Quincy & Boston Street Railway Co. for a location from North Weymouth to Shaw's Corner. The citizens of East Weymouth are also anxious to have the line extended to Jackson Square.

Wilkesbarre, Pa.—The Wyoming Valley Traction Co. has resolved to extend its line to Pittston within a year, also to West Nanticoke, taking in Avondale and Grand Tunnel.

Windsor, Ont.—The Sandwich, Windsor & Amherstburg Railroad Co. is asking a bonus from the city for the extension of its line to Amherstburg.

Worcester, Mass.—The Worcester & Shrewsbury Street Railway Co. has petitioned for an extension of the tracks of its electric line on Foster Street from the present terminus to Main Street.

THE North End Street Railway Co. has petitioned for permission to increase its capital stock $50,000, in order to build and equip its lines through Summer and Lincoln Streets.

THE Worcester, Leicester & Spencer Street Railway Co. has petitioned the mayor and Aldermen of this city, and the Selectmen of the towns of Leicester, Oxford, Charlton and Southbridge, for permission to lay tracks in those towns. The extensions will aggregate eighteen miles.

Youngstown, O.—A largely signed petition to the City Commissioners and Council praying for a street car line on the South Side, has been presented to the Commissioners by the Youngstown Street Railway Co. If this franchise is secured, the company will have two belt lines around the city, one on the north side and the other on the south side.

New Roads.

Ashland, Pa.—A charter has been granted to the Ashland, Locustdale & Centralia Electric Railway Co. The capital stock is placed at $60,000. Among the incorporators are Josiah F. Bailey, C. H. Cofrode and F. E. Bailey, of Philadelphia.

Atlanta, Ga.—A charter has been granted to a company to be known as the Atlanta City Street Railway Co., and the line is to be run to Decatur and through certain streets of this city, nine miles. The capital is $25,000. The petition for the charter was signed by W. I. Zachry, Aaron Haas, J. B. Zachry, of Fulton; and J. R. Mell, and Clyde L. Brooks, of DeKalb.

Ayer's Village.—The residents of this place are conferring with E. P. Snow, of Newburyport, in regard to running an electric railroad from Haverhill through Ayer's Village to Salem Depot, N. H.

Bradford, Mass.—James H. Winchell and others are interested in a street railroad proposed to run from Bradford to Groveland.

Bridgeport, Conn.—The Bridgeport Traction Co., a syndicate composed of Colonel Heft, James H. Beardsley, Henry Setzer, Jr., Howard Scribner, L. F. Curtis and Bradley Nichols & Sons has applied for a charter to run cars to the suburban districts. It is said the company will use the trolley system, and will run direct lines to Seaside Park, Beardsley Park and other places. The capital of the company will be $500,000.

Bridgeton, N. J.—There is every indication that this city will have electric street cars at an early date. A Philadelphia corporation has had its representative here on several occasions, and City Council has been assured that the road would be built inside of a year, providing they could secure a franchise from the city. The capitalists interested in the project say the road will positively be run between this city and Millville.

Cadiz, O.—There is a movement on foot here to build an electric railroad from this point to Unionvale, a distance of four miles. It is said that J. D. Riply, of New York, is the promoter of the scheme.

Cambridge, Mass.—The Board of Aldermen has granted the Storage Battery Co. certain track locations for an experimental line.

Charleston, Ill.—A new company, the Charleston Street Railway Co., has just been incorporated; capital stock, $100,000. The incorporators are Murat W. Hopkins, James K. Rardin and J. W. Neal.

Chicago, Ill.—A certificate of incorporation has been issued to the City Elevated Railway Co., of Chicago, which will construct a railway from some point on Michigan Avenue, between Lake and Harrison Streets, to a point on the boundary line of Cook County. The capital stock of the company is placed at $7,500,000. The incorporators are William H. Davis, L. C. Link, J. L. Reade, James K. Viele and S. Southard Homans.

THE Des Plaines Electric Railway Co. has been formed, with a capital stock of $2,000,000. The incorporators are: Willis Griffith, Samuel A. Jacob and F. E. Brady.

THE Pennington & Fuller Electric Co. has been incorporated. The incorporators are: J. L. McKittrick, Joseph A. Fuller and Lutellus Smith.

A PLAN has been formed by which residents of Jefferson Park, Forest Green, Irving Park, Maplewood and Avondale, suburbs of Chicago, may ride directly to the cable lines of the North and West Sides. The new railway project is to be undertaken by the Jefferson Street Railway Co., recently incorporated. The line, it is stated, will extend along Rand Road from the city limits to Jefferson Park, thence to Lawrence Avenue, then along Elston Avenue, connecting with the Milwaukee Avenue cable line and also with the Lincoln Avenue cable. The total length of the whole system will be about ten miles. The projectors hope to be able to secure permission to use overhead wires.

THE Metropolitan Elevated Railway Co., is quietly acquiring the right of way for its elevated railway on the West Side. It is stated that $1,000,000 has already been expended in the purchase of real estate.

Cœur d'Alene, Idaho.—The Cœur d'AlèneElectric Railway Co. has commenced negotiations for the raising of subsidies for the new line to Cœur d'Alène via Trent. The property owners on East Sprague Avenue did not respond as liberally as it was hoped they would; hence the proposed change of route.

Colfax, Wash.—D. T. Thompson, of Portland, has applied to the City Council for a franchise to build an electric street railway in this city. Milton Santee, of San Diego, Cal., has also applied for a franchise.

Columbus, O.—The Columbus & Westerville Railway Co. has an offer from an Eastern syndicate to purchase the road. John F. Barry, of New York, representing the syndicate, has offered to equip and build the road complete and in the best manner, provided that the franchise is assigned to them and the sum of $35,000 raised as a donation.

Dubuque, Ia.—Articles of incorporation have been filed with the secretary of state by the Eighth Street & West Dubuque Street Railway Co. Its capital stock is $100,000.

Duryea, Pa.—Ground was broken here November 15, for an electric street railway to connect with Pittston, a distance of two miles. The road will connect with the Pittston street railway.

East St. Louis, Ill.—It is rumored that East St. Louis parties desire to build an electric line to Madison.

Elizabeth, N. J.—The Elizabeth & Plainfield Street Railway Co. has petitioned the Common Council for a right of way through certain streets, and also for permission to use electricity as a motive power.

Elmira, N. Y.—It is said that J. Griswold, of the firm of Griswold, Maloney & Co., and others propose the construction of a street railroad in the Fifth Ward.

Glasgow, N. S.—The New Glasgow Electric Co, has asked the Council to approve of a route for its proposed electric street railway to extend from Trenton to the Intercolonial Railway station, which will be eventually extended to Stellarton.

Grand Rapids, Mich.—William Alden Smith and 200 others have petitioned the Council to grant a franchise to Percy T. Cook to construct a street railway line north and south across the city.

Hamilton, Ont.—Two companies, the Hamilton Radial Electric Railway Co., and the Watertown & Guelph Electric Railway Co., have applied for a charter to construct a radial electric railway from this city to surrounding points.

Hastings, Neb.—A company has been formed here for the purpose of building and operating a line of street railway from the business center of the city to the asylum, and the stock has been taken.

Hazleton, Pa.—Papers of incorporation have been issued to the Beaver Meadow, Hazleton, Mahanoy & Shenandoah Railway Co, to construct and operate an electric railway. The capital stock is fixed at $150,000. A. Markle, of Hazleton, is president.

THE Lehigh Traction Co., of Hazleton, was chartered November 8.

Homestead, Pa.—Plans are in preparation to extend the proposed electric street railway to Duquesne. A survey of the route has been ordered.

Jeanette, Pa.—The Jeanette & Penn Electric Railway Co. has been incorporated, with a capital stock of $30,000. George Wagoner of this place is president. Others interested are: A. J. Case, D. T. Kappenberger and J. R. Spiegel, all of Jeanette; and E. N. Frisbie, of 29 Broadway, New York.

Lafayette, Ind.—A new company is being organized to put in a new street railway here.

Lansing, Mich.—There was organized recently the Lansing City Electric Railway Co., with a capital of $100,000. The following officers were elected: President, Gordon McDonald; vice-president, C. H. Osband; secretary, Jay P. Lee; treasurer, Willard V. King. The company has purchased from the Continental Trust Co., the Lansing City Railway, with all its franchises, equipment and property.

Lebanon, Pa.—Parties interested in the Lebanon & Annville Electric Railway have organized the Lebanon Valley Traction Co., for the purpose of constructing, operating and leasing street railways in the county.

Lewiston, Me.—A party of Lewiston and Portland capitalists are arranging to petition the next legislature for a charter to run an electric railroad from Lewiston to Mechanic Falls.

Lockport, N. Y.—Articles of incorporation of the Lock City Electric Street Railway Co., have been filed. The capital stock is $150,000. New York capitalists have invested, while E. M. Ashley, Hon. John Hodge and others are local stockholders. The company has deposited the $1,000 per mile guarantee required by law and has applied for a franchise from the Common Council.

London, Ont.—The City Council has bargained with a new company for an electric street railway. The present horse car company has by the terms of its charter a thirty day's option to take over the bargain, in default of which the new company will build.

Macon, Ga.—Work was commenced November 1 on the Macon & Indian Spring Railroad.

Mahonington, Pa.—The Mahonington Railway Co., with a capital stock of $150,000, has been organized. George B. McLane, of Alexandria, Pa., is president; others interested are: P. J. Scanlon, H. E. McMillan and Charles D. Johnston, all of Mahonington.

Metuchen, N. J.—An electric railway is being considered by the Freeholders' Committee. They recently heard the application of W. B. Price, secretary of the City Railway, New Brunswick, to lay tracks on certain streets. It is proposed to run the road across the bridge and in the towns in the immediate vicinity.

Middletown, N. Y.—It is proposed to organize a company with a capital of $100,000 to build an electric railroad through North Street to lands which have been secured just north of the city limits.

Oakland, Cal.—W. M. Rank has petitioned the Board of Supervisors for a franchise to construct and operate a street railroad over certain streets.

Omaha, Neb.—A short time ago the franchise of the Metropolitan Street Railway Co. was sold by Netherton Hall, the agent, to J. E. Markel of this city, and a number of Eastern investors. The franchise purchased is in South Omaha and as yet the Metropolitan company has no way of getting into Omaha. As soon as possible an effort will be made to obtain an Omaha franchise.

Phœnix, Ariz.—The Phœnix Tramway Co. filed articles of incorporation November 3. Capital stock $20,000. The principal office of the company is named as Denver, the incorporators being J. S. Macbeth, Frederick Robinson, Jr., Henry B. Robinson, Granville Malcolm and George M. Harris.

Piqua, O.—The Miami Valley Railway Co. will build an electric railway extending from Piqua to Troy, O., a distance of eight miles. Those interested in the enterprise are W. P. Orr, A. M. Orr, S. K. Slatter and L. M. Flesh, of Piqua.

Reynoldsville, Pa.—The Reynoldsville & Rathmel Electric Street Railway Co. has been chartered, with a capital of $25,000.

Rochester, N. Y.—A company composed entirely of Rochester capitalists has been formed to build an electric line to run through streets in the suburbs not covered by the Rochester Railway Co., and to extend lines to Summerville, Windsor Beach, Sea Breeze, the Newport House and Glen Haven. The projectors of the scheme are Charles Goetzman, Joseph C. Tone and Emanuel Linder.

St. Johnsbury, Vt.—A charter has been asked for the St. Johnsbury Street Railroad Co. The incorporators are Col. T. C. Fletcher, J. C. Clark, W. S. Boynton, F. G. Bundy, and others.

St. Louis, Mo.—A certificate of incorporation has been issued to the Etzell Hill Railway Co., of St. Louis; capital $120,000. Incorporators: J. H. Terry, J. H. Murphy, S. S. Scott, R. F. Spencer, F. B. Fox, A. T. Terry.

J. D. HOUSEMAN, JR., F. W. Roeder and Geo. Minch have incorporated a company and purchased the franchise, which the County Court granted a year ago, for the construction of the Kirkwood & St. Louis Electric Railway. A survey of the route is now progressing, and definite steps are being taken to have it built. The company's charter requires that the road be completed within a year from January 1, 1893.

St. Marys, O.—A company has been formed here to build and operate an electric railway.

Sandusky, O.—The stock is all taken for the extension of the Sandusky, Huron & Milan Electric Railroad from Milan to Norwalk.

Sacramento, Cal.—The Sacramento Electric Power Co. was incorporated November 1. The directors are: Albert Gallatin, A. J. Ralston, Horatio P. Livermore, Charles E. Livermore and Joshua Barker. The amount of the capital stock is $1,500,000 and $600,000 worth of stock has been subscribed. The object of the company is the furnishing of light and power, also to construct a street railway running from the Southern Pacific depot to the eastern city boundary.

Scranton, Pa.—A charter has been granted to the Valley Passenger Railway Co., of Scranton. Capital $200,000. The proposed road will be twenty-six miles in length and will extend from a point in the borough of Archbald to Scranton thence to Pittston; thence to the borough of Hughestown. The directors are August Robinson, John J. Fahey, Joseph O'Brien, M. W. Collins, George M. Halstead, Scranton.

THE Hyde Park Railway Co., has been incorporated, with a capital stock of $50,000, to construct and operate an electric railway in Lackawanna County. John P. Ilsley, of Philadelphia and Ilsley Noyes, P. S. Page and Horace E. Hand, of Scranton, are interested.

Shamokin, Pa.—A charter was granted recently to the Shamokin & Mount Carmel Electric Railway Co., with a capital of $100,000. E. C. Hamilton, of Shamokin, is president. Others interested are H. S. Robins and David J. Lewis, of Mt. Carmel.

Sing Sing, N. Y.—Work has been commenced on the new electric line here, which, it is expected, will be finished by January 1.

Springfield, O.—William B. McKinley, Charles A. Harris, Samuel L. Nelson, Alvard S. Krotz and Oscar T. Martin have incorporated a company to lease, purchase and construct street railways in Springfield. The capital is $1,000,000.

Somers Point, N. J.—A public meeting of the citizens of Somers Point, Linwood, Bakersville, and Pleasantville was recently held for the purpose of organizing a company to construct an electric railroad between Somers Point and Atlantic City, a distance of twelve miles. The sum of $25,000 has already been subscribed for the project. It is expected to have the road ready for use in June next.

South Monson, Mass.—A company has been formed, with a capital stock of $60,000, to build and operate an electric street railway, starting at South Monson, and taking in Palmer and Wilbraham with a terminus at Ludlow. A branch will also be extended through Thorndike, Bondville and Three Rivers.

Sterling, Ill.—The Sterling & Rock Falls Inter-Urban Railway Co. is the name of a new company with a rapital stock of $100,000. The incorporators are: E. W. Jackson, Sheridan Block and W. N. Newton, and its object is to construct and operate a street railway in Sterling and Rock Falls.

Stockton, Cal.—The owners of the electric railway in this city, five local capitalists, have formed two corporations to engage in furnishing electric power and light and to run an electric railway from Stockton to Lodi and Woodbridge and Wallace, in Calaveras County, covering a district of thirty-two miles. It is proposed to erect a large power house near Lodi, which will be operated by water power, and supply Stockton with electricity for all uses, and to operate the railways.

Toronto, Ont.—The road of the Toronto & Scarboro Electric Railway Light & Power Co. from the Woodbine to Little York and East Toronto will be put in operation this season.

Town of Lake, Wis.—The supervisors have been applied to by the Milwaukee Street Railroad Co. for a franchise to build a line to Cudahy. It is provided that the work of constructing the road must begin May 1, and cars must be running by September 30, next year.

Uvalde, Tex.—The Board of Aldermen of this city has granted a franchise to the Uvalde Street Railway Co. to run its lines through any streets of the city.

Washington, Pa.—There is a movement on foot for the building of an electric road from Brownsville to Washington. Prominent capitalists in the vicinity are interested, and a Pittsburgh contractor has been asked for estimates.

Walford, Ont.—Much interest is manifested by residents of Walford, Arkona and Thedford, in a scheme to connect these places by an electric railway.

Watertown, Mass.—It is rumored that a company has been formed for the purpose of building an electric railway between here and West Newton. The cars are to be operated by the storage battery system. Petitions for locations in Watertown and Newton are to be presented at once, and it is hoped to begin work early in the spring. The line will be about three miles in length.

Personal.

Mr. Frank X. Cicott of the *Railway World*, London, has been in New York during the last month.

Mr. H. M. Thompson, secretary and treasurer of the Brooklyn City Railway Co., has resigned from that company.

Mr. J. F. Johnson for the past five years in the employ of the St. Paul (Minn.) Street Railway Co. has accepted a position as cable splicer with the Cleveland City Cable Railway.

Mr. Edward J. Stenhouse, assistant superintendent of the Denver Tramway Co. was killed by the accidental discharge of a gun, September 24, while out hunting. Mr. Stenhouse was a native of New York State.

Mr. J. A. McLure has resigned his position as superintendent of construction of the Short Electric Railway Co., of Cleveland, to take a position with the Siemens & Halske Electric Co., of America, with headquarters at Chicago.

Mr. Fred. H. Fitch, assistant engineer of the Chicago City Railway Co., and Miss Hattie Perkins, of Carthage, Mo., were married at the latter place on November 2. The contracting parties have our best wishes for a long and happy union.

Mr. H. A. Everett has handed in his resignation as secretary of the East Cleveland Railway Co., Cleveland, O., to take effect January 3, 1893. Mr. Everett will make his headquarters in future at Montreal, Can., where he is vice-president and managing director of the Montreal Street Railway Co.

Mr. Harry C. Simpson, who for nearly fourteen years has been connected with the Lewis & Fowler Manufacturing Co., and who has recently been their representative in California, has been obliged to sever his connection with the company on account of failing health. Mr. Simpson is well and favorably known among the street railway fraternity not only in this country but abroad, where he has traveled in the interests of the Lewis & Fowler Co. He retires from the employ of this company with entire good feeling and best wishes for his future on the part of his late associates.

Mr. Edward E. Higgins, until recently the general manager of the Short Electric Railway Co., has opened an office at 35 Wall Street, Mills Building, New York, and will engage in professional work as street railway and financial counsel. Mr. Higgins has been closely identified with street railway interests for a long time, and his thorough knowledge of the business will especially fit him to judge of the value of street railway properties, and to act as adviser to intending purchasers. This work, we believe, has never before been attempted in exactly the same line as will be followed by Mr. Higgins, and we feel sure that his efforts will not only be greatly appreciated by investors, but will meet with marked success.

Mr. John W. Fowler, president and one of the largest stockholders in the Lewis & Fowler companies of Brooklyn, has sold his stock in both companies to Mr. Frank Barnaby, of Brooklyn, and has resigned his position as president and director. Mr. Fowler was the founder of the business with which he has been so long associated, and has always been its active manager. From a small beginning the business of the Lewis & Fowler Manufacturing Co. has steadily grown until it is now one of the most prominent and best known manufacturing concerns in the street railway field; for this, Mr. Fowler deserves great credit, for it is largely due to the good business methods which he has pursued, and the energy and ability with which the entire business has been conducted. Mr. Fowler has large business interests at his home at Northport, L. I., to which he is devoting considerable time, and has contemplated severing his connection with the Lewis & Fowler Co. for more than six months past. And while his many friends will greatly miss him in street railway circles, all will join in wishing him continued prosperity in his new field of labor.

New Publications.

Catalogue No. 1 of Rail Joints, Rail Chairs and Tie Plates, etc. Published by Mark & Sterling, Cleveland, O.

This handsome catalogue gives illustrations and descriptions of the different types of rail joints, rail chairs, and tie plates manufactured by Mark & Sterling. The goods of this firm are made of malleable iron, and have given good satisfaction where used. Mark & Sterling also state in their catalogue that they have facilities for turning out all kinds of special work in addition to the standard types shown, and upon information as to the needs of any company are in a position to manufacture whatever is required.

Street Railway Employes' Gazette. Vol. 1, No. 1. Published by W. J. Law, Detroit, Mich.

The first number of this new publication, the official journal of the Amalgamated Association of Street Railway Employes, was issued last month. The endeavor of the paper, according to the editorial announcement, will be "to aid the organization in placing the occupation of street railway employes upon a high plane of efficiency and intelligence," an aim in which it will be in accord with all interested in the welfare of street railway interests. The first number is well printed, and contains much interesting matter.

The Catalogue of the Peckham Motor Truck & Wheel Co., Kingston, N, Y.

This catalogue gives illustrations and descriptions of the well known trucks and wheels of the Peckham Motor, Truck & Wheel Co., showing as well various parts in detail to exhibit the method of operation. Several handsome engravings are also given of the cars of the Union Railway Co., of New York, and of the Brooklyn City Railway Co., eqnipped with the Peckham No. 5 and No. 5 A truck; and complete trucks are shown equipped with the Thomson-Houston W. P. and Westinghouse S. R. motors. At the end of the catalogue are included a number of testimonials from well known street railway companies,

Recent Progress in Electric Railways. By Carl Hering, 386 pages. Published by the W. J. Johnston Co., Ltd., New York. Price $1.

In no industry, perhaps, have there been so many changes in methods and appliances during the last few years as in the street railway industry, and every indication points to many further changes, in details at least, during the immediate future. To obtain benefit from the experience of others, it is hardly necessary to state that every street railway manager should keep himself informed of the improvements constantly being made in the line of work in which he is engaged. For this reason technical journals in industries of this character are indispensable to secure the best economy in management and no text-book, however complete, and carefully prepared can supplant them. Mr. Hering recognizing these conditions has sought in his "Recent Progress in Electric Railways" to combine the advantages of book and periodical by giving in book form a "summary of current periodical literature relating to electric railway construction, operation, system, machinery, appliances, etc. In consequence, the volume is largely made up of articles or extracts from articles which have appeared elsewhere, added to which are the author's comments in some cases. Unfortunately, however, the material used is so heterogeneous in character that the effect upon the reader is rather confusing, carrying him as it does from expert opinions to daily newspaper statements and reports and back again to statistics with bewildering rapidity. Still there is much in Mr. Hering's work that is valuable, and the articles selected for republication are in nearly every case worthy of the space they occupy. As a substitute for the technicvl paper as a record of recent progress in the electric railway field this book can never succeed, but as an adjunct it may often be found convenient. The volume has no index.

Electric Traction on Railways and Tramways. By Anthony Reckenzaun, C. E. 422 pages. Published by Biggs & Co., Salisbury Court, Fleet Street, London.

Mr. Reckenzaun is recognized, both in this country and abroad, as a leading authority on electric railways, and anything upon this subject from his pen is worthy of attention. The volume takes up in the first chapter the early bistory of electric traction, giving in clear and simple language the fundamental laws upon which the operation of the electric motor and generator are based. Special and commercial types of appliances are described completely later on, and a number of views are given of different plants both in this country and abroad. We note that the author is still an enthusiastic advocate of worm gearing, and claims besides the advantage of noiselessness and compactness, efficiencies when properly constructed of 85 to 90 per cent. in the transmission of power between motor and shaft, considerably higher than that generally accepted in this country. In support of this he quotes some recent researches by Professors Thurston and Kimbal and Mr. Tower, showing that the co-efficient friction between lubricated bearings is not .1 or .2, as frequently stated in text books, but 0.003 and less. Mr. Reckenzaum recommends for street cars a steep thread steel worm with phospor bronze worm wheel, and believes that such a construction ought to last twenty years without renewal if properly lubricated. Other specially interesting parts of the book are the chapters on accumulators, of which the author has made a special study, and of load diagrams made under his supervision in connection with the Electric Car Co., in Philadelphia, and the results of tests of electric locomotives on the City & South London Railway. The greater part of the book and illustrations is taken from Mr. Reckenzaun's contribution on "Electric Traction" in "Electrical Engineering," the publication now being issued in installments by Messrs. Biggs & Co. The first volume of this book was reviewed in our March issue.

Equipment Notes.

The General Electric Co., of New York, states that all communications regarding, and orders for, railway line material manufactured by the Lieb Machine Works should now be addressed to the railway department of the General Electric Co., full arrangements having been made to this effect.

Jas. A. Trimble, of New York, is manufacturing a number of electric cars for Jersey City as well as a number for the Metropolitan Railway Co., of Washington, for use with storage batteries. The large number of orders that Mr. Trimble has received recently will probably oblige him to enlarge his works in the near future.

H. N. Bates & Co., of Boston, Mass., report they are meeting with a large call for their patent turned shafting. By their process of turning shafting they are enabled to furnish finely finished, accurate work and shafting, perfectly round, straight and true to size. The key seating will not warp or twist their shafttng out of true.

The Interior Conduit & Insulation Co., of New York, has decided to send a printed circular each month to every architect in the United States, giving a list of the different buildings, contracts for the wiring of which have been closed by them or their agents. The circular will give full particulars in regard to each installation.

The Burton Electric Co., of Richmond, Va., is meeting with a large sale of its well known electric heaters for street cars. The managers say that orders are being received from all sections of the country, and the different railway companies which have purchased heaters are generally testifying their satisfaction at its excellent operation.

The Frost Veneer Seating Co., New York, writes us that owing to its large trade in the West for car seats and ceilings, the managers have been compelled to fit up the plant of the company at Newport, Vt., with considerable additional machinery. The company is now turning out a large amount of work at Newport and receiving many orders.

Reed & McKibbin, of No. 2 Wall Street, New York, have closed a number of contracts recently for the electrical equipment of street railways. Among these are contracts with the Brooklyn City & Newtown Railway Co., Brooklyn, N. Y.; Chester & Media Railway Co., Chester, Pa.; Paterson & Little Falls Electric Railway Co., Paterson N. J.

William M. Sturges has opened an office as consulting electrical and mechanical engineer, at 22 Main Street, Utica. Mr. Sturges has had fifteen years' practical experience in the management, construction and equipment of electric railways, power houses, tracks and shops and has been connected with some of the best paying roads in the country.

The Peckham Motor Truck & Wheel Co., of Kingston, N. Y., has sold 100, 5 A, trucks to the Atlantic Avenue Railroad Co., of Brooklyn, N. Y. The company is now represented in Chicago by P. S. Bemis, Jr., whose office is in the Phœnix Building, Clark and Jackson Streets. There is a large amount of business to be secured in the West and Mr. Bemis proposes to have his share of it.

Watson & Stillman, of New York City, have recently received a large order for hydraulic projectile drawing presses from the United States Projectile Co., of Brooklyn. Orders for hydraulic presses, pumps and accumulators have been so abundant during the past year that it has been found necessary to operate their plant both day and night, notwithstanding increased facilities in the several departments.

C. H. Smith, of Troy, N. Y., has put on the market a signal light box for street cars, in which the lights can be changed from one color to another in a moment's time, so that the same car can run on any line and show the desired color. Companies running more than one line of cars will find this of great advantage. The manufacturers state that more than a thousand of these signal light boxes are now in use on the various roads in different parts of the country.

Ralston & Henry, of Philadelphia, Pa., electrical engineers and contractors, are meeting with marked success in their construction and equipment work. This firm has also a complete line of electric railway supplies, which is meeting with a large call. Ralston & Henry are now furnishing the entire equipment for a number of new electric roads, and call particular attention to their new cotton waste, of which they have a special brand for use on dynamos.

The John Stephenson Co., Limited, furnished the cars for the Jersey City & Bergen Railway Co., as described in this issue. The company is now principally occupied on its contract for the cars for the Broadway Cable Railway of New York. There are also being built at the factory ten very handsome cars for the Forty-second Street & Grand Street Ferry Railway. Among other cars upon which the company is at work are some for Cuba and Mexico.

The Electric Railway Engineering Co., of 180 Summer Street, Boston, Mass., reports a large number of orders. This company, aided by a corps of competent engineers, is now prepared to do general engineering for designing and construction of power plants for electric railways, lighting and other stations, also steam plants and water powers. The managers state, however, that they make electric railway construction a specialty, J. F. McGowan is manager of the company.

The Duplex Street Railway Track Co., of New York, is supplying the rails for the Lake Roland Elevated Railway, described elsewhere in this issue. This company is in receipt of a letter from A. E. Smyrk, city Commissioner of Baltimore, in which he says: "I

have no hesitation in stating that I consider your rail joint the best I have seen, and I have no doubt the entire structure, when completed, will be entirely satisfactory. I, therefore, approve of its use in our city streets."

The Safety Car Heating & Lighting Co., of 160 Broadway, New York, has received the contract for the equipment by its system of the new cable cars on the Third Avenue Railway. The Pintsch system is now in use on over sixty railroads and over 4,000 cars in this country, and in 47,000 cars in all parts of the world. The company has had a great success in installing its system, and has received from exhibition authorities in all parts of the world medals and diplomas testifying to the superiority of the system.

The Sperry Electric Railway Co., of 29 Broadway, New York, a description of whose system was given in our last issue is receiving excellent reports about the operation of its cars at Youngstown, O. In the Sperry system, it will be remembered, a single motor elastically supported and flexibly connected to both axles is used. The Sperry company has issued a circular descriptive of its system, with engravings showing the general arrangement of parts, the cushioned universal clutch, controller and other details.

F. P. Little & Co., of Buffalo, N. Y., recently closed a contract for the equipment of the factory of the Buffalo Furnace Co., with complete electrical equipment for thirty-one arc and 250 incandescent lamps. This will include one fifty horse power 9 × 16 Rice, automatic engine, and one 30,000 watt Thomson-Houston dynamo. They have also closed a contract for equipping the residence of Geo. P. Foreman, of Buffalo, with complete outfit, bells, speaking tubes, electric, gas lighting and incandescent electric light wiring. They write us that business with them is very brisk.

The Westinghouse Electric & Manufacturing Co., of Pittsburgh, Pa., has sent us a copy of a letter recently received from F. G. Jones, vice-president of the Burlington (Ia.) Electric Railway Co., referring to the satisfaction given by the Westinghouse tank lightning arrester. In his letter Mr. Jones says: "We have been using the tank arrester during the past season with the best of results, have had a number of violent electrical storms, and have been able to operate through them all with entire safety, and have tested it so thoroughly that we now feel we are taking no chances from lightning."

Dick, Kerr & Co., Limited, London, Eng., the well known contractors for both street and steam railways in England, are now prepared to introduce their appliances in this country, and to bid upon any work in their line. This house is the largest of its kind in England, and has achieved a wide reputation for the manufacture of steel rails of every shape, size and variety adaptable to every kind of railway service. The firm also makes special claim of excellence of their roadbed for both electric and cable service. Dick, Kerr & Co. are sole proprietors of the cable patents in England, and among other roads constructed by them might be mentioned the line of the Edinburgh & Northern Tramway Co. and the Brixton extension of the London Tramway Co. Mr. George Flett, of this company, has recently spent considerable time in the United States and will be pleasantly remembered by many of our readers.

The Acme Storage Battery Manufacturing Co. has been incorporated under the laws of the state of New Jersey with a capital of $5,000,000, and has aquired the patents of the storage battery recently issued to Patrick Kennedy and Chas. Diss, of Brooklyn. The officers of the company are: President, G. C. Warner; vice-president, Wm. H. Fletcher; general manager, Wm. M. McDougal. The company is operating a car on the Ninth Avenue Railway, of New York. This car, which weighs six and a half tons, is equipped with 144 cells, each weighing twenty-seven pounds complete, and having a capacity of 140 ampere hours at an average discharge rate of twenty-five amperes. The plates are of a special type, and consist of a thin slotted sheet of lead, having a projecting tongue for making the connection between adjacent plates. This thin sheet is then surrounded by the active material, which is held in place by grids made of insulating material which are placed on either side.

The Standard Paint Co., of New York, manufacturer of P & B and other well known paints and compounds, writes us that during the past year there has been a very large and increasing demand for all classes of its products by street railway and electric llght companies, and that its trade has been steadily growing and is probably 50 per cent. larger this year than last. The P & B insulating compound will be extensively used on the electric launches that are to be used on the World's Fair lagoons. The Hercules Iron Works, of Chicago, who are erecting a cold storage building at the World's Fair grounds, after having carefully looked into the merits of the various kinds of insulating papers, have placed with the Standard Paint Co. a contract to supply all the paper for this work. The company has also recently received a contract for supplying its No. 1 P & B pipe coating compound for use on all pipe to be laid by the Waukesha Hygeia Mineral Springs Co., which is to convey water from Waukesha, Wis., to the World's Fair grounds.

Edward C. White & Co., of New York City, proprietors of the Globe Iron Works, have thoroughly re-equipped their factory with new tools and machinery for the purpose of manufacturing, at a reasonable cost, in large quantities and for quick delivery, a full line of modern street railway apparatus. The Globe Iron Works were established by M. M. White & Co., in 1857, and are one of the oldest concerns of the kind in the United States. The proprietors have always made a specialty of street railway supplies, and to-day turn out no other class of work. The specialties of the works are: Cast chilled street car wheels for horse, cable and electric power (in contracting chills); brake shoes of all patterns, both chilled and soft; the West End four wheel truck; the West End radial truck; the West End electric steel snow plow (with or without motors); the White snow sweeper (with or without motors); electric transfer tables for car houses, all steel, equipped with motors ready for operating sixteen to eighteen foot cars; hand power transfer tables for small cars; the Hiet street car fender; track special work (frogs, switches, crossings, etc). The Globe Iron Works also make a specialty of repair work.

The Ball Engine Co., of Erie, Pa., has sent us a large photograph of their new heavy duty, tandem, compound engine, which is certainly a handsome and powerful looking machine. They have recently installed one of these engines in the power house of the Erie (Pa.) Street Railway Co., and are also installing two of the same size in San Francisco for electric railway work. Another recent shipment is a 550 H. P. cross compound engine to the Englewood Electric Light Co., of Englewood, Ill. The Ball Engine Co. writes us that its factory is crowded with orders for electric light and street railway engines, especially the latter, and that its engines are giving good satisfaction wherever used. This company has also made the following among recent shipments: Brockton Street Railway Co., Brockton, Mass., one 600 H. P. cross compound; Calumet Street Railway Co., Chicago, Ill., four 300 H. P. cross compound; San Leandro Street Railway Co., San Francisco, Cal., one 500 H. P. tandem compound; East Oakland Street Railway Co., San Francisco, Cal., one 400 H. P. tandem compound; Englewood Electric Light Co., Chicago, Ill., one 600 H. P. cross compound; Binghamton Electric Light Co., Binghamton, N. Y., two 250 H. P. tandem compound; Wheeling Street Railway Co., Wheeling, W. Va., three 250 H. P. cross compound; Pottstown Electric Light Co., Pottstown, Pa., one 250 H. P. cross compound; Erie Electric Motor Co., Erie, Pa., three 150 H. P. tandem compound.

The Berlin Iron Bridge Co., of East Berlin, Conn., sends us word that the Jackson & Woodin Manufacturing Co., of Berwick, Pa., has given it the contract for the new car wheel foundry of that company. The building, which will be made entirely of iron, will be from the designs of the Berlin company. This company is also building a new machine shop for the Mather Electric Co., at South Manchester, Conn. The building will be 52 × 150 ft., the central portion being thirty-five feet in width and controlled by a fifteen ton traveling crane. The design is a combination of iron and wood, the heavier part of the building all being of iron. Another contract taken by this company is for a new machine shop, to be built at Newport News, Va., for E. C. Hillyer & Co. The building will be eighty-two feet in width, divided into a central portion forty feet between crane girder columns, with a wing on each side twenty-one feet in width. The wings will be two stories high, the balcony floor being used for light work. The central portion of the building will be controlled by a twenty ton traveling crane. The Lobdell Car Wheel Co., of Wilmington, Del., has also placed the contract for their new machine shop with the Berlin company. This building will be sixty-seven feet in width, divided into a central portion twenty-five feet in width, with a wing on each side twenty-one feet in width. The central portion is controlled by a fifteen ton traveling crane. The building will be 151 ft. in length, the entire framework being of iron, the side walls being of brick.

E. H. Wilson & Co., of Philadelphia, Penna., proprietors of the Lamokin Car Works, have sent us a list of the recent orders for cars received by them. These include the following: the Brainerd (Minn.) Electric Railway Co., four 16 ft. closed cars, Robinson truck; the Fond du Lac Electric Light, Power & Street Railway Co., four 16 ft., closed car bodies; the Scranton (Pa.) six 18 ft., closed car bodies; the Citizens' Passenger Railway Co., Steelton, Pa., four 18 ft., palace vestibule cars, second order; the Calumet Electric Street Railway, Chicago, Ill., six 18 ft., closed car bodies, McGuire truck, Detroit Electric System. (These cars are to be the latest style of car, being constructed under Cochran's patents, quartered oak finish, spring rattan seats and backs.) Schuylkill Traction Co., Ashland, Pa., four 18 ft,. closed car bodies, second order from this company; the Chester & Media Railway Co., Chester, Pa., two 16 ft., closed car bodies and two 19 ft. vestibuled car bodies with seats crosswise of car with aisle in center. The recent deliveries of this firm include the following: The Paterson (N. J.) Central Electric Railway Co., ten palace vestibule car bodies, Anger trucks; the Derby (Conn.) Street Railway, one 16 ft., closed car, fourth order; the East Harrisburg (Pa.) Railway Co., three 33 ft., car bodies, Robinson radial trucks; the Atmospheric Propulsion Co., 29 Broadway, N. Y., one 18 ft.. closed car body; the Williamsport (Pa.) Passenger Railway Co., two 16 ft., palace vestibule car bodies, McGuire truck, the fifth order from this company; the Dennison (O.) Electric Railway, two 16 ft., closed car bodies, the Schuylkill Traction Co., six 18 ft., closed car bodies; the Philadelphia Traction Co., Philadelphia, Pa., two 16 ft., closed cars; the Columbia (S. C.) Electric Light & Power Co., six 16 ft. car bodies, McGuire trucks.

The Reliable Manufacturing Co., of Boston, is meeting with a large demand for its well known appliances, especially the Reliable sand boxes and Collett ratchet brakes, which are being shipped to all parts of the United States and Canada. The demand for sand boxes has been especially large, as at this time of the year they are very convenient for keeping control of cars on slippery tracks. During the past month sand boxes and Collett ratchet brakes have been shipped to the following companies among others: The Merrimack Valley Street Railway Co., Lawrence, Mass.; Ottumwa (Ia.) Electric Railway Co., Augusta (Me.), Hallowell & Gardiner Street Railway Co., Newburyport (Mass.) Car Manufacturing Co., Kankakee (Ill.) Electric Railway Co., the Thomson-Houston Electric Co., Kansas City, Mo.; Montreal (Can.) Street Railway Co., Toronto (Can.) Street Railway Co., Union Street Railway Co., Providence, R. I.; Norwich (Conn.) Street Railway Co., Lynn (Mass.) & Boston Street Railway Co., Lowell (Mass.) & Suburban Street Railway Co., Haverhill (Mass.) & Amesbury Street Railway Co., Minneapolis (Minn.) Street Railway Co., Sandusky (O.)

Street Railway Co., New London (Conn.) Street Railway Co., Fitchburg (Mass.) & Leominster Street Railway Co., Citizens' Street Railway Co., Fishkill-on-the-Hudson, N. Y.; Plymouth (Mass.) & Kingston Street Railway Co., Williamsport (Pa.) Passenger Railway Co., Globe Street Railway Co., Fall River, Mass.; Baltimore (Md.) Traction Co., Brooklyn, (N. Y.) City Railway Co., Twenty-third Street Railway Co., New York City; Albany (N. Y.) Street Railway Co., Natick (Mass.) & Cochituate Street Railway Co., Thomson-Houston Electric Co., Lynn, Mass.; Wilkes-Barre (Pa.) & Wyoming Valley Traction Co., South Covington (Ky.) & Cincinnati Street Railway Co.

Beecher, Schenck & Co., of New York, General Managers of the American Casualty Insurance and Security Co , report that, for the first eight months of 1892, the total increase of net premiums over the period for 1891 was $670,503.01. The company was organized in 1890, and the first year's premium receipts were $1,700,000. Of this company a well-known insurance monthly, in a recent issue, states: "No better example now occurs to our mind of what may be done, by the right men with the right methods, than is shown in the successful career of the American Casualty Insurance & Security Co., of Baltimore, Md. The company was started two years ago with a $1,000,000 capital and a $500,000 surplus. Men with the courage and capital to thus endow a new insurance enterprise, with the field as well filled, apparently, as it was, must have imagined they knew what they were about; and they did. Although hailing from Baltimore, the A. C. I. & S. C. has large offices in the great business centers of the country, and has been so wonderfully successful that, when its statement was rendered at the close of 1891, it had assets of $2,208,599, as well as a large surplus, and was able to pay a stock dividend of 10 per cent. For a two years' record this can hardly be surpassed, we think. The company was derisively called the "Jumbo" by envious rivals and chronic kickers for a time after it started, in that it undertook to insure such a variety of risks; for it engaged in all descriptions of liability insurance as well as steam boiler insurance, contribution insurance, elevator insurance, horse and vehicle insurance, and has since added other features. It transacts every kind of insurance save life, fire and live stock, and has received so large a number of testimonials from its customers that it has printed them in pamphlet form. A perusal of these proves how thorough and solid has been the success of the enterprise. The officers of the American Casualty are: President, William E. Midgely; vice-president, Robert Sewell; secretary, J. J. Jackson, and last, but not least, general superintendent, John M. Crane. The general managers of the company are the old and well known firm of Beecher, Schenck & Co., of New York City.

The Robinson Electric Truck & Supply Co. is now building some unusually long Robinson radial trucks designed for a lot of twenty-eight foot body cars. These will be used by a road which, for more than a year, has been using a large number of the twenty-five foot Robinson radial cars. With the approach of winter this company has been very busy recently in furnishing trucks for snow use. The traction of the Robinson radial is so great that it has been found to drive forward when other plows would simply stand still and slip their wheels, while its length of wheel base, fourteen feet, causes a perfectly steady movement not found in any other form of snow plow. Furthermore, it can be driven around street corners at full speed without danger of leaving the track, thus readily disposing of drifts and deep snows, whether on curves or straight lines. The Union Street Railway Co. of Dover, N. H., last winter removed one of its mammoth car bodies from a Robinson radial truck and mounted a snow plow on the truck, using this plow during the winter. It was provided with two fifteen horse power, S. R. G. motors, and ran easily through the heaviest drifts, keeping the road open and perfectly clear during the winter, "piling the snow up on each side of the track as high as a car," to use the language of one of the officials of the road. Mr. Burgett, the general manager of the road, has recently ordered a special Robinson radial truck to be provided with wheels having broad tread and deep flange, and two twenty-five horse power, W. P. 50 motors, to be used especially for a snow plow this winter. The following is a copy of a letter recently received by Mr. Robinson from D. W. Higgins, Esq., president of the National Electric Tramway & Lighting Co., Victoria, B. C., dated October 1, 1892: "The radial truck with which you supplied us about ten months ago has been in active service ever since, and has given the highest satisfaction. It is fitted to a thirty-five foot car, and turns the sharpest curves as readily and as rapidly as if it were on a straight track. Our superintendent and motorneers are in love with it, and the latter almost quarrel for the privilege of driving it. I have not the slightest hesitation in pronouncing it, in every respect, a superior article, and one that may be safely recommended for street car service anywhere."

The R. D. Nuttall Co., of Allegheny, Pa., has recently published a catalogue and price list descriptive of the many appliances manufactured by it. In the notice to the trade the company states that within the past year it has doubled its entire capacity, and, being constantly alive to new improvements, is at present increasing its gear department by the introduction of four special gear machines of immense power, for cast steel gear work. The company has also increased its lines by the addition of many new patterns, and is now prepared to furnish standard gears, pinions, bearings and motor repair parts for every system and all sizes. The capacity of its armature, commutator, trolley and other departments has also been increased, and to facilitate prompt shipments a branch Nuttall Railway Supply Co. has recently been opened at Chicago, where a full line of supplies for the convenience of its Western trade will be carried. The experience of this company in the electric railway field has been long and of a practical nature, and, owing to the fact that the company devotes its time to this branch of the business exclusiveiy, believes it is now in position to thoroughly understand the wants and requirements of electric railway companies. Considerable space in the catalogue is also devoted to the Nuttall compression spring trolley, which has been adopted by the Westinghouse and Short companies as their standard, and is now in operation on the majority of the large railways throughout the country. The Nuttall company sold of these trolleys up to August 1, 1892, 1,763, and states there have been replaced on prominent roads upwards of 100 trolleys of other styles since May 1, 1892. The Nuttall rawhide, intermediate gears, which have made an excellent record for themselves during the last year, also receive their share of attention. These gears consist of two essential parts, a body made of iron and the rim composed of one solid ring of rawhide, into which the teeth are milled. These gears require no lubrication, have immense tensile strength and long life, besides the most essential quality of noiselessness, The principal items in the catalogue are illustrated, and each piece is given a catalogue number to facilitate ease in ordering. The company also supplies iron poles and brackets for center and side pole construction, parts for wooden poles, commutators, armatures, overhead line material, wire, etc. This company has sent us a neat and convenient desk memorandum pad which it has recently issued. The pad is bound in cloth, has a handsome cover upon which the specialties of the Nuttall company are mentioned, and on the back contains a calander for 1893.

WESTERN NOTES.

Gilbert M. Smith, University Building, Chicago, representative of the Aluminum Brass & Bronze Co. has taken a number of large wire orders recently.

The Canton Steam Pump Co., manufacturers of the Miller duplex steam pump for boiler feeding and general purposes, proposes to move its works to Dixon, Ill.

The Oliver P. Clay Co., of Cleveland, O., has issued a striking little folder giving some facts and prices in regard to its soot sucker, in which it reports doing a large business. The company has received a number of testimonials from customers who report the appliances as giving excellent satisfaction.

The Fitzgerald-Van Dorn Co., of Lincoln, Neb., has put on the market an automatic coupler designed for the use of cable and motor cars. The coupler has been adopted on a number of roads and is reported as giving excellent satisfaction where used. The company is in receipt of many testimonials speaking of the coupler in the highest terms.

The International Register Co., of 300–302 Dearborn Street, Chicago, has sold 150 portable registers to the West Chicago Railroad Co. The registers are of the latest type, and are handsomely finished in all respects. Although the company has been in business but a comparatively short time, its registers are in use on forty roads, and giving entire satisfaction.

Ramsay & Kenyon, of 109 Endicott Arcade, St. Paul, Minn., furnished the entire track material for an electric line recently installed by C. N. Parker, at Brainerd, Minn. The firm furnished the switches, curves and a number of crossings over the Northern Pacific Railroad. The line is three and a half miles in length, and steel rails weighing thirty-five pounds per yard were laid. The firm has been appointed Northwestern agents for the sale of the engines of the Ball & Wood Co., of New York.

The Standard Railway Supply Co., Garson Myers, manager, Monadnock Building, Chicago, has had a marvelously good trade in street car heaters, which are adapted to all styles of cars, and may be used, as Mr. Myers has so emphatically declared, without cutting the car seats. Orders have been sent from all parts of the country, and the heaters seem to be giving the best satisfaction. The rush has been so great that Mr. Myers finds no little difficulty in filling orders.

Markle & Harnish have been appointed managers of the central district of the Siemens & Halske Electric Co. of America, with headquarters in the Pierin Building, Fifth and Race Streets, Cincinnati, O. The senior member of the firm is a pioneer in the electrical field. It is stated that he installed the first electric motor in the West at Detroit. He was connected with the Edison company until about eighteen months ago, and since that time has been engaged in expert work.

The Valentine-Clark Co., the Rookery, Chicago, contractors and dealers in poles, ties, etc., is now prepared for making contracts for material in its line for the coming year. To facilitate the prompt filling of orders and to place itself in closer connection with the trade, it has established for the coming year fine branch yards in central localities in the cedar section, thus enabling it to fill orders from all sections with promptness and despatch. Owing to increased demands of the business the company has recently moved to suite 704 and 706, the Rookery, where it will be pleased to see both old and new customers.

The St. Louis Car Co., is at present building 250 cars for the Crescent City, and New Orleans & Carrollton railway companies, of New Orleans, La.; also cars for South Chicago, Ill.; Madison, Wis.; Port Huron, Mich.; Savannah, Ga.; Brooklyn, N. Y.; New York City; Sioux City, Ia.; St. Cloud, Minn.; Louisville, Ky.; Anderson, Ind.; Pueblo, Mex.; DesMoines, Ia.; Grand Rapids, Mich.; Ashland, Wis.; Seattle, Wash., and many other points. The company is at present adding several boilers to its plant, and increasing its power capacity by 100 H. P. Its orders comprise 400 cars yet to be built, and for the last year and during the present, 100 cars per month are being turned out of the company's shops. It is unnecessary to add that the works are in operation day and night.

The American Car Co., of St. Louis, is at present very busy building twenty forty-two foot cars for Minneapolis, to be operated on the interurban line between Minneapolis and St. Paul; also cars for the West Chicago Street Railroad, of Chicago, Ill.; Youngstown Street Railroad Co., of Youngstown, O.; Omaha Street Railway, of Omaha, Neb.; Washington & Georgetown Railroad, of Washington, D. C., and

many other street railway companies. The new paint shop of the car works, which will accommodate 160 cars, is at present filled to its utmost capacity. Mr. Sutton, president of the company, has patented a new truck which is adapted to the two most popular forms of motive power—cable or electric. This truck is to be used for the first time on a number of cable grip cars the company is building for use in a certain city.

The National Fare Box Manufacturing Co., of Chicago, recently received from one of the roads using its fare box a letter which, in effect, was a striking indorsement of this fare receiver. The communication announced that one of the boxes in use was returned as it could not be opened. A blacksmith had endeavored to open it but announced his inability to do so without demolishing the box. When examined it was found that the lock had been tampered with so that the key would not work. The incident was regarded as a complete demonstration of the claim that only in one way can money be taken from the box, *i. e.*, by opening the money drawer. Should the latter be fixed by tampering with the lock, the nickels and dimes are likely to stay where they have been deposited until it is operated upon by the experts at the manufacturer's office.

The Lodge & Shipley Machine Tool Co., of Cincinnati, O., whose specialty is lathes for rapid turning, boring and squaring, is manufacturing a machine which will bore and face heavy circular plates, or plates of other shapes, forty inches in diameter, in one hour, making, the managers say, a true piece of work. The company will place this machine on the market in the near future. This company exhibited one of their motor gear lathes at the recent convention of the National Street Railway Association, at Cleveland. The lathe attracted considerable attention, and accomplished the remarkable performance of turning, boring and squaring a motor gear twenty-three inches diameter, four and a half inches face, and three and three-eighths inches bore, in seventeen minutes. This machine is meeting with general favor, not only for motor gear work, but for general machine work.

The New York Insulated Wire Co. has in its Chicago office, 80 Franklin Street, a novel electric lighting plant installed to exemplify how easily a distributing system can be constructed with Grimshaw white core wire. The current is furnished by a Gregory dynamo driven by an arc light motor, and the wires from the dynamo to the lamps are laid in vulca ducts with all necessary appliances in the way of junction boxes, elbows, etc. Any wire can be disconnected and taken out from a lamp to the switchboard. Among the novelties used in the construction of the plant are the Electric Engineering & Supply Co.'s switches, sockets, etc., the Cutter Electric Manufacturing Co.'s flexible fixtures and Sunbeam incandescent lamps, and Mr. George H. Meeker cordially invites all that are interested, especially architects, to inspect this model plant. A constant source of attraction is an illuminated picture of the grounds and buildings of the World's Columbian Exposition, showing Grimshaw white core wire in vulca ducts lighting all the incandescent lamps.

The Electrical Supply Co., of Chicago, issued for the recent Convention of the American Street Railway Association a most unique and tasty little volume in which are illustrated many of the specialties to be found in its railway department. The book is profusely illustrated, and will be consulted with interest by all those needing supplies for street railway plants. This company has recently established closer arrangements with the Crocker-Wheeler Electric Co.. of New York, for handling its motors in the West. The motor generator, or direct current transformer, a new specialty recently brought out by the Crocker-Wheeler Co., is meeting with a very large demand, particularly from electric railway companies, to transform the E. M. F. of 500 volts to 100 volts for lighting purposes. F. S. Terry, manager of the Electrical Supply Co., recently visited the factory of the Crocker-Wheeler Co., and was much impressed with the care taken in the manufacture of motors. It is the aim of the Crocker-Wheeler people to build up a reputation based entirely on the superior quality of the goods they turn out.

The Stirling Co., of the Pullman Building, Chicago, is doing an extremely large business, and its manufacturing facilities have proved inadequate to the demands upon them. The company has been forced to build a large foundry in connection with its plant at Barberton, O., and expects to turn out its own castings in January. Among the recent contracts awarded the company for installing boilers in electrical stations are the following: Beaver Valley Traction Co., Beaver Falls, Pa.. 200 H. P.; Charles Heap, Milwaukee, 300 H. P.; Hyde Park Electric Light Co., Boston, 200 H. P.; Pennsylvania General Electric Co., for Barberton, O., 200 H. P.; Hyde Park Electric Light & Power Co., Chicago (second order), 300 H. P. The company will furnish five 333 H. P. boilers for use in the plant of the Armour Packing Co., of Kansas City, Mo. This is the second order from that company, the first embracing a steam plant of 1,000 H. P. The new boilers will generate steam for the new electrical transmission system to be introduced in the packing houses. The Armour company has decided that it will be more economical to employ electric motors for furnishing power in the various departments of its plant than to use shafting, and will introduce a general system of electric power.

Taylor, Goodhue & Ames, 827 Monadnock Building, Chicago, have secured a number of important agencies of late. They have obtained the Western agency for the Philadelphia trolley, which has been commended so highly by railway men. They have become agents for the well known Burton electric heater, and have recently been corresponding with all the customers of the Burton Electric Co. A large number of the writers speak in the most complimentary terms of the heaters, and in many cases refer appreciatively to Dr. Burton's work as a pioneer in the electric heating field, and express the hope that he may secure the full benefit of the patents granted him. Taylor, Goodhue & Ames are meeting with an excellent trade in electrical supplies, and are receiving many inquiries from electric railways. They are handling an anchored filament, eight candle power lamp which is attracting much attention. As five lamps must be used in cars, many railway men think that sixteen candle power bulbs afford an unnecessary amount of light, and five of the new eight candle power lamps furnished by Taylor, Goodhue & Ames will, they think, answer the purpose very nicely. The firm carries a full stock of fuse wire in all sizes, and all orders are filled the day they are received.

The Railway Equipment Co., Pullman Building, Chicago, is already finding it difficult to meet the demand for Ahearn electric heaters. "There is no trouble in getting orders for heaters," says Mr. Mason, the general manager, "the only difficulty consists in filling them. The street railway men say they do not care for electric stoves, but when they see the one we have, they all find they want at least one for their offices. The stove is ornamental and is suitable for any room." The company's business has increased of late to such an extent that additional facilities for storing and shipping have been secured. The company recently took the contract for the overhead equipment for the Cincinnati Street Railway and Cincinnati, Covington & Newport Railway companies, and for one week the orders aggregated overhead materials for over 100 miles of road. This company has recently issued a catalogue, No. 18, devoted to overhead parts. The catalogue is completely illustrated, and a glance through it shows many new appliances as well as well known standard articles manufactured by this company which have shown excellent results in practice. This company, it is well known, advocates the use of their special hard rubber composition for insulating purposes in overhead parts. The catalogue also illustrates the Ahearn electric stove and car heater of which this company is the exclusive agent.

The Short Electric Railway Co., furnished the motor equipment for the Fort Wayne (Ind.) Electric Railway which has given entire satisfaction. In a recent conversation Mr. Frank De H. Robison, one of the owners of the road, said regarding the motors: "We are more than pleased with the operation of the entire system. On July 8, 1892, we commenced operating four electric cars on one line. About the middle of August, we completed our second line of road and put seven electric cars in operation there. Since then we have taken off all our horse cars and run with electric cars entirely. We have not had a hitch to speak of since we first started running, and in the statement received from my brother, Mr. M. S. Robison, Jr., who is our general manager at Fort Wayne, he stated that the cars had given entire satisfaction in every respect, and that he had been to no expense whatever in the way of repairs, that $50 would cover all of the expenses, and this was caused by carelessness of our own men." This company has also sold twenty-five equipments to the Wyoming Valley Traction Co., Wilkesbarre, Pa. The Short company announces that F. R. Ford has been appointed agent in charge of its Chicago office, Alex. Kempt having resigned. The company extends a cordial invitation to all street railway managers when in the city to call on Mr. Ford, who will be pleased to give any information that may be desired. The company has moved its New York office from 35 Wall Street to 44 Broad Street where most comfortable quarters have been secured. The managers most cordially invite any person interested in street railways who may be in New York to pay them a visit at their new quarters.

The Westinghouse Electric and Manufacturing Co.

The current year, the Westinghouse Electric & Manufacturing Co. reports, has been the most successful in its history. not only on account of the fact that it leaves the company in a most prosperous financial condition, but also because of the record made during the year by the apparatus manufactured by it. With 1892 the business of the company assumed extraordinary proportions. Contracts, unsolicited in a number of cases, came in very fast, and daily shipments averaged many times the amount of what had ever been experienced prior to the reorganization.

To meet the demand of the many orders, the old works on Garrison Alley, in Pittsburgh, were rearranged so as to give additional room, and to give the company an opportunity of making the most of all available space. A new boiler house was put up with an increased capacity. But as even this was not ample. the company decided to make use of the old Westinghouse air brake works in Allegheny City. In the latter place a machine shop is now being erected and is almost completed, which will be one of the best equipped establishments of its kind in the world. It will be a dynamo shop, the management having decided to utilize it exclusively as a place in which are to be manufactured electric light generators and power generators. Among those in course of construction at present are the large generators which will be used for lighting the World's Fair buildings at Chicago.

This success of the Westinghouse company has been largely due to the character of the apparatus made by it, the rule being to employ only the best materials and workmanship. In the street railway department of the company the Westinghouse motor has kept pace with the improvements made in the science. It is strong, easily handled, can be operated with facility, and runs with scarcely any noise. It has not only manifested its excellence by having been adopted by many of the largest street railway corporations in the country, but the Westinghouse company has also some obtained contracts for replacing other systems.

The same activity which characterized the electric railway business of the company during this year has also manifested itself in all the other departments. The alternating current electric lighting apparatus manufactured by the company, is still maintaining its well

earned reputation. Not only has the Westinghouse lighting system been selected by the World's Fair committee of Chicago to illuminate the World's Fair buildings and grounds at Jackson Park, but the Westinghouse company has also received a large number of orders for central station plants throughout the country.

The company states that it has also made wonderful progress in the construction of apparatus for electrical transmission of power over long distances. As it owns all the patents for the manufacture of the Tesla motor, it holds a very advantageous position in the development of this branch of electrical industry. Electrical transmission of power is one of the latest developments in the electrical business, but the prospects for a wonderful amount of work in this field are already very large. Already a number of plants are in operation with the Westinghouse system, and all of them are reported to have been a success from the start.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, SEPTEMBER 27, 1892, TO NOVEMBER 22, 1892, INCLUSIVE.

SEPTEMBER 27.

Car Truck, Robert L. Ellery, Taunton, Mass.....483,211
Electric Locomotive, Norman C. Bassett, Lynn, Mass.....489,204
Electric Railway System, Andrew L. Riker, New York, N. Y.....483,366
Electric Railway Conductor, Rudolph M. Hunter, Philadelphia, Pa.....483,494
Guard for Railway Cars, Patrick Barron, Pittsburgh, Pa.....483,202
Journal Bearing for Car Axles, Peter Sweeney, New York, N. Y.....483,405
Railroad Tie, William R. Kinnear, Columbus, O.....483,154
Trolley Track Hanger for Electric Railways, Wm. Q. Prewitt, Lexington, Ky.....483,388

OCTOBER 4.

Cable Grip, Frank A. Yard, St. Louis, Mo.....483,952
Cable Railway, James B Mahaffey, Baltimore, Md.....483,965
Car Axle Box Lid, Frank P. Boatman, Indianapolis, Ind.....483,801
Car Brake, John W. Neuman, and John R. Pflanz, Louisville, Ky.....483,859
Closed Conduit for Electric Railways, William G. Creighton, Norwood Park, Ill.....483,761
Combined Foot and Brace for Railway Rails, Edward Samuel, Philadelphia, Pa.....483 873
Combined Foot and Brace for Railway Rails, Victor Angerer, Philadelphia, Pa.....483,889
Dust Guard for Axle Boxes, William Barr, Detroit, Mich.....482,524
Electric Locomotive, Thomas L, Wilson, Brooklyn, N. Y.....483,822
Electric Railway, William G. Murphy, Jr., Marysville, Cal.....483,856
Grip for Cable Railways, Charles Vogel, San Anselmo, Cal., and Conlin McIntosh, Tacoma, Wash.....483,774
Grip for Cable Railways, Charles Vogel, San Anselmo, Cal.....483,775
Rail Fastening, Hugo Alexy, Buda-Pesth, Austria-Hungary.....483,518
Rail Joint and Chair, Joseph H. Campbell, Chicago, Ill.....483,898
Rail Joint Fastening, Robert Morrell, Summit, N. J.....483,854
Railway Chair, William Wharton, Jr., Philadelphia, Pa.....483,592
Railway Rail Fastening, Robert Morrell, Summit, N. J.....483,855
Switch Attachment for Cars, Wm. E. Meagher and Albert Howarth, Providence, R. I.....483,744
Trolley Catcher, John J. Hoppes, Springfield, O.....483,689

OCTOBER 11.

Automatic Release for Cable Crossings, Frank W. Smith, St. Louis Mo....484,346
Electrically Operated Railway Switch, Charles A. Stone, Newton and Edwin S. Webster, Boston, Mass.....484.123
Rail Joint, Winfield Curtis, Oakland, Cal.....483,993
Rail Joint, John H. Rouse, Advance, Mo.....484,341
Rail Joint, Milton C. Niles, Oak Park, Ill.....484,226
Rail Joint, Milton C. Niles, Oak Point, Ill.....484 227
Rail Joint, Milton C. Niles, Oak Point, Ill.....484,228
Rail Joint, Milton C. Niles, Oak Point, Ill.....484 229
Railroad, William Latimer, Wilmington, N. C.....484,027
Railroad Tie and Fastening, Thomas B. Moore, Philadelphia, Pa., and John G. Hodgson, Maywood, Ill.....484,036
Railroad Crossing, Moses G. Knight, Oak Cliff, Tex.....484,100
Running Gear for Vehicles, Robert L. Ellery, Taunton, Mass.....484,186
Switch Operating Device, Gerhard Schumacher, Milwaukee, Wis.....484,250
Track Rail, John T. Hill and Bernard Meiring, Cleveland, O.....484,315
Trolley Wire Cleaner, Ernest B. Smith, South Amherst, Mass.....484,344
Trolley Wire Insulator, Albert Anderson, Boston, Mass.....484,280

OCTOBER 18.

Railway Rail Joint, George W. Hanner, Holbrook, Ariz.....484,424
Skylight for Electric Cars, Henry Cochran, Chester, Pa.....484,515
Tramway Switch, John H. Gagie, Seattle, Wash.....484,706

OCTOBER 25.

Apparatus for Elevating Hose, Adolph O. Muhlstein, Pittsburgh, Pa.....485,129
Apparatus for Sanding Railroad Tracks, Alice A. Whipple, Providence, R. I.....484,926
Cable Crossing, Hiram A. Benedict, New York.....484,772
Car Brake, Gilbert R. Elliott, Boston, Mass.....484,783
Car Fender or Guard, Whitfield W. Baxter, Boston, Mass.....484,989
Closed Conduit for Electric Railways, Benjamin F. Sutton, Brooklyn, N. Y.484,924
Driving Mechanism for Cars, Charles W. Hunt, West New Brighton, N. Y.484,914
Electric Railway System, John H. Peudleton, Brooklyn, N. Y.....484,919
Grip Mechanism for Cable Railways, John H. Robertson, New York.....484,920
Insulator for Electric Railway Conductors, Charles T. Lee, Boston, Mass..485,105
Railroad Cross Tie, William M. Hewitt, Chattanooga, Tenn.....484,855
Railway Fish Plate Set Screw and Nutlock Therefor, James P. McGuire, Atchison, Kan.....484,809
Tie Plate, William Goldie, West Bay City, Mich.....485,030
Trolley Pole Catcher, Montraville M. Wood, Chicago, Ill.....484,986
Vehicle Starter, Joseph W. Lee, Cambridge, England.....485,125

NOVEMBER 1.

Cable Railway Grip, Phillips T. Taylor, San Francisco, Cal.....485,237
Car Axle Box, Edgar Peckham, New York, N. Y.....485,219
Car Construction, Stephen A. Jennings, Evanston, Ill.....485,198
Car Starter and Brake, Wilhelm Prinzlau, Hamburg, Germany.....485,353
Car Truck, Alexander T. Loyd, Chicago, Ill.....485,286
Combined Rail Brace and Tie Plate, Daniel F. Holman, Chicago, Ill.....485,384
Fare Registering Apparatus for Vehicles, Frederick W. G. Bruhn, Hamburg, Germany.....485,529
Gearing for Propelling Cars, Will W. Dunlap, Detroit, Mich.....485,179
Railway Car, Thomas E. Pope, Oakland, Cal.....485,562
Railway Chair, Benjamin N. Payne, Elmira, N. Y.....485,298
Safety Guard for Cars, Julius Simons, New York, N. Y.....485,598
Switch Operating Device, Benjamin Bartelmes, Brooklyn, N. Y.....485,446
Track Cleaner, Charles E. Bostwick, Du Bois, Pa.....485,528
Track Sweeper, William H. Leigh, Beaver Falls, Pa.....485,348
Underground Electric Conduit and Trolley Bar for Electric Railways, John S. Moss, Martinsburg, W. Va.....485,555
Underground Electric Trolley System, Ruben B. Ayres, New York, N. Y..485,252

NOVEMBER 8.

Brake Mechanism for Car Trucks, George M. Brill, Philadelphia, Pa.....485,858
Car Spring, Louis Pfingst, Boston, Mass.....485,652
Combined Wheel and Rail Brake for Cars, James Grad , Brooklyn, N. Y...486,037
Device for Locking Spikes, Carl S. Von Hanor, See Villa, near Attersee, Austria, Hungary.....485,939
Electric Railway Switch, Charles A. Stone, and Edwin S. Webster, Boston, Mass.....485,668
Elevated Railway, Henry W. Kirchner, Denver, Colo.....485,700
Elevated Railway System, Edwin Norton, Maywood, Ill.....485,708
Rail Joint, John Delaney, and Albert D. Reaume, Trenton, Mich.....485,862
Street Car, John E. Foster, Monmouth, Ill.....486,034
Switch, Irving Cook, Fall River, Mass.....485,786

NOVEMBER 15.

Brake Mechanism for Cars, Jasper Murrey, Cleveland, Ohio.....486,384
Cable Railway, Robert McClintock, John F. Langhammer and John W. Lowell, Baltimore, Md.....486,262
Car Brake and Starter, Peter D. Van Vradenburg, Binghamton, N. Y.....486,140
Electric Locomotive, William E. Allington, East Saginaw, Mich.....486 068
Electric Railway Conduit, Augustin W. Wright, Chicago, Ill.....486,315
Girder Rail and Process of Manufacturing Same, Rudolph M. Hunter, Philadelphia, Pa.....486,211
Power Transmitting Mechanism, Benjamin W. Grist, Philadelphia, Pa....485,287
Trolley for Electric Railways, Augustus H. R. Gulley, South Easton, Pa...486,333

NOVEMBER 22.

Automatic Station Indicator, William L. Dillon, Portland, Oregon.....486,543
Car Brake, Patrick J. Lawrence and Miles F. Garrettson, Wellston, Mo...486,785
Car Starter and Brake, Paul Wuelfing, Indianapolis, Ind.....486,520
Insulating Chair for Rails, Frank E. Kinsman, Plainfield, N. J.....486,477
Lightning Arrester, Harry G. Osburn, Chicago, Ill.....486,498
Lightning Device, Bradford H. Pendleton, Chicago, Ill.....486,499
Motor Car, Oskar Blessing, Dresden, Germany.....486,660
Railway System, John P. F. Kuhlmann, Seattle, Wash.....486,719
Street Car Curtain, Arthur D. Cochran, Indianapolis, Ind.....486,433
Street Railway Switch and Operating Device, Horace Blanchard, Boston, Mass.....486,836
Street or Station Indicator, William A. Turner, San Francisco, Cal.....486,514
Track Cleaning Machine, Alpheus B. Beall, and Philip V. Ball, Sioux City, Iowa.....486,526
Tramway Switch, Robert C. David and Davis A. Ripley, Columbia, O.....487,769
Trolley Wire Hanger, David E. Lain, Yonkers, N. Y.....486,583

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

Model Locomotive Engines.

The Baltimore & Ohio Railroad has just placed in service on its Chicago Division three new passenger engines, built at the Baldwin Locomotive Works, after new designs furnished by the general superintendent of motive power of the Baltimore & Ohio Railroad Co. The engines weigh 113,000 lbs., have driving wheels six feet six inches, cylinders 19×24 ins., and are without doubt the finest passenger locomotives running into the city of Chicago to-day. Companions of these new engines have developed wonderful power and speed in hauling the famous Royal Blue Line trains, which run between New York, Philadelphia, Baltimore and Washington, over the Philadelphia Division of the Baltimore & Ohio Railroad. The B. & O. has added over forty new, high class engines to its motive power equipment within the last sixty days, and others are under construction. While constantly adding engines of a new design and highest grade to its motive power, and passenger coaches of Pullman standard to its rolling stock, the B. & O. is also expending large amounts for additional second and third tracks and sidings, and improved facilities at terminal points. By the time the World's Fair is opened for the reception of visitors, the B. & O. will be well equipped to handle, expeditiously, the large volume of passenger traffic which will naturally seek this picturesque route from the Atlantic seaboard to Chicago. ***

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co ...	50	1,250,000	Q.—J.	1½	.....	250	.....
Brooklyn City R. R. Co.....	10	6,000,000	Q.—J.	2	.....	218	220
Coney Island & Brooklyn R. R. Co.....	100	500,000	Oct. 1.	4	.....	165	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.....	.....	140,500	M. & N.	7	May. 1894	101	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	....	104
Broadway R. R. Co.....	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds.....	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates.....	.....	300,000	J. & J.	6	July, 1894	101	.....
South Brooklyn Central R. R. Co., 1st.....	.....	125,000	F. & A.	7	Aug. 1897	106	.....
South Brooklyn Central R. R. Co., 2d.....	.....	150,000	F. & A.	6	July, 1941	102	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	109	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.....	100	750,000	Q Feb.	1½	1890	120	122
Watervliet Turnpike & R. R. Co.....	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort...	1865	40,000	J. & J.	5	1905	105	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	104	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	103	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	103	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	102½	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	105	.....
" " " Debenture..	1891	200,000	M. & N.	6	1901	115	117
Watervliet Turnpike & R. R., 1st Mort.....	1889	350,000	M. & N.	6	1919	115	118
Watervliet Turnpike & R. R., 2d Mort.....	1889	150,000	M. & N.	6	1919	110½	.....

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	200	202
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	.....	150
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	140	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	128	130
42d & Grand St. Ferry.....	100	748,000	Q.—F.	3	.....	295	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	65	70
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	260	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	130	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	195	200
Third Avenue.....	100	2,000,000	M. & N.	4	.....	210	225
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q —J.	1½	.....	135	140

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	112
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	102	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	5	July, 1924	105	.....
Additional.....	.....	1,000,000	J. & J.	5	July, 1905	93	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	115	118
Central Crosstown.....	.....	250,000	M. & N.	6	Nov., 1922	115	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	101	103
Scrip.....	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry.....	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.....	.....	1,200,000	J. & J.	6	1915	68	70
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	101	107
Second Avenue.....	.....	1,600,000	M. & N.	5	Nov., 1909	103	105
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	110	112
23d St.....	.....	250,000	M. & N.	7	May, 1893	100	103

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. Nov. 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.....	50	$6,400,000	J. & J.	4	1887	86¼	87
West End Com'n.....	50	9,085,000	J. & J.	5	1890-1892	73¾	74

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Nov. 19.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co.....	100	$270,000	New.	...	Oct., 1887	92½	97
Union R. R. Co., Prov.....	100	2,000,000	Q.—J.	2	1862-1863	204	210
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co....	100	1,000,000	J. & J.	4	.....	220	225
Holyoke Street R. R.....	100	200,000	J. & J.	4	.....	225	230
Northampton Street R. R.....	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.....	50	$100,000	J. & J.	3	.....	.....	65
Enterprise Ry. Co.....	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.....	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	800.000	Quart.	1½	1867	136½	138
Crescent City R. Co.....	100	1,150.000	"	1¼	.866	107¾	109
Canal & Claiborne R. R. Co..	40	240,000	.....	...	1888	29	3-½
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	147½	14 ¾
Orleans R. R. Co.....	50	185,000	"	2	1868	64	69
St. Charles Street R. R. Co ..	50	600,000	"	2	1866	94½	94½

Bonds.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	.....	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93-'99	.....	.....
do do new	1886	40.000	M & N	6	1896	.....	.....
N. O. City R. R. Co.....	1879	495,200	J & D	6	1903	120	.....
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92-'06	.....	.....
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89-'01	.....	.....

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	37	.....
State Street Horse R. R. Co...	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	...	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	...	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500.000	M. & N.	5	Nov. 1912	100	101½
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued).....	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	228	239

BONDS.	Date of Issue	Amount Out-standing.	Interest Period.	%	Principal Due	Bid.	Ask'd
Montreal St. Ry.	1885	£60,000	.....	5	1965	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref.	100	$1,000,000	A. & O.	5	Jan. 1891	90	91
Louisville St. Ry. Co., com.	100	5,000,000	.....	...	Jan. 1891	38	39

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	98	98½
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	115	.....
Central Passenger Ry. Co.	1888	400,000	M. & N.	6	1908	115	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	470	480
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	99½	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	258	259
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	204	204½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	97½	98
Chicago Passenger	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	101½	102
" " "	.....	1,850,000	M. & N.	4½	1927	96½	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100⅝	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	100¾	.....
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	99

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr. 421 Wood Street, Pittsburgh, Pa., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	..	.....	29¼	29⅝
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	61½	62
Pitts. & Birmingham R. R. Co	25	3,000,000	.....	...	.....	24⅛	24¼
Pittsburgh Traction R. R. Co.	25	2,500,000	.....	3	.....	58	59
Federal St. & Pleasant Valley	50	1,400,000	J. & J.	3	.....	25	25⅛
Pittsburgh, Allegheny & Man	50	3,000,000	.....	1¾	.....	43½	44
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	50	55
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	27½	27⅞

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O	5	1927	106½	.....
Pitts. & Birmingham Traction Co.	1890	1,500,000	M. & N.	5	1929	99⅞	100
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	104½	.....
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	.....
P., A. & M. R. R. Co.	1891	1,500 000	J. & J.	5	1931	103	.....
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	101½	102
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	102¾
West End R. R. Co.	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.	1883	125,000	.....	6	1903	...	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	...	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.	100	1,000,000	Monthly	5	.....	.....	115
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Occan R. R. Co	100	1,000,000	.....	1	.....	.....	100
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	75	.....
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	32	34
Omnibus Cable Co.	100	2,000 000	Monthly	4	.....	55	.....
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	28¾

Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	102	105
Market Street R. R.	.....	3,000,000	J. & J.	6	913	123	.....
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	114½	115
Powell Street R. R.	.....	700.000	M. & S.	6	1912	.....	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	.....	115
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	96	.....
Cal. St. Cable R. R.	.....	.....	.....	...	.....	...	105½

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine	100	$324,000	.....	3	1864	110	150
Cass Ave. & Fair Grounds	100	2,500,000	.....	...	1876	46	47
Citizens'	100	1,500,000	Oct. '91	4	1887	90	95
Jefferson Avenue	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	76	80
Missouri	100	2,000,000	Oct. '92	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
People's	50	1,000,000	M. & S.	6	1889	45	50
St. Louis	100	2,000,000	July '92	6	1890	150	160
4th Street & Arsenal	50	150,000	Jan.	.50	1872	10	12
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban	100	2,500,000	.....	...	1891	48	50

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine	1891	$500,000	F. & A.	6	1911	102	102½
Cass Avenue & Fair Ground	1892	1,800,000	J. & J.	5	1912	97	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	106	107
Lindell	1890	1,500,000	J. & J.	5	1895-1910	99	100
Mound City	1890	525,000	A. & O.	6	1900-1910	105	106
Missouri Cable	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort	1882	125,000	J. & D.	6	1902	102	105
" 2d mort	1886	75,000	M. & N.	7	1902	104	105
People's Cable	1889	800,000	J. & J.	6	1889-1914	97	100
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union Depot	1890	1,000,000	A. & O.	6	1900-1910	105	106

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'	50	$500,000	Q.—J.	4	1858	260	265
Continental	50	1,000,000	J.—J.	6	1873	120	124
Frankford & Southwark	50	1,250,000	Q.—J.	5	1854	224	225
Germantown	50	1,500,000	Q.—J.	2¼	1858	105	107
Green & Coates	50	500,000	Q.—J.	3	1858	120	122
Hestonville	50	2,050,000	.....	...	1859	33¾	34½
Lombard & South	25	500,000	A.—O.	8	1861	57	59
People's Common	25	1,500,000	M.—S.	2½	1873	52	54
" Preferred	25	750,000	M.—S.	2½	.....	52	55
Philadelphia City	50	1,000,000	J.—J.	7½	1859	152	153
Philadelphia & Gray's Ferry	50	617,500	J.—J.	3½	1858	70	72
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	93	95
Ridge Avenue	50	750,000	Q.—J.	5	1872	225	227
Second & Third	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	210	212
Union	50	1,250,000	J.—J.	9½	1864	195	197
West Philadelphia	50	750,000	J.—J.	10	1857	202	204
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	135	137
Baltimore Traction	25	5,000,000	.....	1	1889	26	27
Buffalo (N. Y.) Railway	100	6,000,000	.....	...	.....	65	67
Newark (N. J.) Passenger	100	6,000,000	.....	...	.....	28	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	24	26

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1,250,000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	106	107
Germantown, 1st mort.	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort.	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	108¾	109¼
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	108	108¾
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	140	.....
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	90	91
" " " Pref.	100	100,000	.....	6	.....	100	101
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	.....	.....
" "	.....	50,000	J. & J.	7	July, 1893	102¾	.....
" "	.....	50,000	J. & J.	7	July, 1894	107	.....
" "	.....	50,000	J. & J.	7	July, 1895	108½	109
" "	.....	50,000	J. & J.	7	July, 1896	110½	111½
" " extended	.....	100,000	J. & J.	4	July, 1896	99¾	100¾
	.....	50,000	J. & J.	5	July, '96	102	103½
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	106
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je.'94-1924	105½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104½	105¼
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	116	.....
" " " "	.....	300,000	J. & J.	6	Jan. 1914	108	109
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap.'93-1908	.....	105
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	115	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Nov. 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	84	90
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	26½	27
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	109	110
" " " cons. mort.	1892	500,000	.....	5	.....	104½	104¾
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
City & Sub. Ry. Co. gen. mort	.....	1,500,000	.....	5	.....	106	106½
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	108¾	109
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	106	106½
" "	1891	1,250,000	M. & S.	6	1901	106¾	107
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	110	110½

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co, Bankers, 1344 F Street, N.W., Washington, D. C., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	330	350
Metropolitan R. R.	50	750,000	Q. J.	2	1864	94	100¼
Columbia R. R.	50	400,000	Q. M.	1	1870	58	.....
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	34	37
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	30	40
Georgetown & Tenallytown	50	200,000	.....	...	.....	....	50
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	162	.....
do. do. convert.	'83-'91	3,000,000	J. & J.	6	1899-1929	144	.....
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	101	103
Capitol & North O St. R. R.	1921	240,000	J. & J.	5	1921	104⅜	108
Metropolitan R. R. convert.	1901	200,000	J. & J.	6	1901	114	1:0
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

ROCHESTER, BUFFALO, PATERSON, NEWARK AND COLUMBUS STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Builitt Building), Philadelphia, Nov. 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	58	60
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	67	70
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	.....	25
Newark (N J.) Pass. Ry	100	6,000,000	.....	...	1890	28¾	29
Columbus (O.) St. Ry.	100	3,000,000	.....	...	1892	56	58½
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y) Ry.	1890	3,000,000	A & O	5	1930	95	96
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	97½	100
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry	1890	6,000 000	J & J	5	1930	90	92
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	94	97½

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	176	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	100	2,000,000	Quart.	2	.....	166½	170
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	136	140

Financial.

THE South Chicago (Ill.) City Railway Co. has certified to an increase of capital stock from $100,000 to $900,000.

$ $ $

THE North End Street Railway Co., of Worcester, Mass., has petitioned for right to increase its capital stock from $10,000 to $60,000.

$ $ $

THE Rochester (N. Y.) Railway Co. reports for the month of October: Gross earnings, 1892, $64,918.19; 1891, $54,413.96; increase 19 per cent., or $10,504.24.

$ $ $

THE Worcester (Mass.), Leicester & Spencer Street Railway Co. announced a dividend of $4 a share payable November 15, to full paid stockholders of record, at the close of business, November 5.

$ $ $

THE stockholders of the Lynn & Boston Street Railway Co. propose to increase the company's present capital $1,000,000 and also to issue $3,000,000 5 per cent., twenty-year, consolidated mortgage bonds.

$ $ $

THE Helena (Mont.) Electric Railway Co. has filed a statement with the Secretary of State showing that its capital stock has been increased from $100,000 to $300,000 consisting of 60,000 shares of $5 each.

$ $ $

THE Chicago City Railway Co. has issued a call for the annual meeting of the stockholders January 16, 1893. One of the principal objects to be considered at the meeting is the increase of the capital stock $2,000,000.

$ $ $

THE Troy (N. Y.) City Railroad Co. has certified to the Secretary of State that its capital has been increased from $400,000 to $2,000,000, that all its previous capital has been paid up, and that its debts and liabilities are $739,984.

$ $ $

THE Braddock (Pa) & Turtle Creek Street Railway Co. is proposing increasing the capital stock of the company from $100,000 to $200,000, for the purpose of making extensions to the line, and of making a better equipment.

$ $ $

N. W. HARRIS & Co., of Chicago, have recently purchased a block of the $395,000 of the 5 per cent. bonds of the Metropolitan Street Railway Co., of Kansas City, and the total issue of $450,000 of the first mortgage, 6 per cent. bonds of the San Antonio (Tex.) street railway system.

$ $ $

THE Buffalo (N. Y.) Railway Co. shows as earnings and expenses for October: Gross earnings. 1892, $116,276.90; 1891, $84,044.98; increase $32,231.92; operating expenses, 1892, $67,954.45; 1891, $52,497.84; increase, $15,456.61; net earnings, 1892, $48,322.45; 1891, $31,547.14; increase, $16,775.31.

$ $ $

THE Newark (N. J.) Passenger Railway Co. reports as its earnings for the month of October: Gross earnings, 1892, $109,843.18;

1891, $100,059.67; increase, $9,783.51; operating expenses, 1892, $72,795.88; 1891, $69,791.69; increase, $3,004.19; net earnings, 1892, $37.047.30; 1891, $30,267.98; $6,779.32.

$ $ $

THE Inter-State Railway Co., of Providence, R. I., has filed a trust mortgage in favor of the New York Guaranty & Indemnity Co. for $1,000,000 to secure an issue of bonds for the purpose of "purchasing real estate, extending and completing its plant, equipping its road, and for the purpose of paying all its indebtedness, etc."

$ $ $

THE Rochester (N. Y.) Railway Co. gives the following comparative statement of its operations for the month of September: Gross earnings, 1892, $68,274.92; 1891, $56,884.29, increase, $11,390.63; operating expenses, 1892, $39,266.29; 1891, $31,297.58, increase $7,968.71; net earnings, 1892, $29,008.63; 1891, $25.586.71, increase $3,421.92.

$ $ $

THE Columbus (O.) Street Railway Co. has given out the following comparative statement of its operations for October: Gross earnings, 1892, $44,543.58; 1891, $35,964.52; increase, $8,579.06; operating expenses, 1892, $23,861.30; 1891, $26,935.09; decrease, $3,073.79; net earnings, 1892; $20,682.28; 1891, $9,029.43; increase, $11,652.85.

$ $ $

THE Rochester (N. Y.) Railway Co. presented the following comparative statement of its operations for the months of October during the last two years: Gross earnings, 1892, $65.652.62; 1891, $54,-627.57; increase, $11,025.05. Operating expenses, 1892, $32,517.67; 1891, $41,853.74; decrease, $9,336.07. Net earnings, 1892, $33.134.95; 1891, $12,773.83; increase, $20,361.12.

$ $ $

THE report for the five months ending October 18, of the People's Electric Railway Co., of Sandusky, O., shows: Capital, $80,000; bonds, $35,000; gross earnings, $13,653.02; expense of operation, $8,849.61; earnings, $4,803.41. From May 16 to October 17 the daily reports show a total number of 318,392 fares collected and 139,490 miles of service rendered. A dividend of 5 per cent. was declared on the earnings.

$ $ $

ON petition of the Fidelity Insurance, Trust & Safe Deposit Co., the Dallas Consolidated Traction Railway Co. was put into the hands of a receiver, October 17. Samuel P. Cochran was appointed in charge of the property by the order of Hon. Charles Fred Tucker, judge of the District Court for the 44th Judicial District. The Fidelity Insurance, Trust & Safe Deposit Co. acted as trustee for the second mortgage bondholders.

$ $ $

THE Louisville (Ky.) Railway Co. gives the following comparative statement for the month of October: Gross earnings, 1892, $119,-072.90; 1891, $108,101.00; increase, 10.15 per cent., or $10,971.60, For September the same company reports: Gross earnings, 1892. $113.826.50; 1891, $109,099.96; increase, $4,726.54; operating expenses, 1892, $70,839.38; 1891, $67.332.42; increase, $3,506.96; net earnings, 1892, $42,987.12; 1891, $41,767.54; increase, $1,219.58.

$ $ $

THE Third Avenue Railroad Co., of New York, reports for the quarter ending September 30: Gross earnings, 1892, $453,047; 1891, $483,560; decrease, $30,522. Operating expenses, 1892, $286,336; 1891, 280,959; increase, 5,377. Net earnings, 1892, $166,711; 1891, $202,610; decrease, $35,899. Other income, 1892, $7,182; 1891, $6,172; increase, $1,010 Total income, 1892, $173,893; 1891, $208,782; decrease, $34,889. Fixed charges, 1892, $67,681; 1891, $66,489; increase, $1,192. Surplus, 1892, $106,211; 1891, $142,294; decrease, $36,083. The company reports a profit and loss surplus of $107,404, and cash on hand $132,369.

$ $ $

THE annual meeting of the stockholders of the Union Railroad Co., of Providence, R. I., was held November 14. The directors elected were the same as last year. From the report it is learned that the total amount of receipts from passengers during the year was $958,556.50; balance of rolling stock account and general equipment at end of year, $566.166.88; balance of construction account at close of year, $951,-038.20; total number of persons carried during the year, 19,329,963; number of horses owned, 1,543; number of cars owned, electric, 27, horse, 302; total, 327; number of horses purchased, 184; number of horses sold, 181. The mileage during the year was 3,131,909 miles.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Co. submits the following statement of its operations for the months of September and October 1892 and 1891: Gross earnings, September 1892, $35,485.17; 1891, $26,193.94; increase, $9,291.23; operating expenses, 1892, $15,-766.64; 1891, $14,540.51; increase, $1,226.13; net earnings, 1892, $19,718.53; 1891, $11,653.43; increase, $8,065.10. Gross earnings. October 1892, $38,220.32; 1891, $27,902.64; increase, $10.317.68; operating expenses, 1892, $20,020.44; 1891, $14,891.31; increase, $5,129.13; net earnings, 1892, $18,199.88; 1891, $13,011.33; increase. $5,188.55. The figures for 1892 include the inclines leased by the company.

$ $ $

THE annual report of the Worcester (Mass.) Consolidated Street Railway for the year ending September 30 contains the following figures: The capital stock is $700,000. There are $150,000 in bonds. The accounts payable amount to $28,423.57. The cash and cash assets aggregate $64,651.57. The net debt is $113,772. The value of the construction of the road is $471,499.19; of the equipment, $150,122.08; of electric equipment, $38,566.94; of real estate, $180,468.57. The total valuation is $915,383.85. The receipts of the year amount to $318,472.75. The operating expenses were $255,495.57; interest paid in, $15,912.31, and dividends, $28,000; leaving a surplus of $19,054.87.

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Street Railway and Financial Counsel,

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$ $ $

THE annual meeting of the Montreal (Can.) Street Railway Co. was held November 1. L. J. Forget was elected president and H. A. Everett vice-president and managing director. The report of the president and directors for the year ending September 30, 1892, showed a net profit of $93,880.21, as against $60,261.77 the previous year. Out of that amount two dividends of 4 per cent. each have been declared, together amounting to $71,095.80, $22,784.44 being placed at the credit of contingent account. The travel on the company's line for the three months ending October, 31, 1892, compared with the same period last year was as follows: August, 1892, 1,427,308; 1891, 990,740; increase, 436,628; September, 1892, 1,627,769; 1891, 1,121,999; increase, 505,770; October, 1892, 1,430,190; 1891, 902,824; increase, 537,366; increase for three months, 1,479,746.

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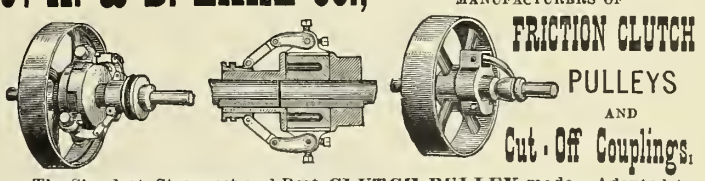
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THE Baltimore (Md.) Traction Co. has secured an important and extensive addition to its already large railway system in Baltimore, by the purchase of the property of the City & Suburban Railway Co. This latter company comprises a number of lines, the most important of which is that belonging formerly to the Union Passenger Railway Co., and has altogether probably forty or fifty miles of track. The entire stock, amounting to 60,000 shares, was purchased by the Baltimore Traction Co., the amount paid, it is stated, being about $2,000,000. A considerable portion of the system is already in operation with electric power. To pay for this property the Traction company, it is announced, will issue $2,000,000 of new stock for which present shareholders are entitled to subscribe at par, and it has been agreed that nothing further will be called in upon the old stock, upon which $15 has been paid.

$ $ $

THE Brockton (Mass.) Street Railway Co. reports for the year ended September 30, as below: Earnings, 1892, $143,506; 1891, $110,662; increase, $32,844; expenses, 1892, $99,963; 1891, $85,241; increase, 14,721; net, 1892, $43,543; 1891, $25,420; increase, $18,122. The equipment of the road as an electric property has been in progress most of the year. Construction charges were $346,837. The capital was increased $100,000 to $150,000, and the bonds to $300,000 by an issue of $150,000 fives. The income account shows: Net income, 1892, $43,543; 1891, $25,421; increase, $18,122; interest, 1892, $15,031; 1891, $6,940; increase, $8,091; dividends, 1892, $11,904; 1891, $15,000; decrease, $3,096; surplus, 1892, $16,608; 1891, $3,480; increase, $13,128; total surplus, 1892, $36,816; 1891, $20,208; increase, $16,608. From the above surplus there has been deducted for depreciation $12,240, leaving the surplus $24,576.

$ $ $

THE Binghamton (N. Y.) Railroad Co. has issued $600,000 first mortgage, 5 per cent., thirty year bonds. The trustee of the mortgage is the Atlantic Trust Co., 39 William Street, New York, at whose office the interest is payable. The Binghamton Railroad Co. is the outgrowth of the consolidation on Aug. 22, 1892, of the Binghamton Street Railroad and Binghamton & Port Dickinson Railroad, and owns and operates upwards of twenty-two miles of road. The gross earnings and operating expenses of the roads consolidated into the Binghamton Railroad Co., for the fiscal year ending June 30, 1892, are given as: Gross earnings, $74,088.18; operating expenses, including taxes, $46,544.58; net earnings, $27,543.60. The Binghamton & Port Dickinson road, forming part of the consolidation, was operated by horse power. The Binghamton Street Railroad Co., also forming part of the consolidation, had but ten miles of its system under electricity, and was unable to carry the passengers, owing to inadequate power, the balance of the road being operated by horse power. With new eleetric equipment it is believed the showing will be much more favorable. The balance sheet October 1, 1892, contained the following items: Assets. Cost of road and equipment, $550,403.31; open accounts, $14,540.02; treasury stock, $3,481.25; cash on hand, $7,165.97; total. $575 570.55. Liabilities. Capital stock, $260,000; funded debt, $200,000; bills payable and open accounts, (new work) $87,255.43; surplus, $28,315.12; total, $575,570,55. Of the new bonds, $200,000 have been deposited with the Atlantic Trust Co. as trustee, to retire as fast as possible the bonds of the Binghamton Street Railway Co. of like amount. $50,000 of bonds will be retained in the treasury for future extensions, and the remaining $350,000 will be used for present improvements, etc. Land has been purchased in the heart of the city, and a complete power plant is now being constructed with a maximum capacity of 1,400 H. P. The tracks are being relaid with a seventy-two pound girder rail, ties two feet center, throughout the city, and a forty-eight pound T rail through the suburbs. Contracts have also been made for Thomson-Houston W. P. motors, and Stephenson cars. The company has issued a circular descriptive of these bonds, and containing some particulars about the franchise, which is quite liberal, and a copy of a report on the property submitted by W. J. Clark of the railway department of the General Electric Co., of New York, to that company under date of May 10, 1892. Mr. Clark's examination was very thorough, and in his opinion the prospects for the company's future were very favorable.

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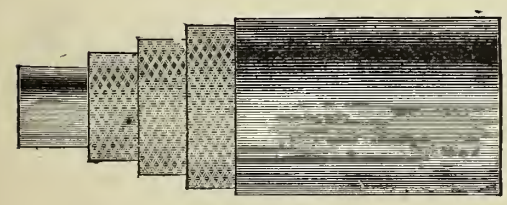
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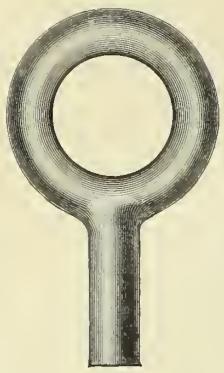
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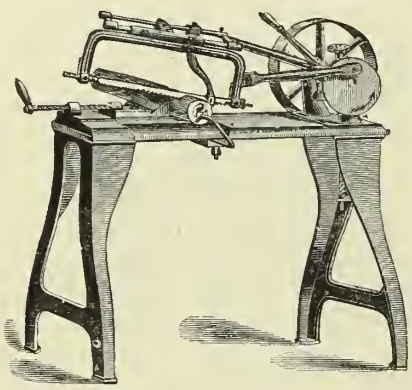
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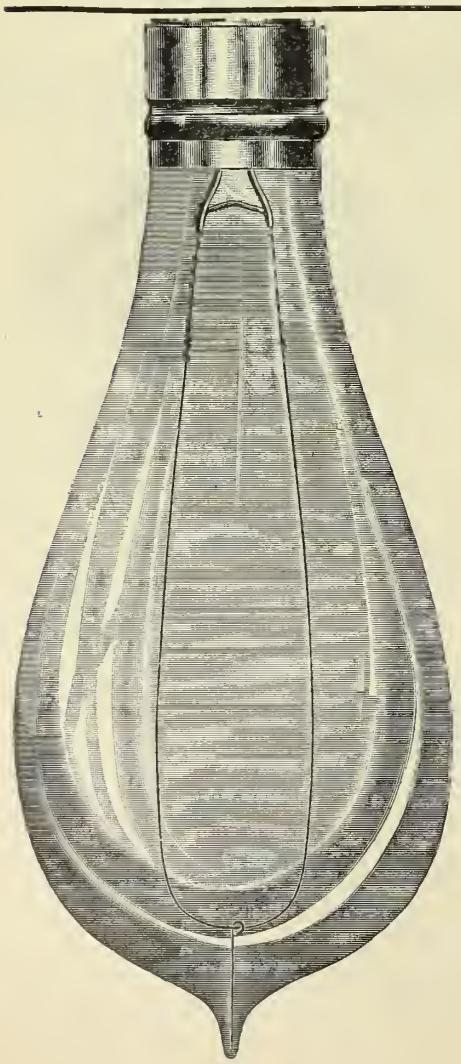
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THIS Lamp is made specially with the view of being burned in series on railway circuits. The Filament is anchored to prevent mechanical injury by vibration, and the Lamp is so constructed as to withstand the great fluctuation in voltage which is unavoidable with variation of load. TRY THEM--- you will be convinced of their merits.

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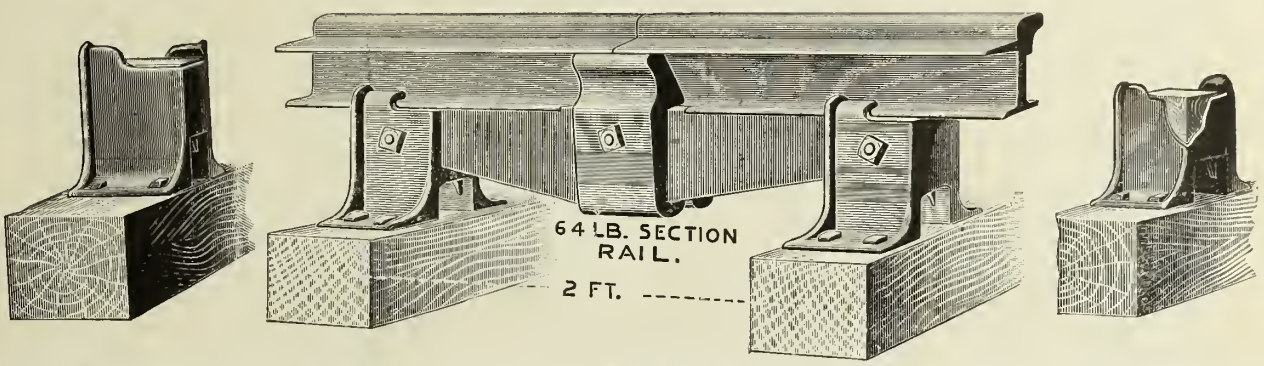
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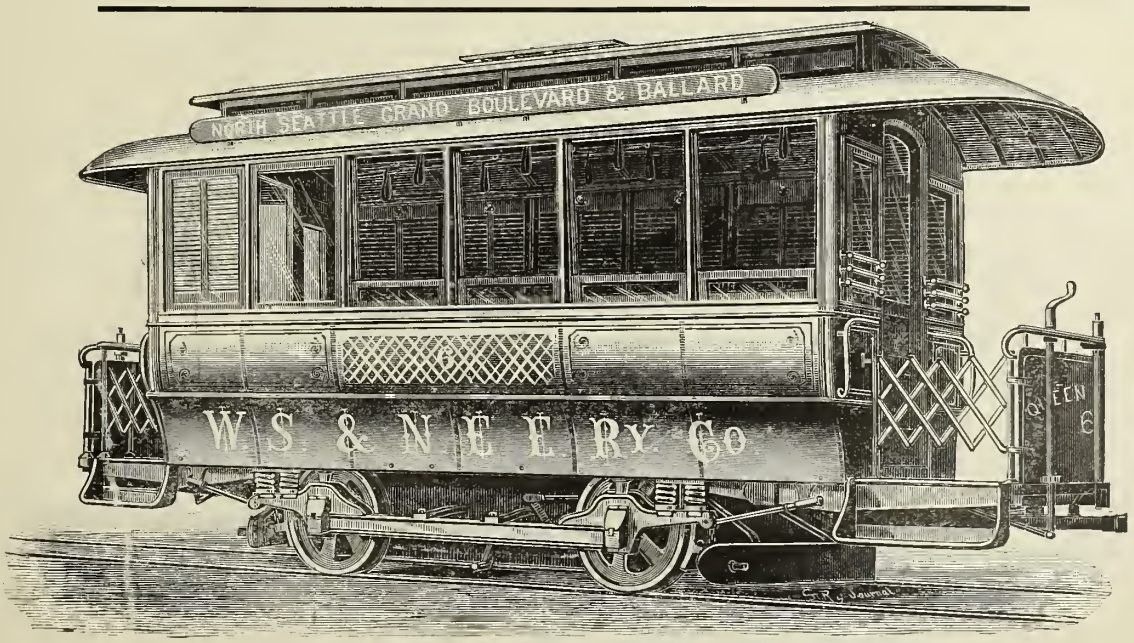
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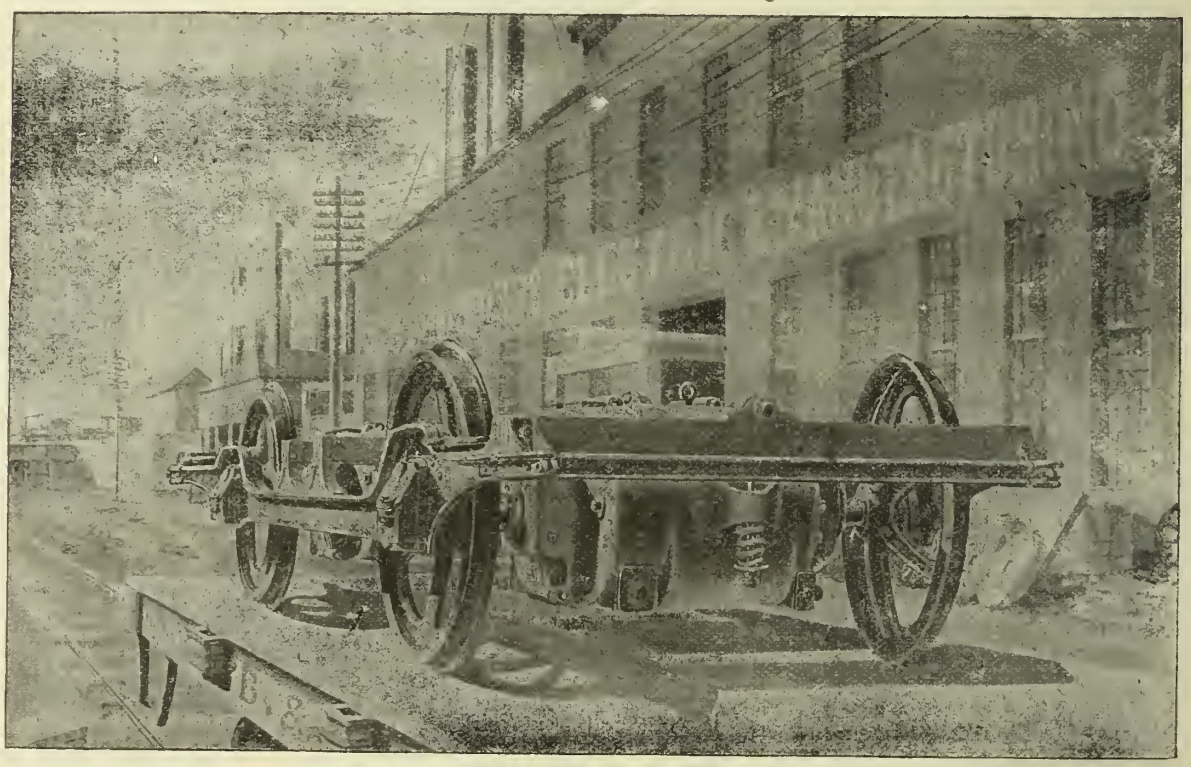
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THE HIGH EFFICIENCY OF OUR GEARLESS MOTOR IS SHOWN BY THE FOLLOWING FIGURES, WHICH ARE THE RESULTS OF A PUBLIC TEST MADE DURING THE RECENT CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

TORQUE TESTS.

Current to each Motor, 25 amperes at 500 volts. Revolutions of Car Wheel per minute, 155.

Pull on Lever of a Prony Brake:

DOUBLE REDUCTION MOTOR	78 LBS.
SINGLE REDUCTION MOTOR	88 "
GEARLESS MOTOR	110 "

THESE FIGURES, WHICH WERE VERIFIED BY MANY PROMINENT STREET RAILWAY ENGINEERS, PROVE BEYOND QUESTION THAT THE WESTINGHOUSE GEARLESS IS THE MOST EFFICIENT MOTOR ON THE MARKET.

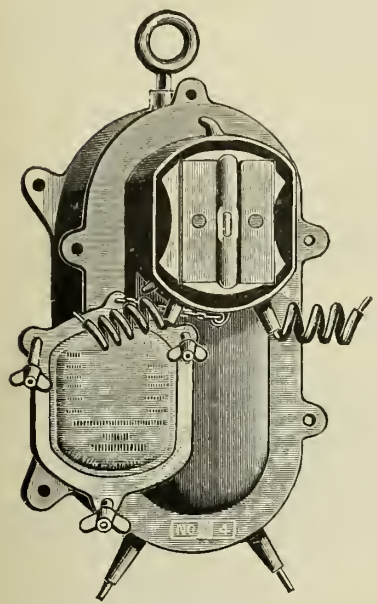
WITH THE SAME CURRENT IT WILL DRIVE A HEAVIER CAR AT A HIGHER SPEED THAN ANY GEARED MOTOR; OR, IN OTHER WORDS, WITH THE SAME WEIGHT OF CAR IT WILL CONSUME MUCH LESS ENERGY TO GIVE THE SAME SPEED.

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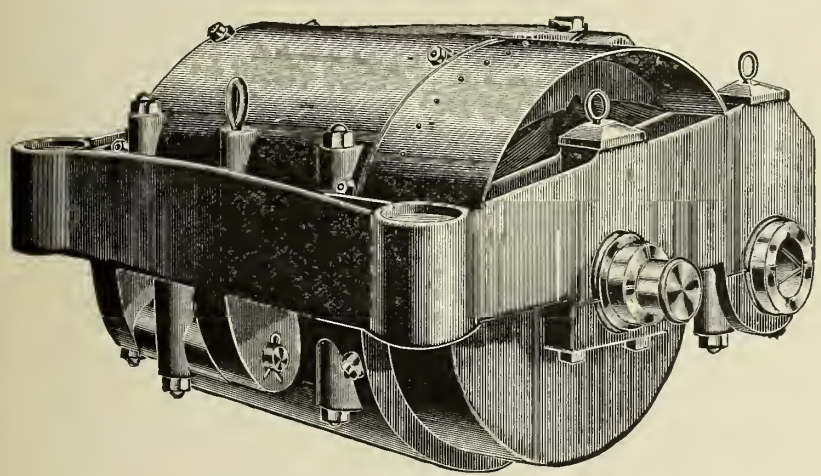
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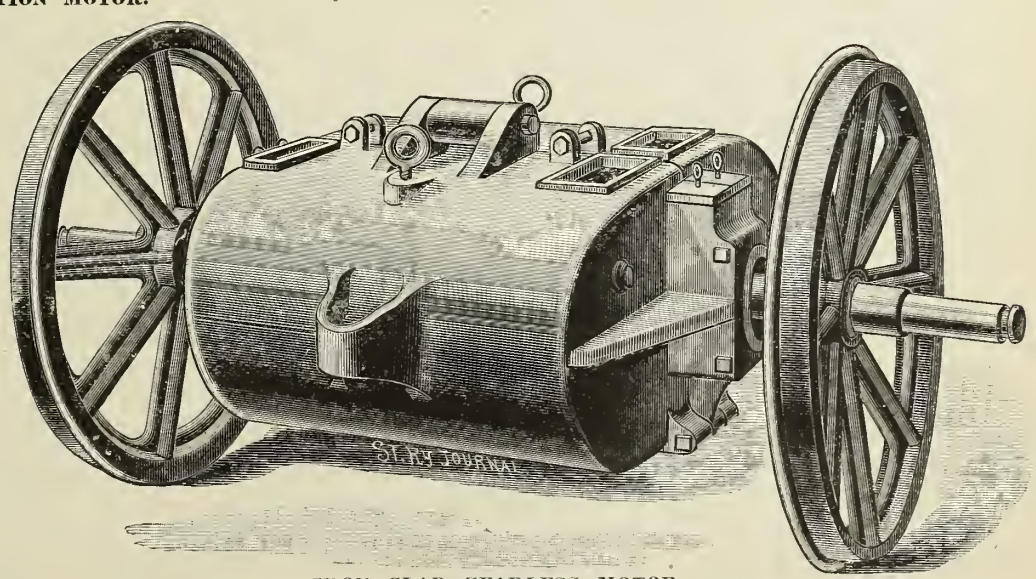
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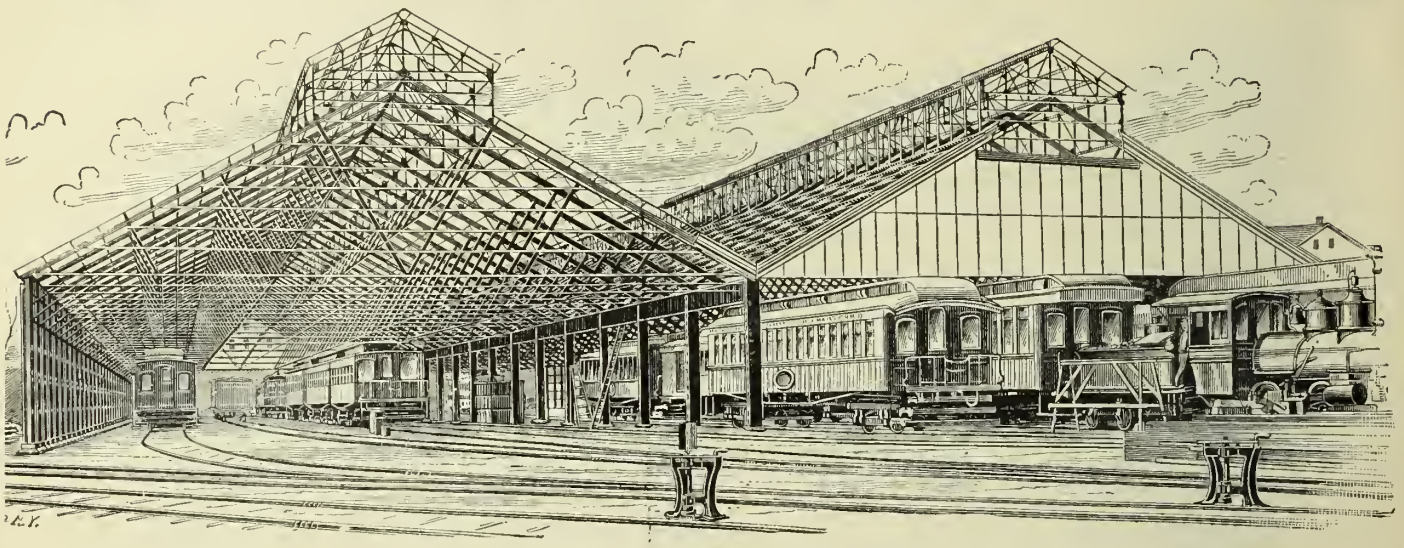


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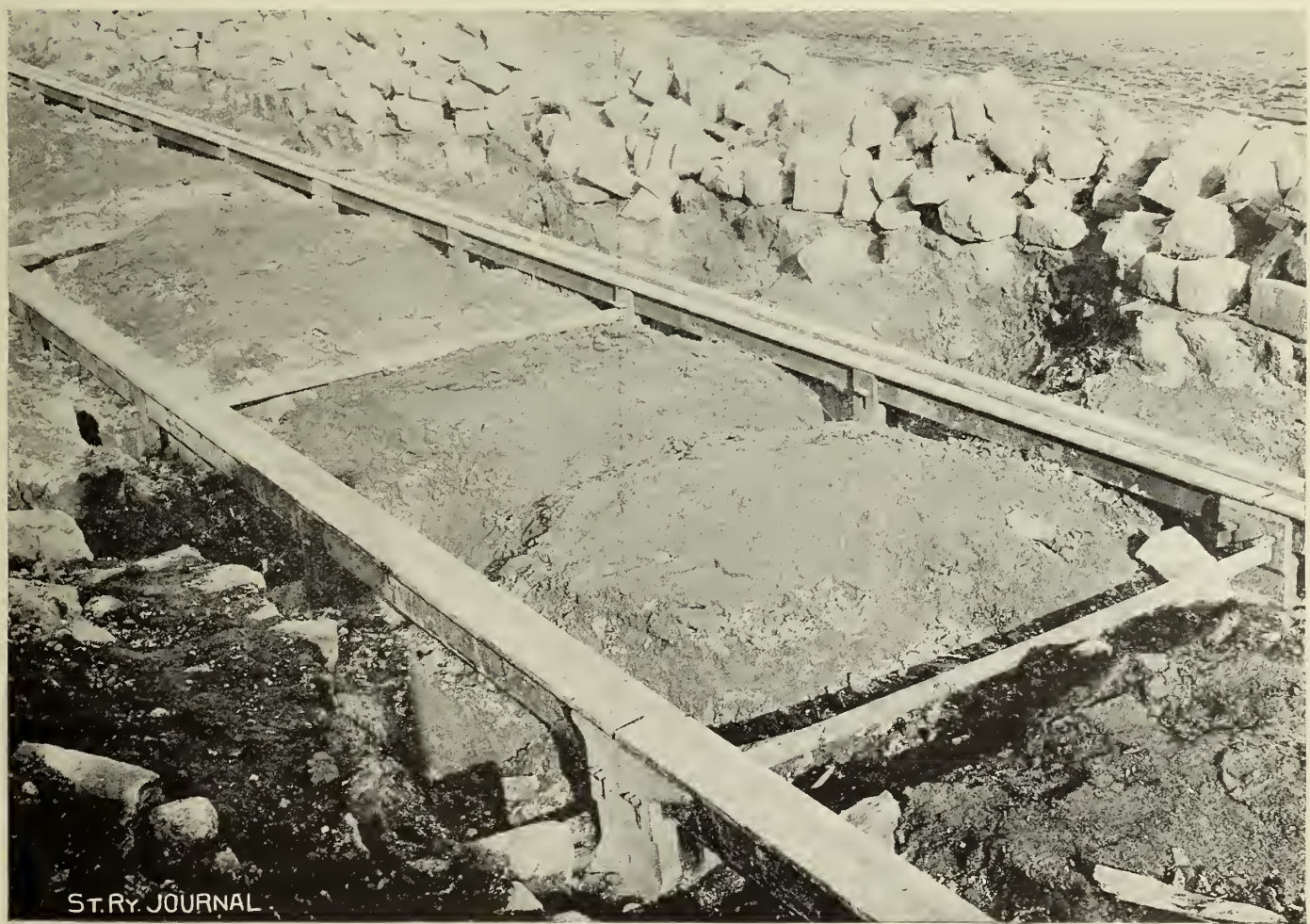
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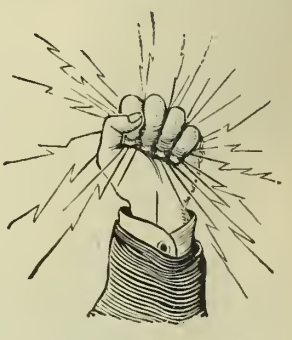
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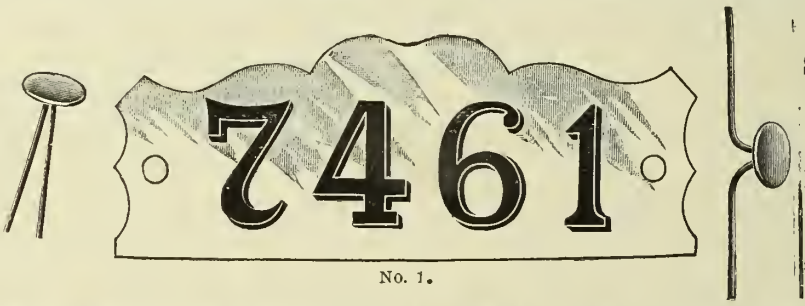
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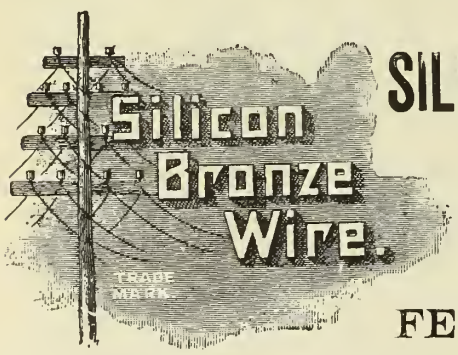
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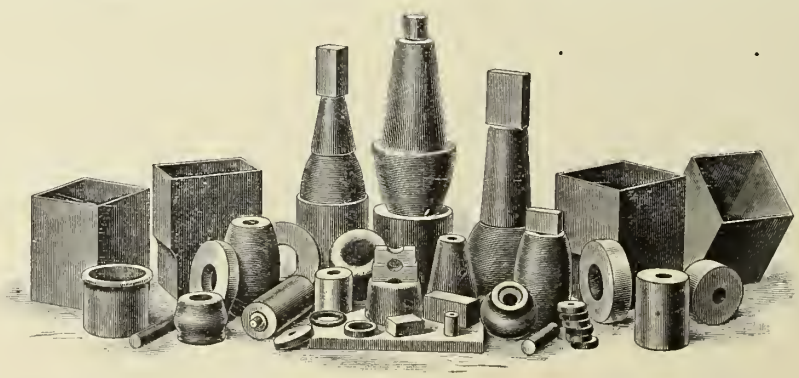
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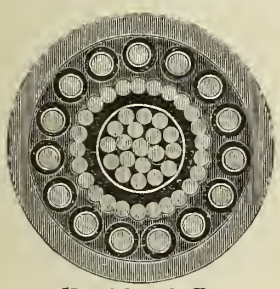
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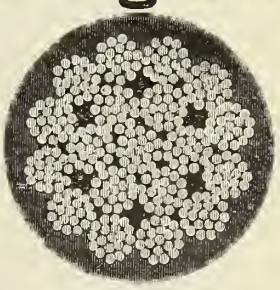
IS PURE PARA.

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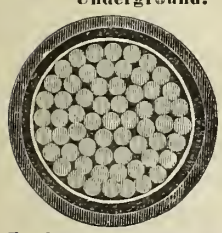
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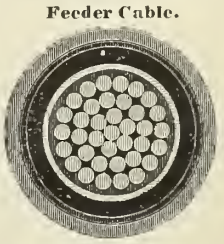
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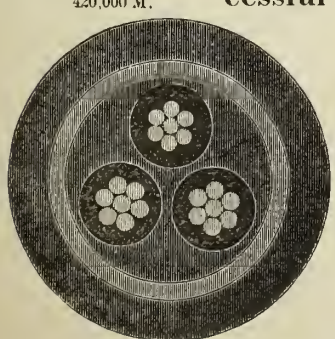
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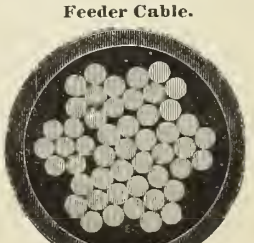
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THE Attorneys will give estimates of the cost of a policy insuring a company against all liability arising from accidental bodily injury or loss of human life caused to passengers, employes, or any other persons in the cars, or along the line of its Street Railway, or in connection with the operation thereof, and against all liability arising from loss or damage to property of others resulting from collision, or caused by the rails, road-bed or plant of the assured.

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OF THE

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THE SHORT SYSTEM.

One of the most recently equipped, as well as one of the most complete railways, electrically and mechanically, in the country was put into operation Dec. 15, between the towns of East Liverpool and Wellsville, O. The Short overhead system is used throughout on this road, and that it is eminently satisfactory to both managers and patrons is a fact which it is hardly necessary to repeat here.

The first trip of an electric car over the line of route, made to test the apparatus, took place on the morning of the fifteenth of December. Upon that date at 2.08 A. M., to be precise, the first car started from the terminus at Liverpool, with Mr. A. L. Johnson acting as motorman, assisted by George Wohler of New York. The passengers included some of the most prominent citizens of each town. On the line of the road are many severe grades, some of which, it was thought by those on board who had never seen a Short railway motor in operation, might prove insurmountable, but the car ascended every grade with surprising ease, much to the gratification of every one present, who manifested their appreciation of the work done by most favorable comments upon the electrical apparatus.

The formal opening of the road occurred on the following Thursday, two days later, and was the occasion for a repetition of many of the incidents accompanying the trial trip. At this time three electric cars were run, in the first of which were seated the city officials of East Liverpool and Wellsville and representatives of the press; the second car was devoted to the invited guests of the two City Councils, while the third carried two complete bands. The programme of opening exercises commenced with a public meeting at the Rink at East Liverpool at which short addresses were delivered by prominent citizens of both cities, congratulating the management upon the opening of the road, to which a suitable response was made by a representative of the company. Following this meeting a trip was made to the power plant where an inspection took place, by the visitors, of the generating machinery, after which the party proceeded to Wellsville where further interesting exercises of a nature similar to those at Liverpool were held.

The type of motors used upon this road is the Standard, Short single reduction, two on each car. The generators employed are two in number and also of the Short latest improved type, having a capacity of 150,000 watts each. These generators have a guaranteed efficiency of ninety-two per cent.

One specially interesting feature about the road, not already mentioned, is the short space of time in which the entire work of road construction and equipment was performed. Only ninety days were required from the time that the first pick was struck upon the line to the formal opening of the eight miles of completely equipped railway.

The Short Gearless Motor.

The Short Electric Railway Co. of Cleveland, O, is working its shops day and night on a heavy factory order for gearless and single reduction motors. The first large road to be equipped with the single reduction motors will be the Trenton Passenger Railway Co. of Trenton, N. J., work upon which is now progressing very rapidly, with the expectation that the road will be in operation on or about February 1. The first gearless motors of the final type will go to Albany, Washington, Louisville, Indianapolis, Rochester, St. Louis, Chicago, Cleveland, Denver, Houston, Brooklyn and elsewhere, in filling large contracts already secured by the Short company.

Although the Short company had a commercially successful gearless motor as early as last July and could have made shipments in quantities at that time, it foresaw that the financial situation would be such that very few large contracts would be closed before fall, and therefore determined to complete all experiments upon its gearless motor before sending it out in large numbers. The wisdom of this course has been justified, and the "Perfected" gearless is now not only the simplest but the most economical motor on the market. The magnetic circuit has been greatly improved by imbedding the armature coils entirely in the armature core, and extending the pole pieces so as to "present" at the top as well as at the sides of the armature. The armature has also been cross connected so that the brushes are both on top and extremely easy of access. The frame has been made rectangular instead of circular as before, so that it can now be easily placed on a thirty-three inch wheel with four inches clearance over the track. The method of connection between the hollow armature shaft and the truck has also been simplified. It will be remembered that the original plan provided a spring connection between a disk keyed to the hollow shaft and the car wheels. The second method was to do away with the springs, keying a three legged spider to the hollow shaft and providing wheels with special lugs cast on their spokes. This, while an extremely simple arrangement, had the disadvantage of calling for special wheels. The final method now adopted is to key a disk directly to the car axle close to the end of the hollow armature shaft, upon the latter being placed a two legged spider connecting with the disk through flexible rubber bushings, the car being driven both ways upon the same side.

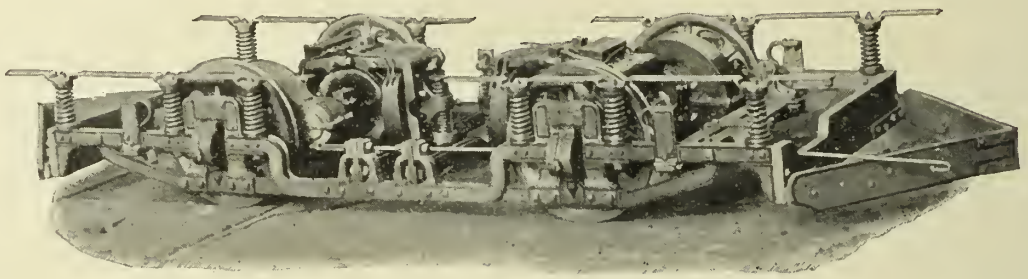
It is interesting to note the development of great manufacturing corporations in the electrical field. Two years ago the Short Electric Railway Company was hardly known outside of a limited circle of believing friends. Its past reputation for never failing success is high, and it may also be noted that it has rarely failed to *start* a road successfully and without a hitch. The company has an active and pushing corps of agents—many of them the best products of other companies—who are making its name known in all parts of the country. The department organization in the main office at Cleveland is exceedingly efficient, while the branch offices are an important feature in the company's growth. Altogether, the conviction is growing in the minds of the street railway public, that the Short Company "take water" from no other similar corporation.

CLEVELAND, OHIO.

See Pages II and III.

EDISON

GENERAL ELECTRIC CO.



SINGLE REDUCTION MOTORS.

FOUR SIZES:

15, 20, 25 & 30 H. P.

NOISELESS GEARING, EASY STARTING, HIGHEST EFFICIENCY.

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EDISON BUILDING,

BROAD STREET, NEW YORK.

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SINGLE REDUCTION MOTORS.

Neversink Mountain Railroad, Reading, Pa.



OPERATED BY

EDISON SINGLE REDUCTION MOTORS.

THIS ROAD HAS BEEN IN OPERATION FOR MORE THAN THREE MONTHS, WITHOUT EXPERIENCING THE SLIGHTEST TROUBLE OR DELAY TO TRAVEL.

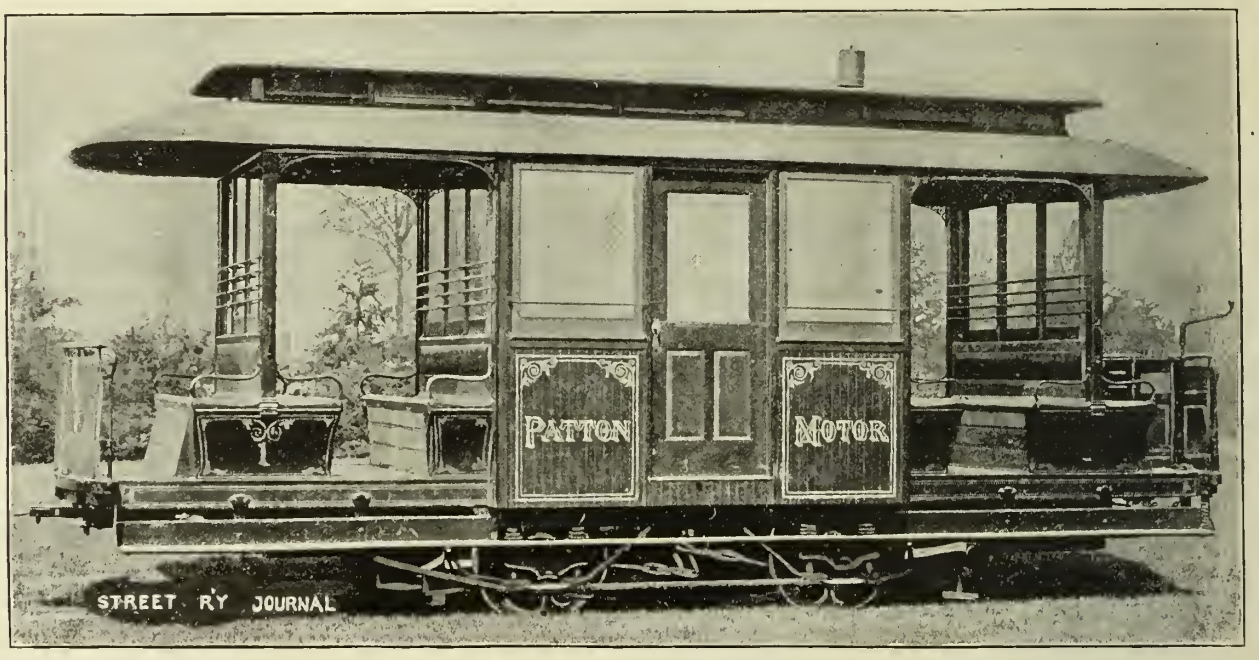
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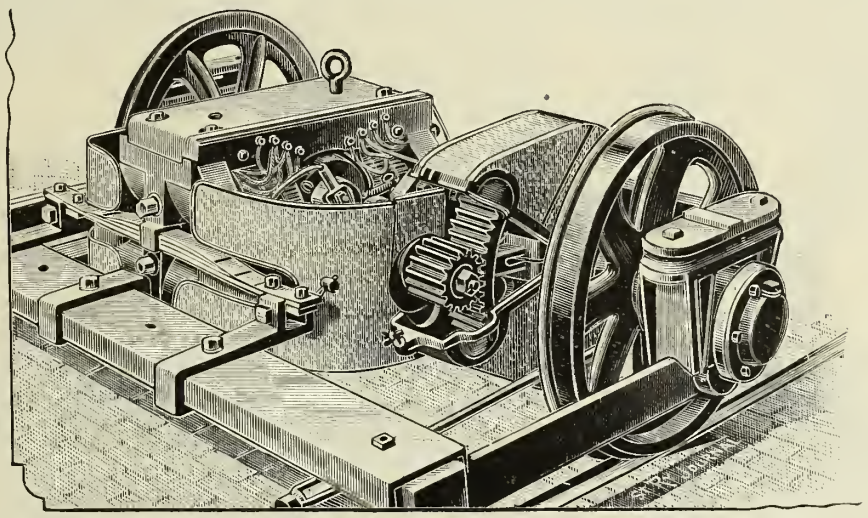
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MORE PROFITABLE TO OPERATE THAN ANY OTHER STREET CAR MOTOR.

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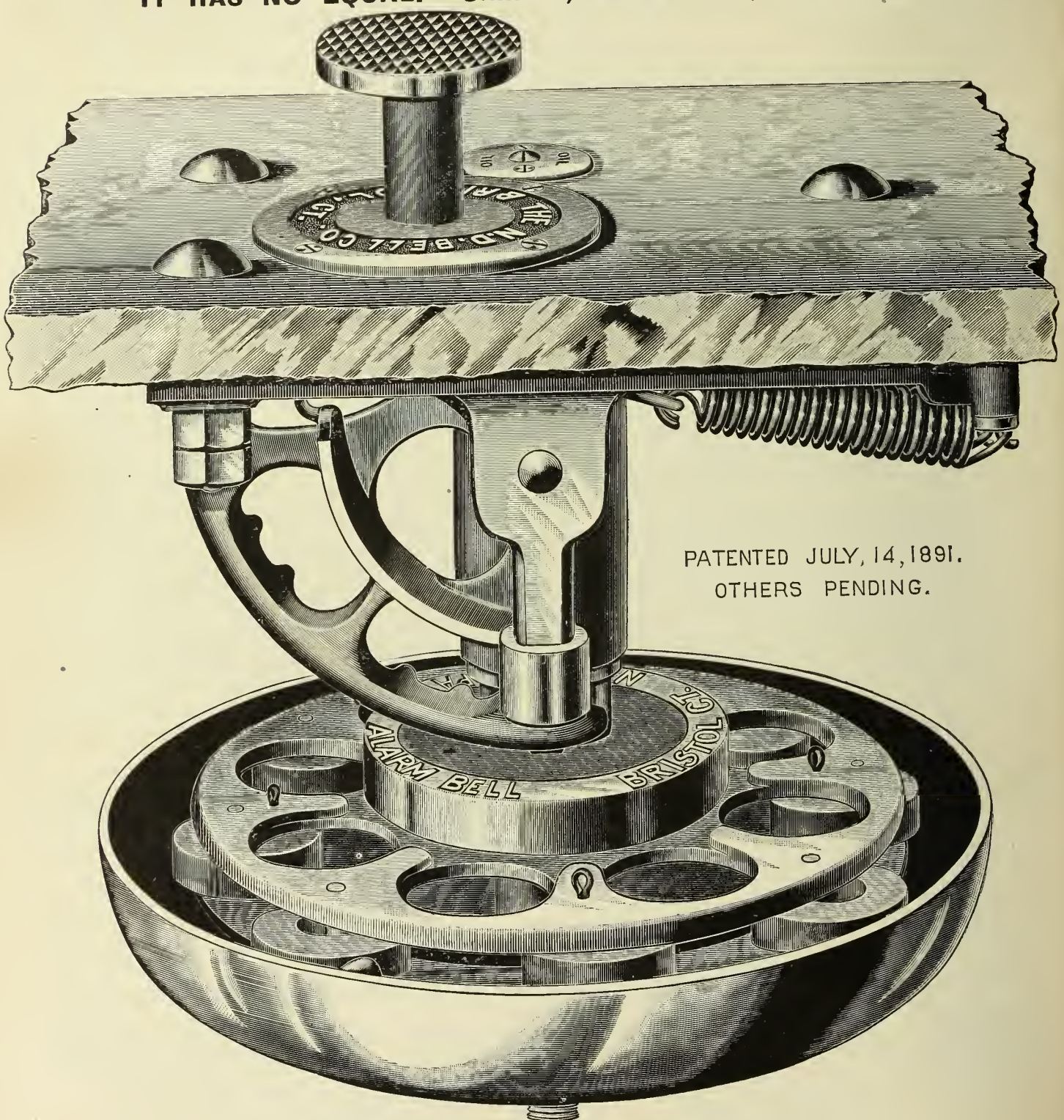
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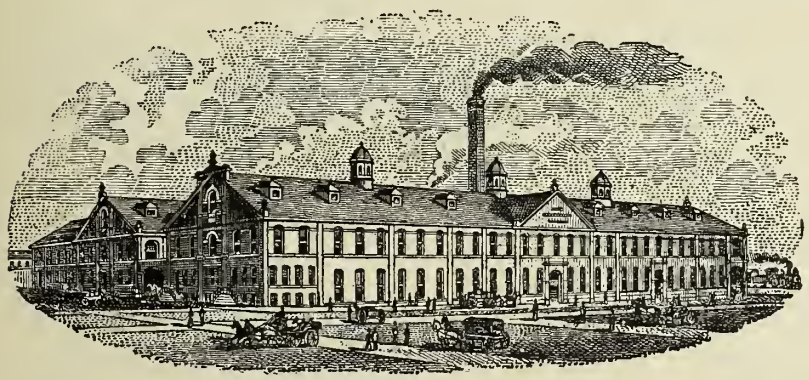
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WITH

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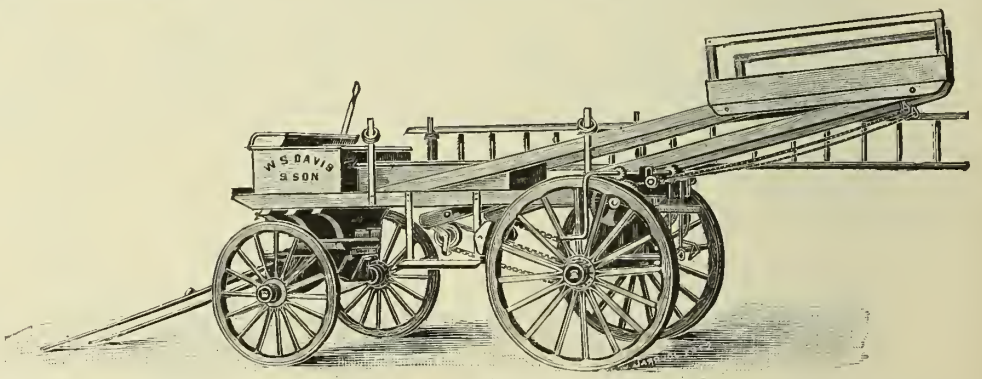
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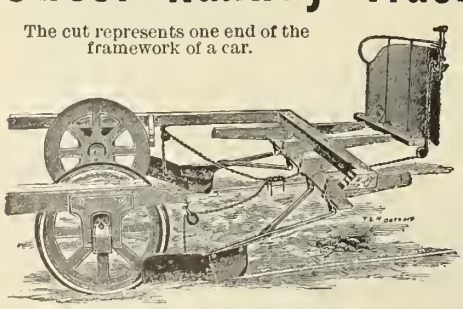
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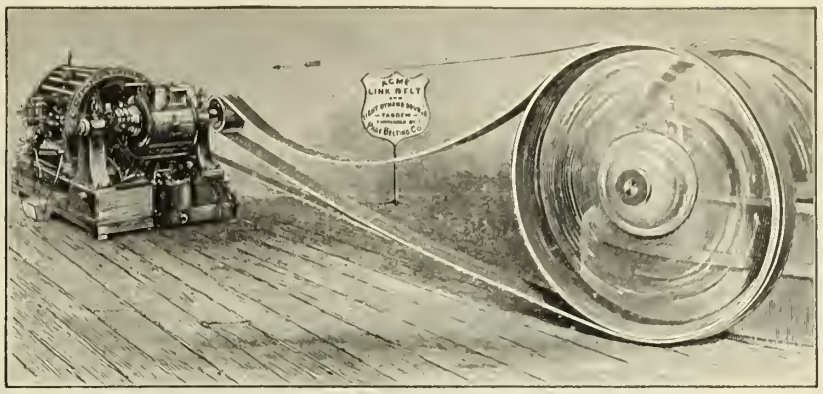
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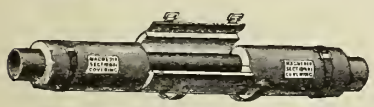
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SEE PAGE XXII.

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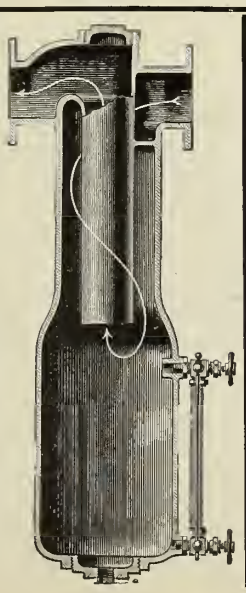
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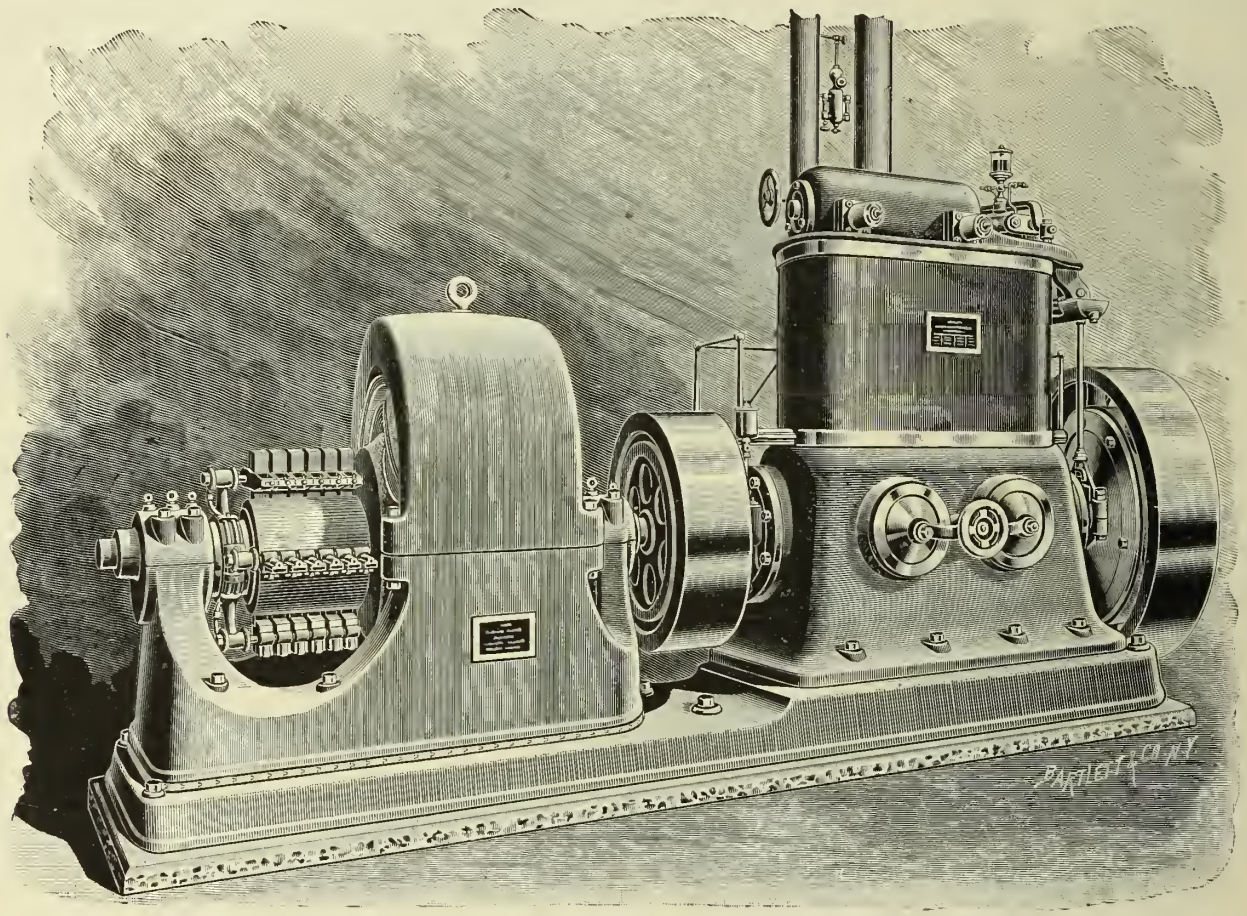


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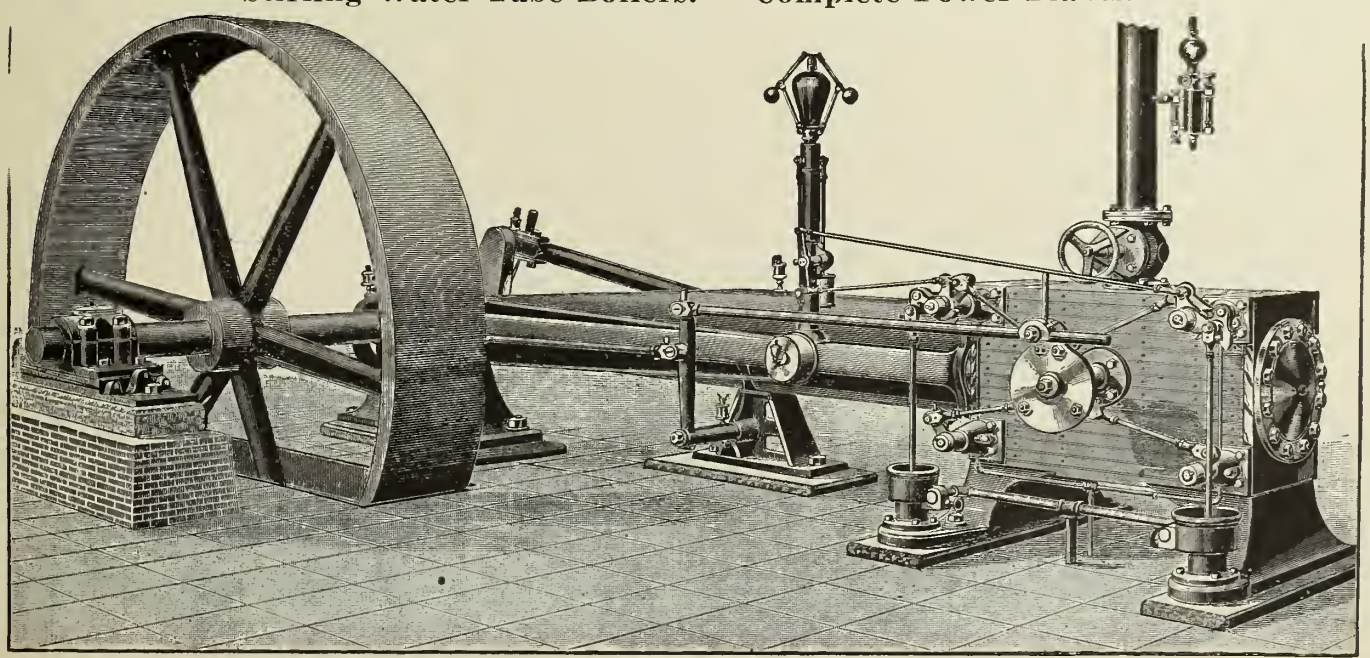
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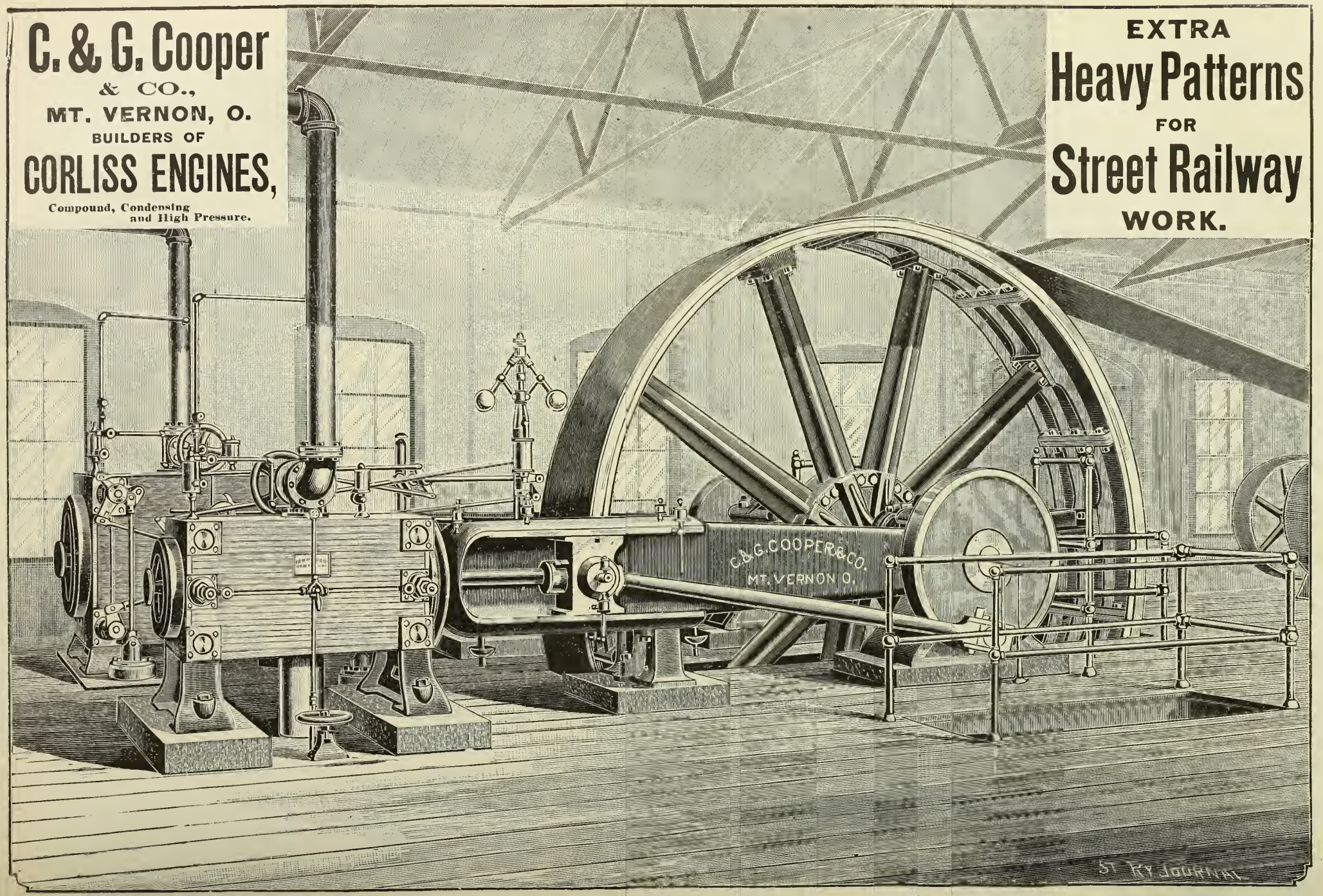
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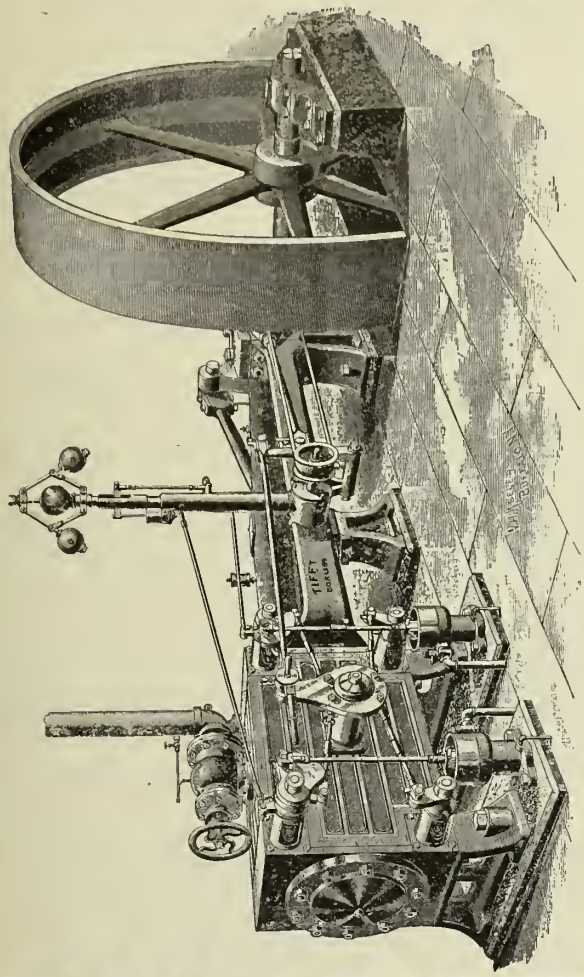
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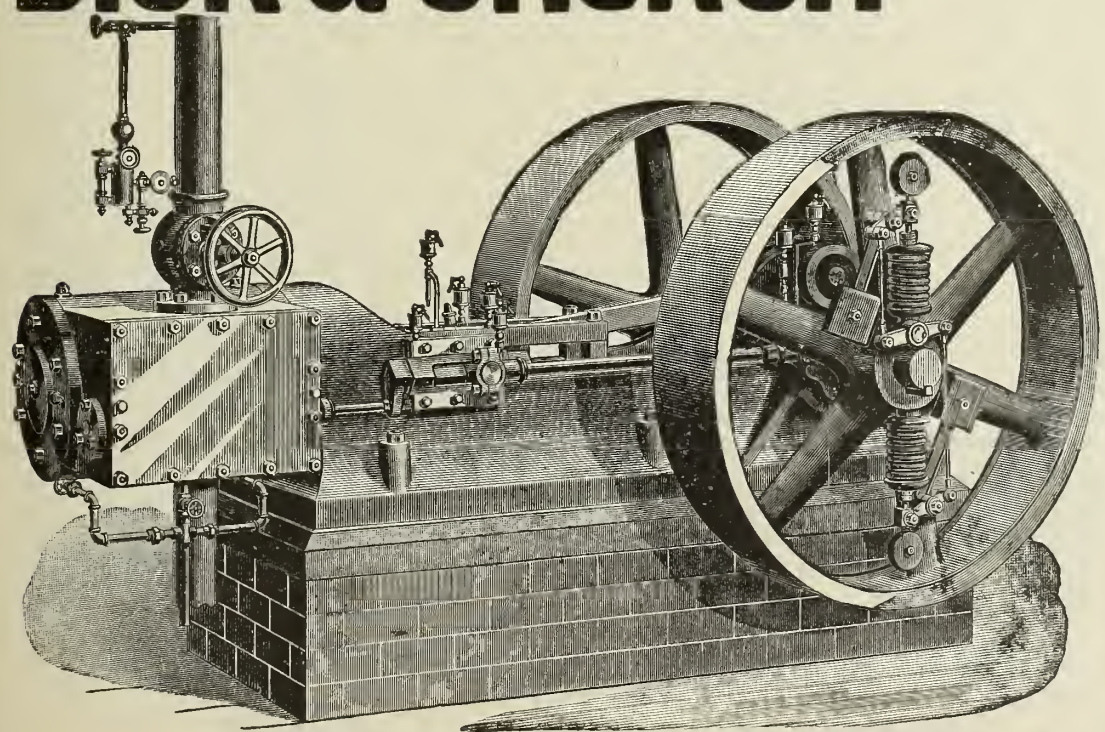


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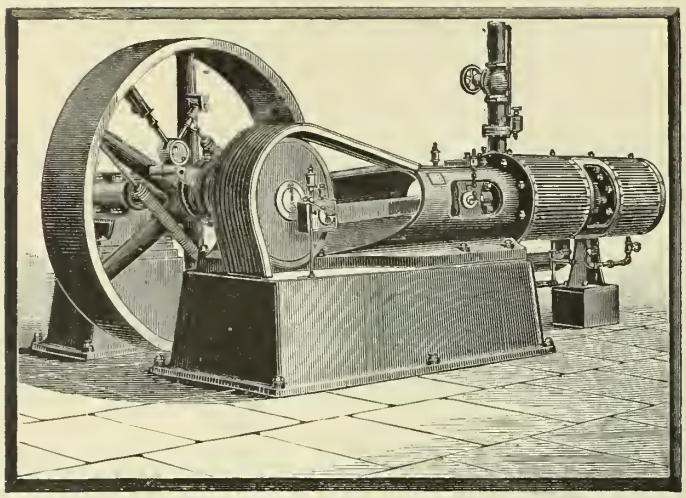
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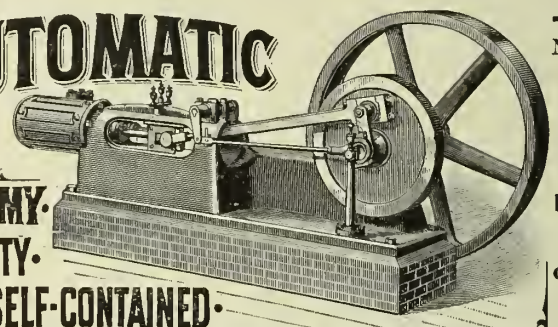
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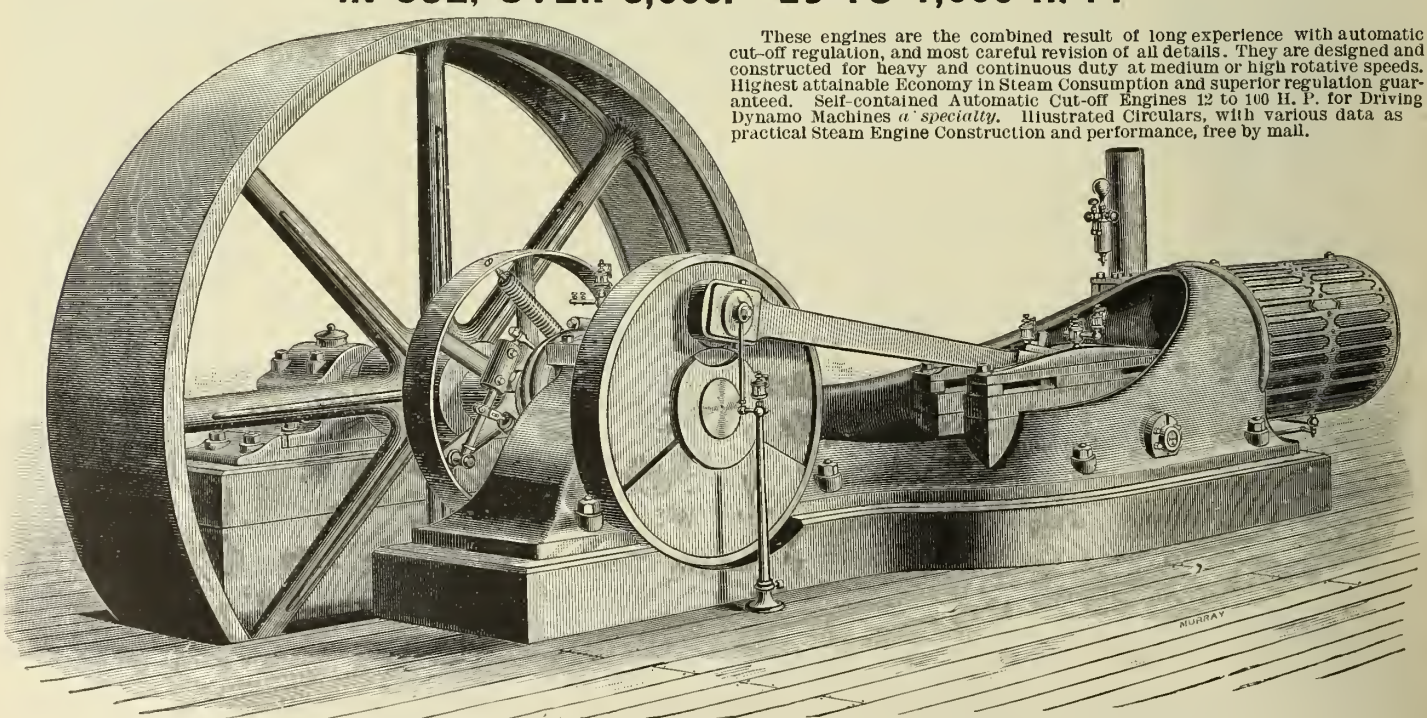
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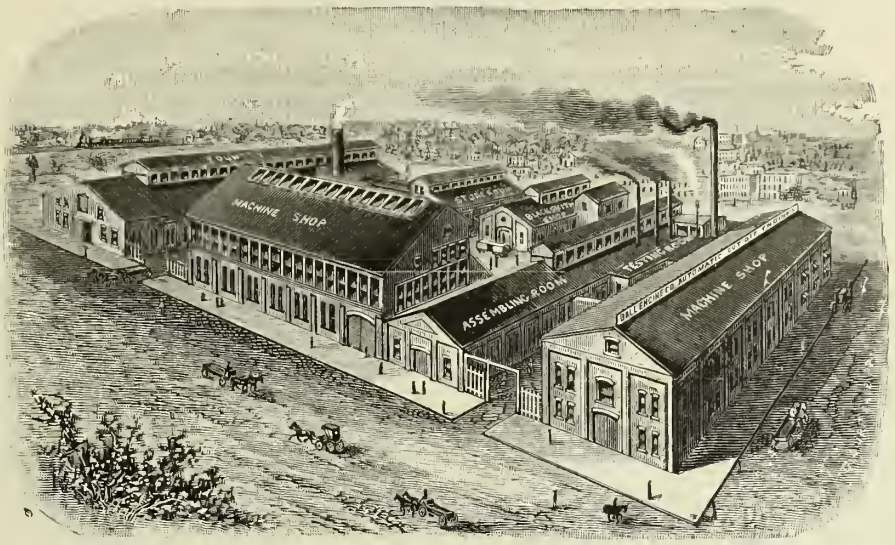
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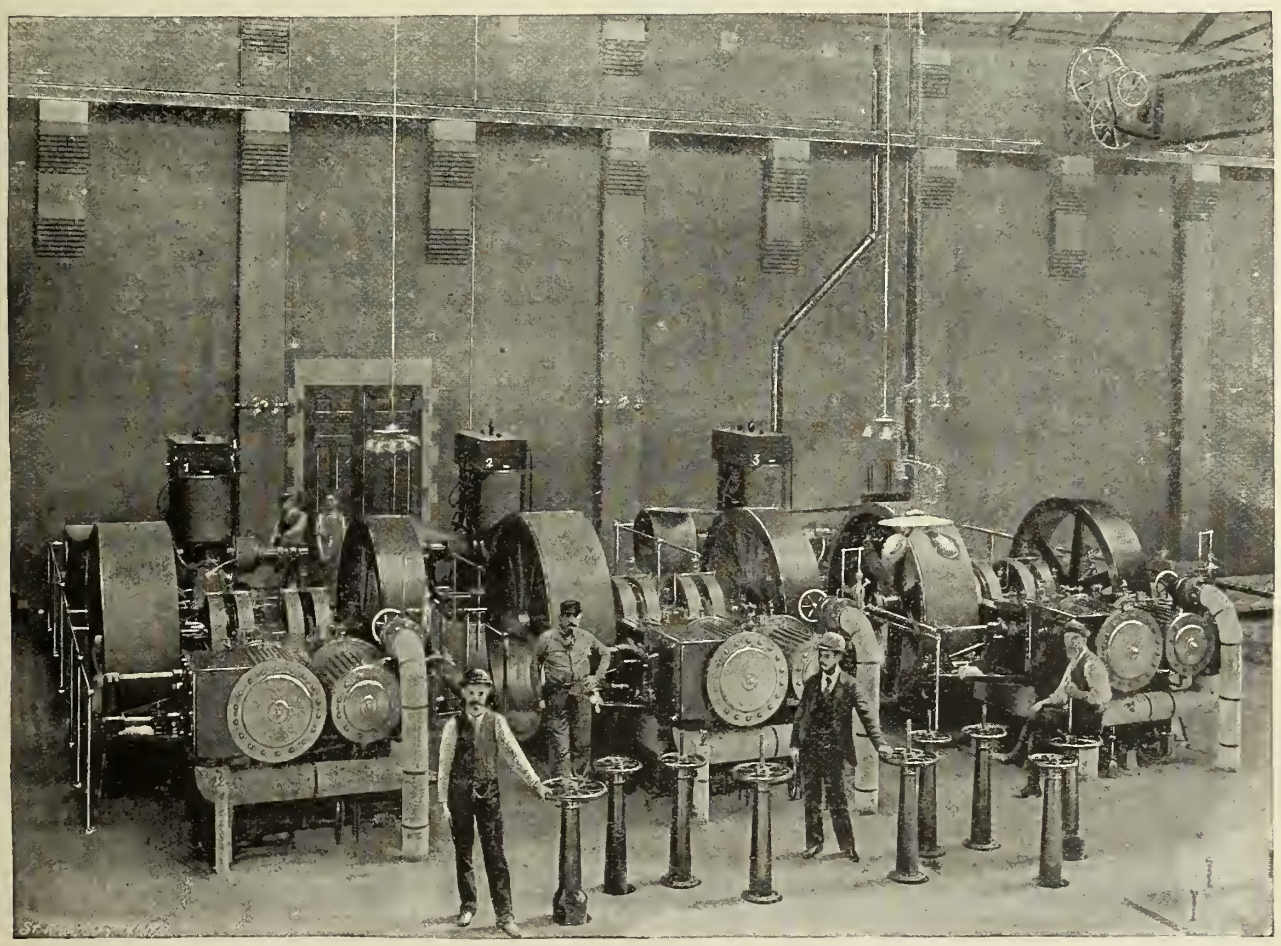
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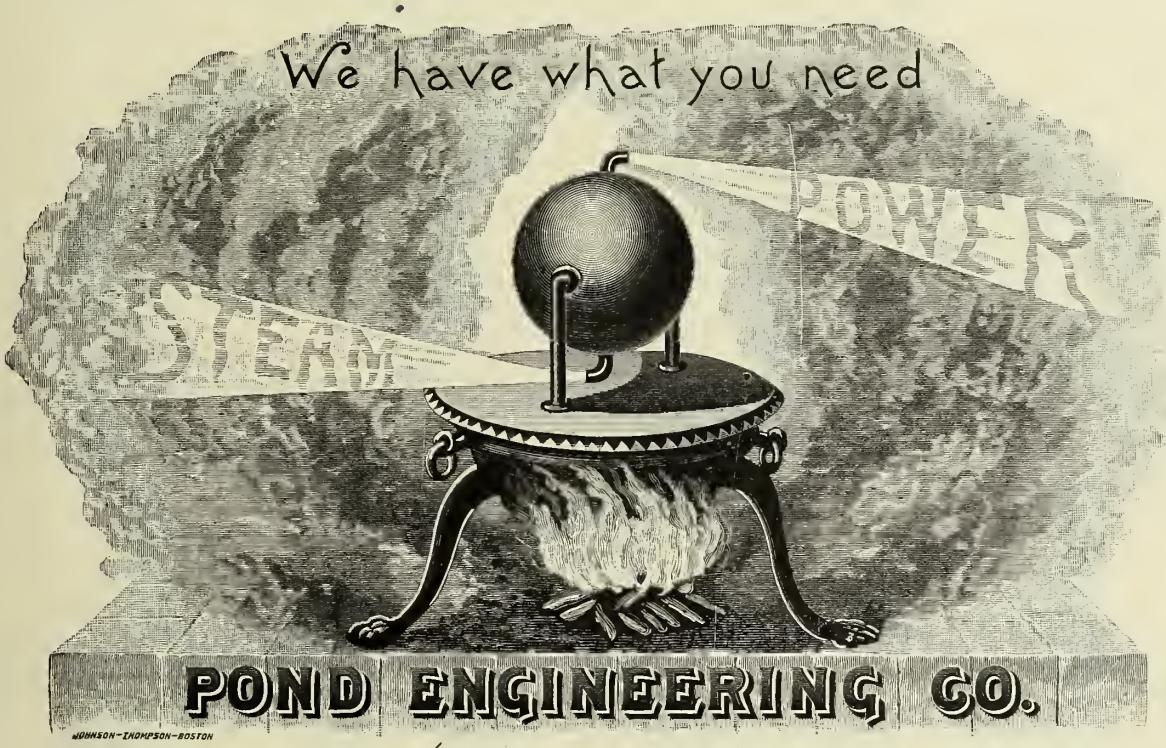
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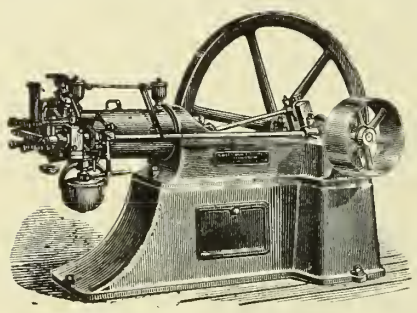
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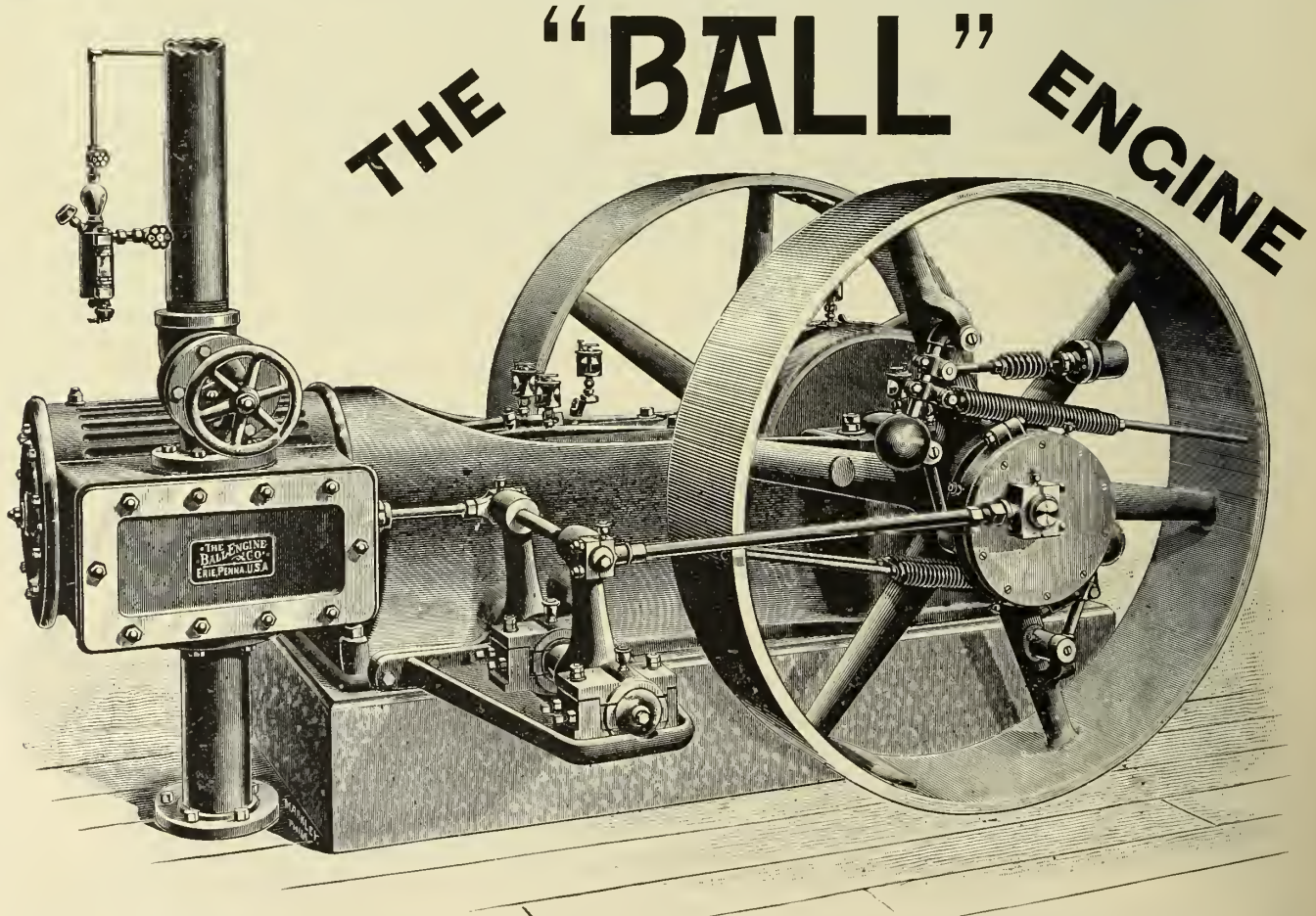
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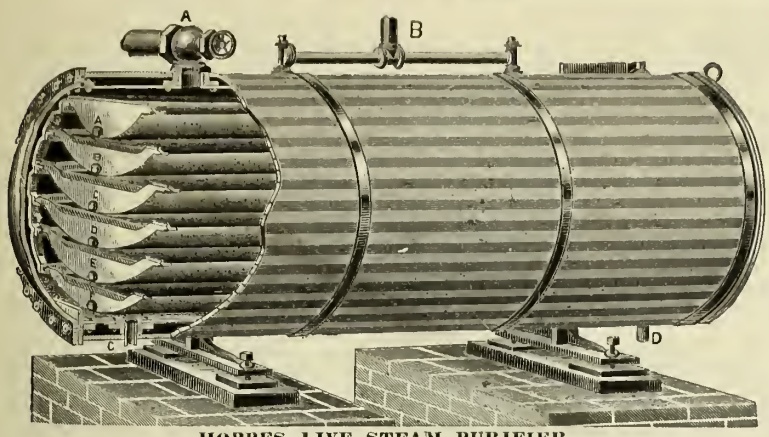
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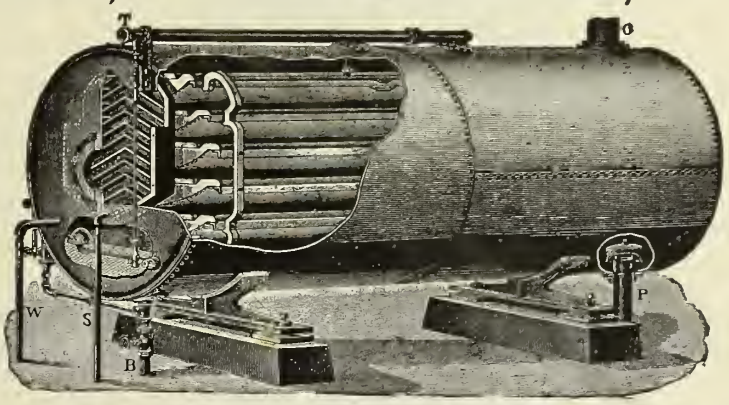
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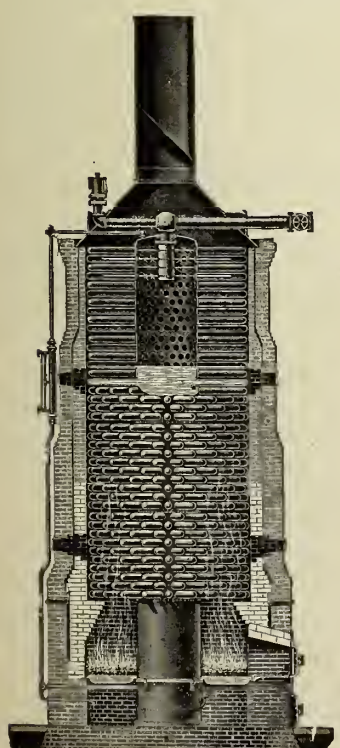
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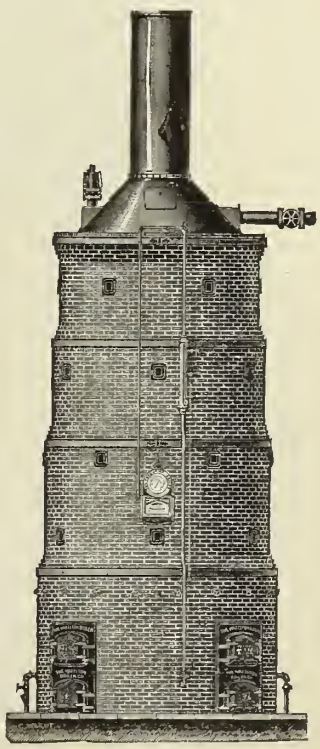
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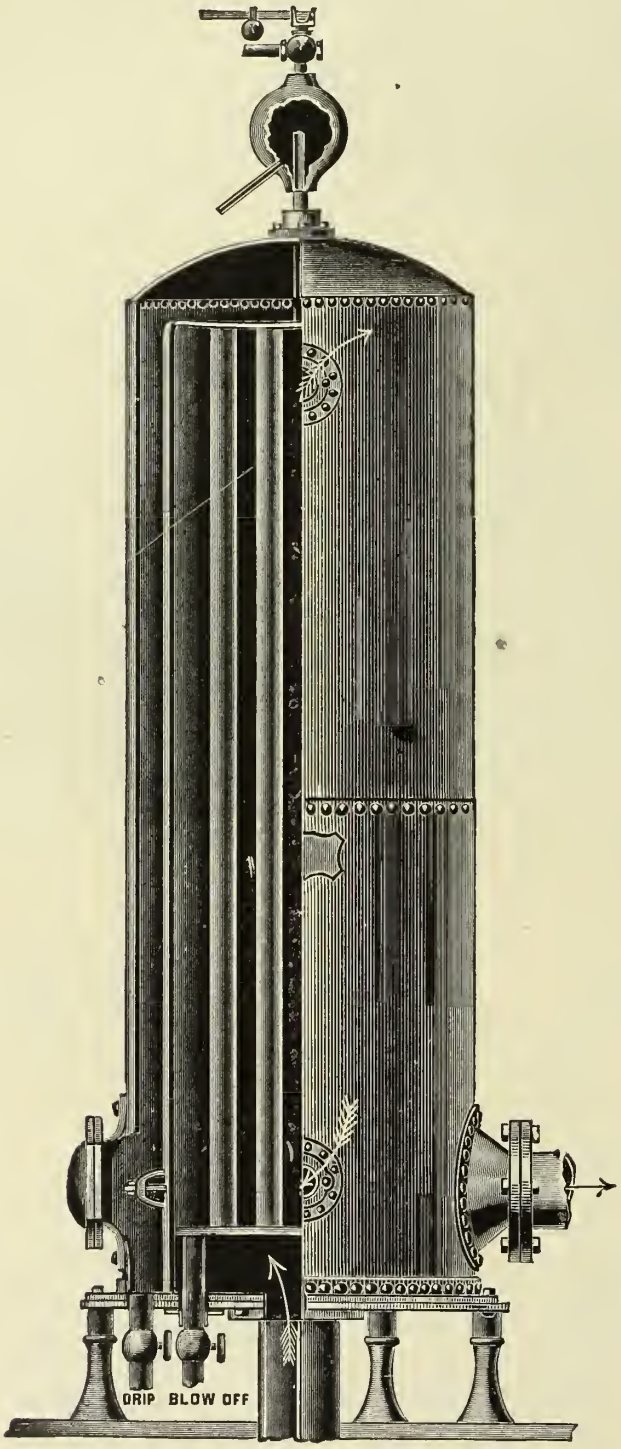
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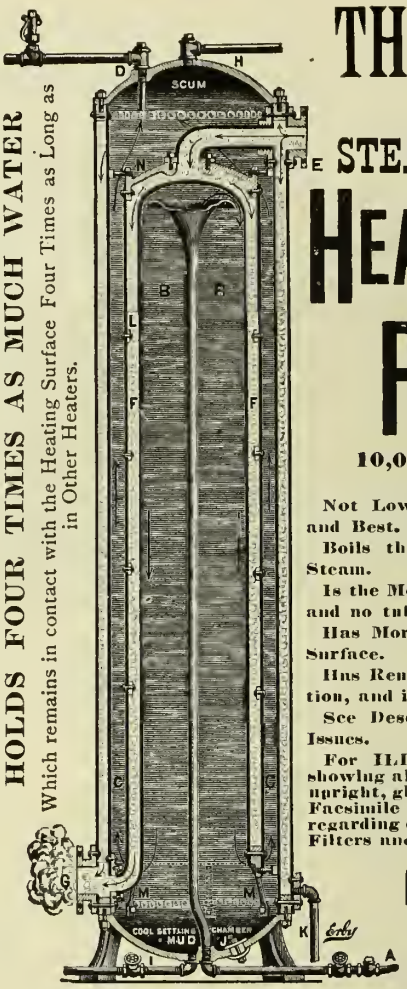
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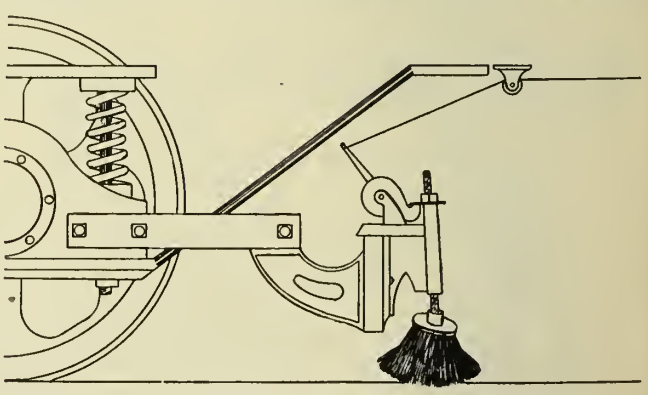
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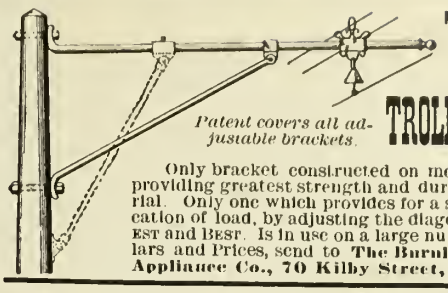
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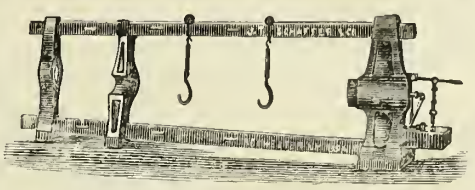
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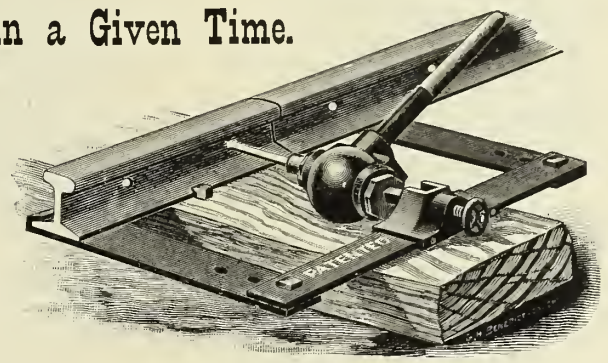
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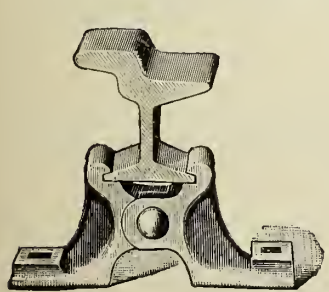
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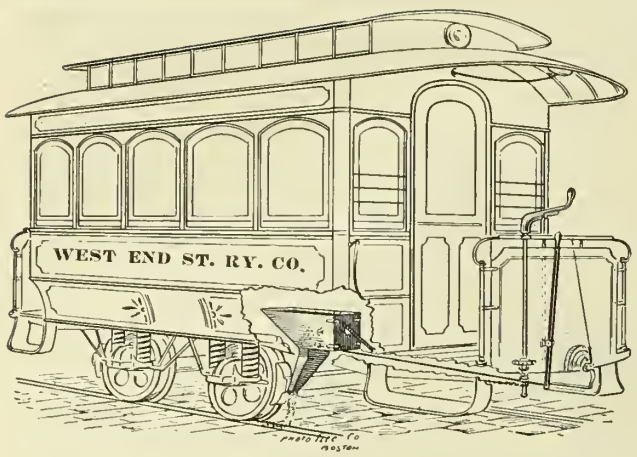
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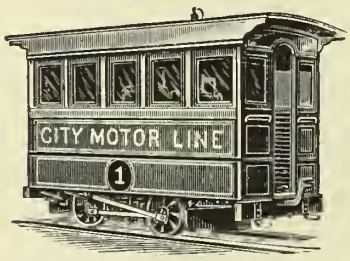
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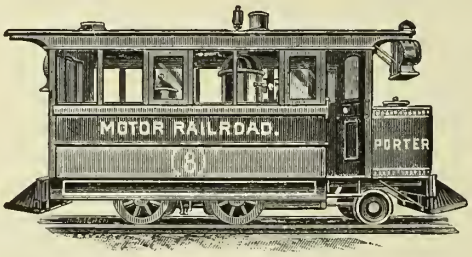
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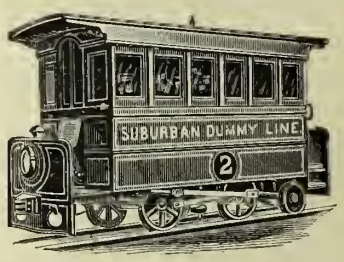


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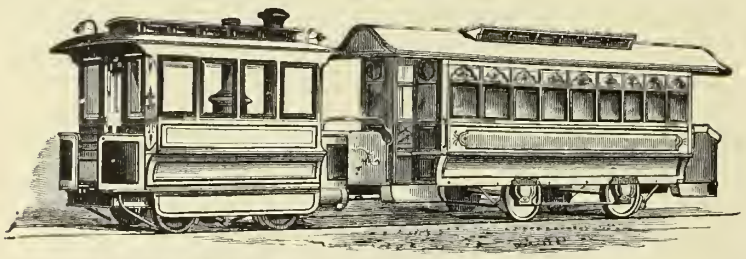




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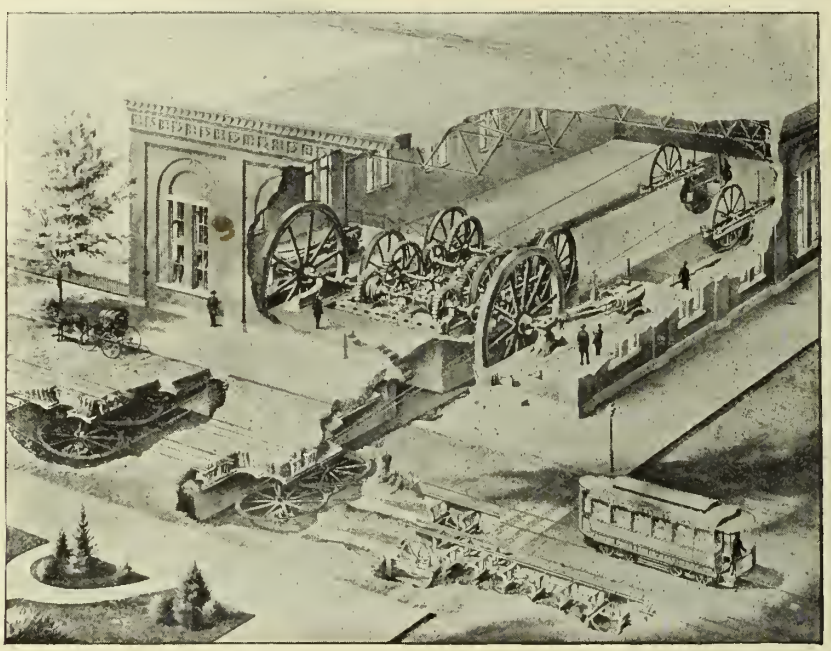
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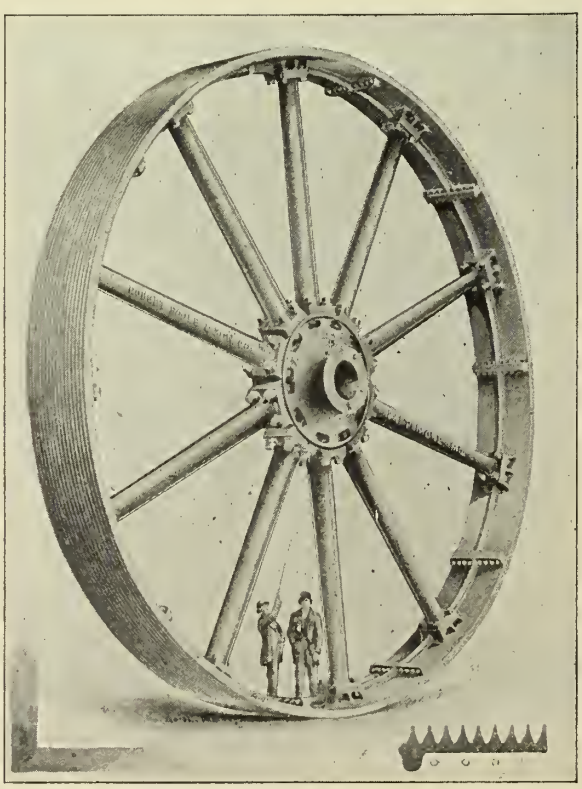
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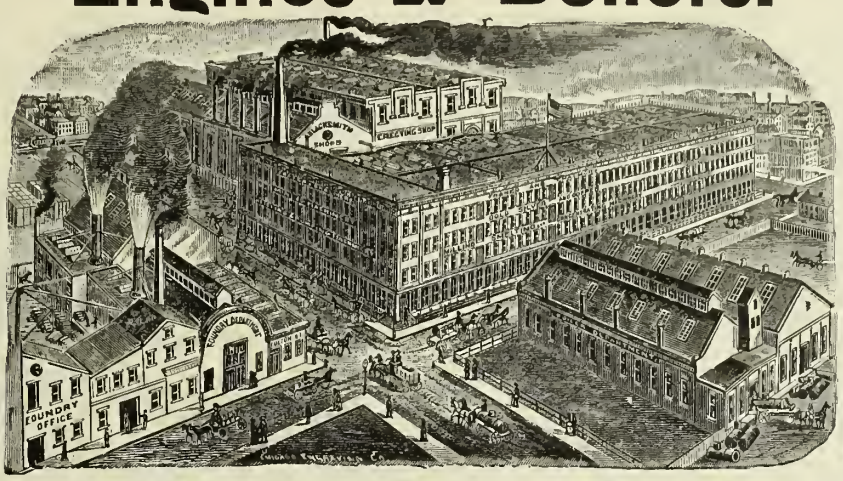
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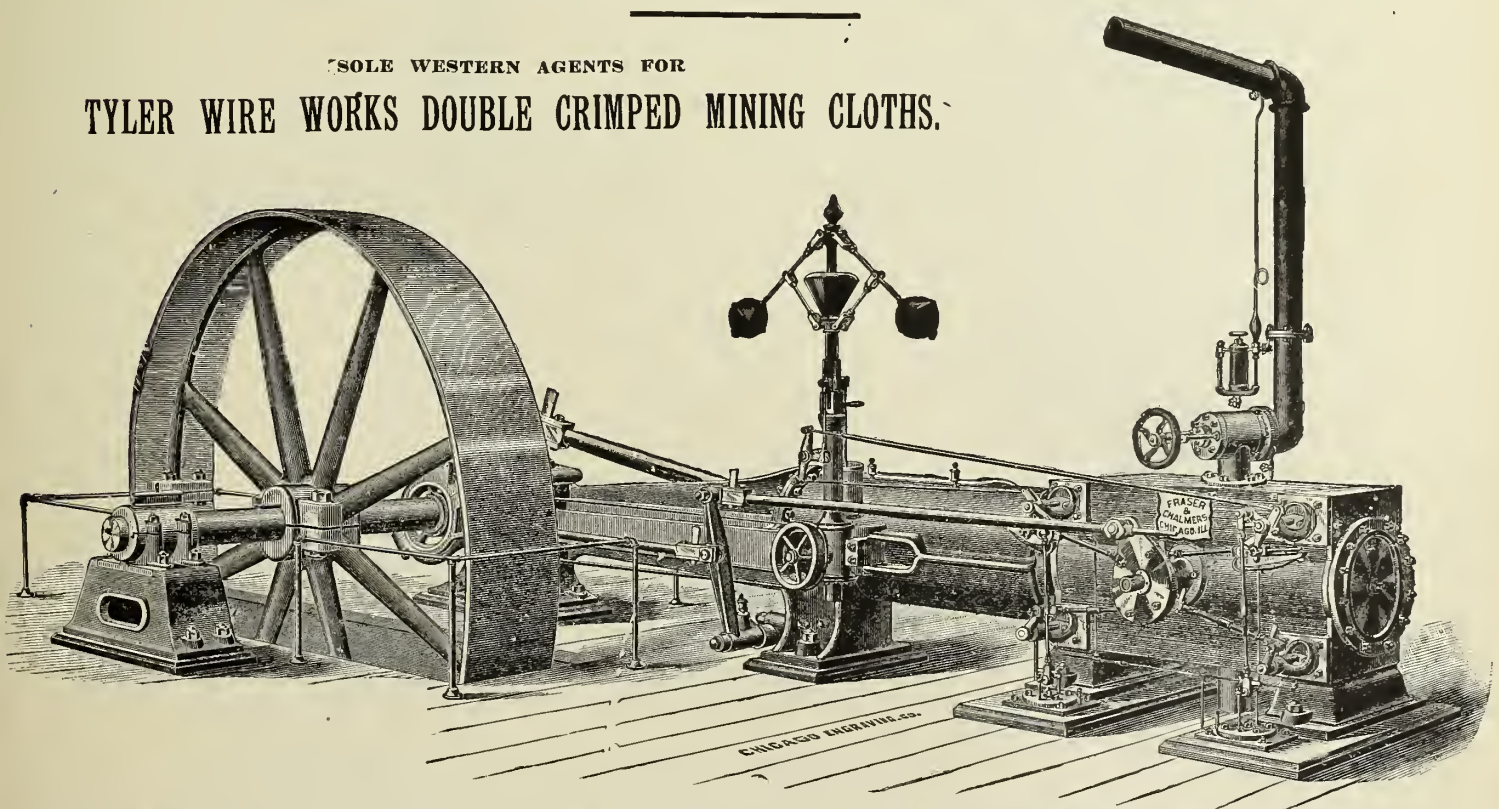


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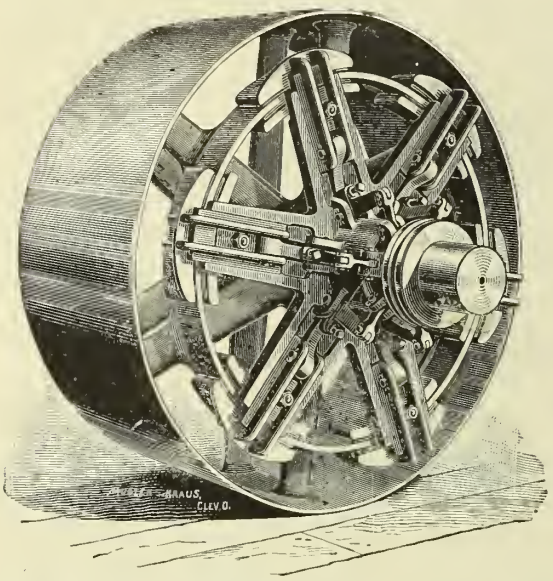


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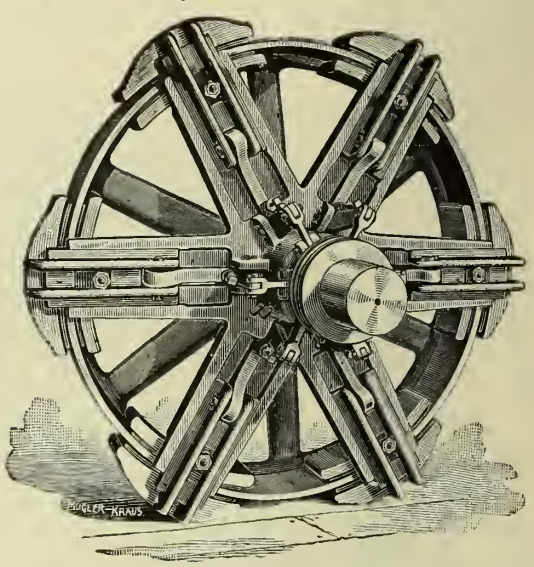


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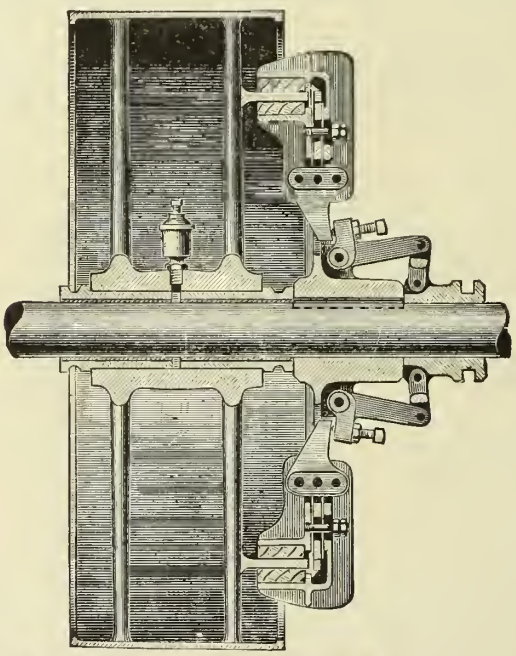
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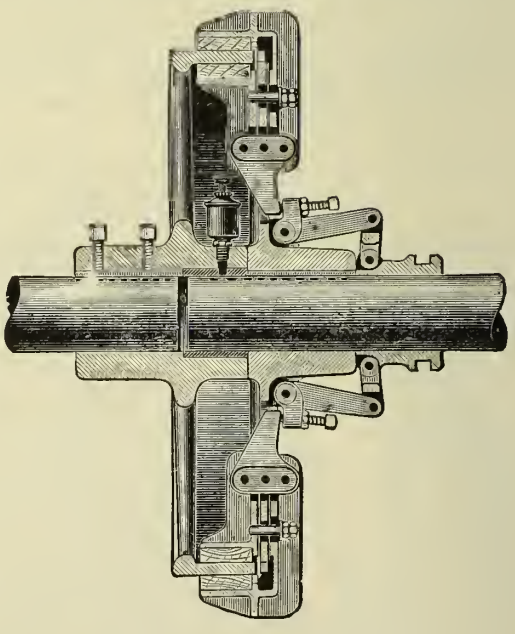
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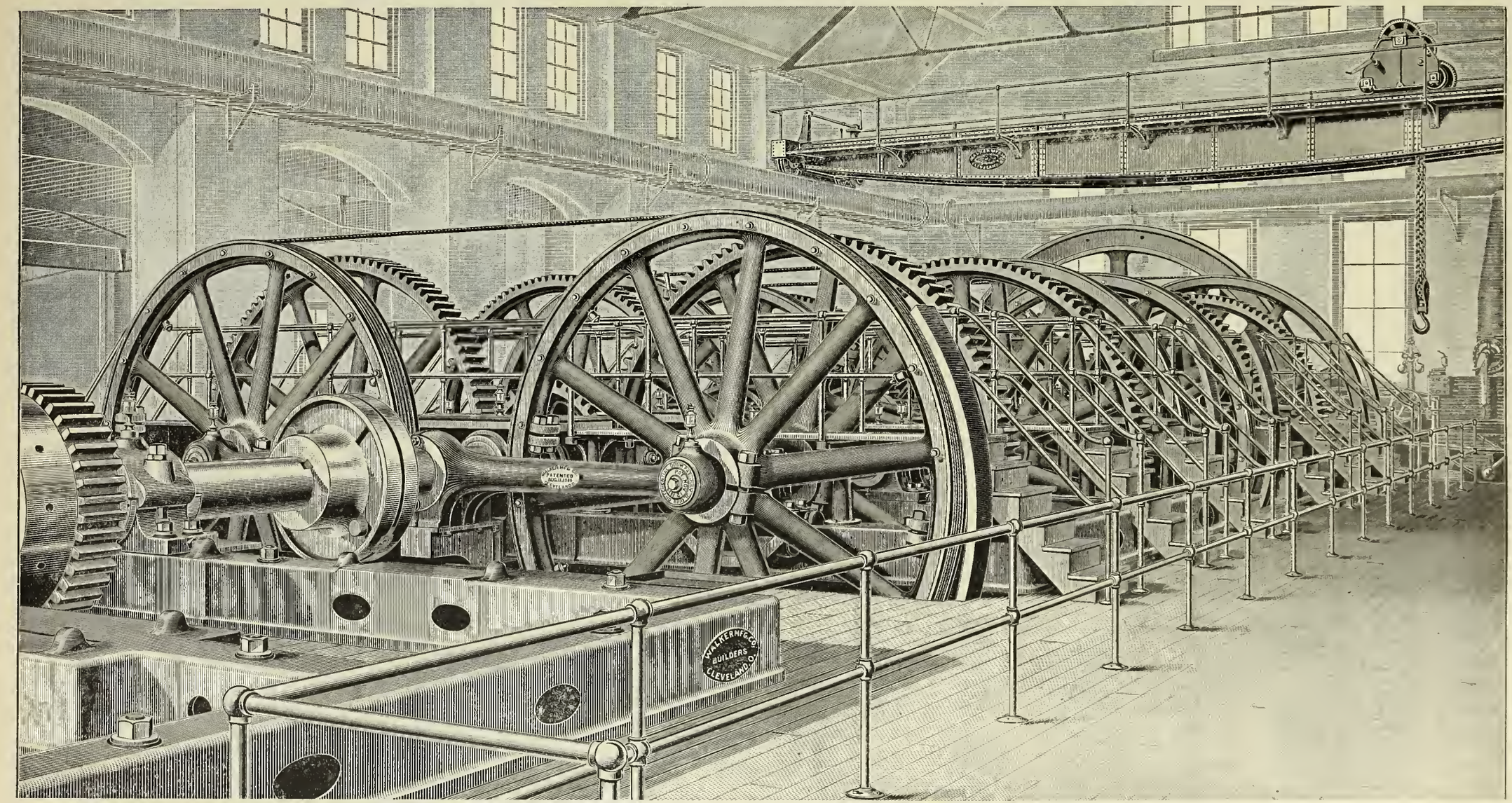
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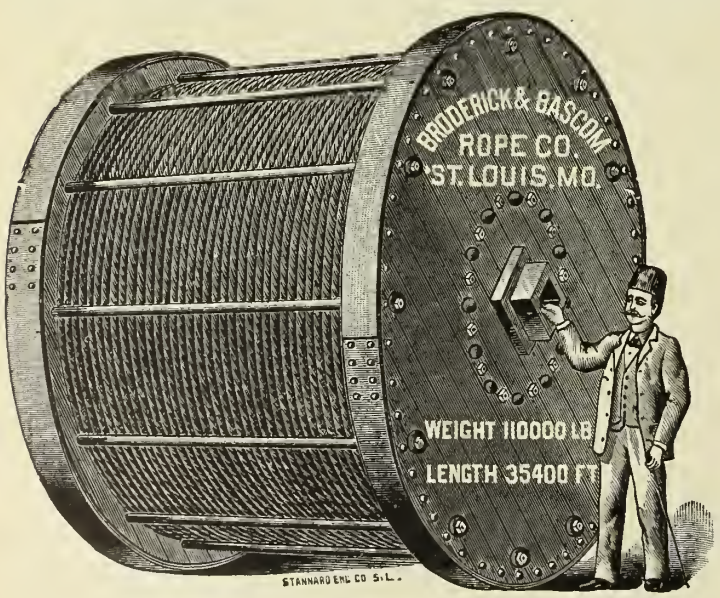
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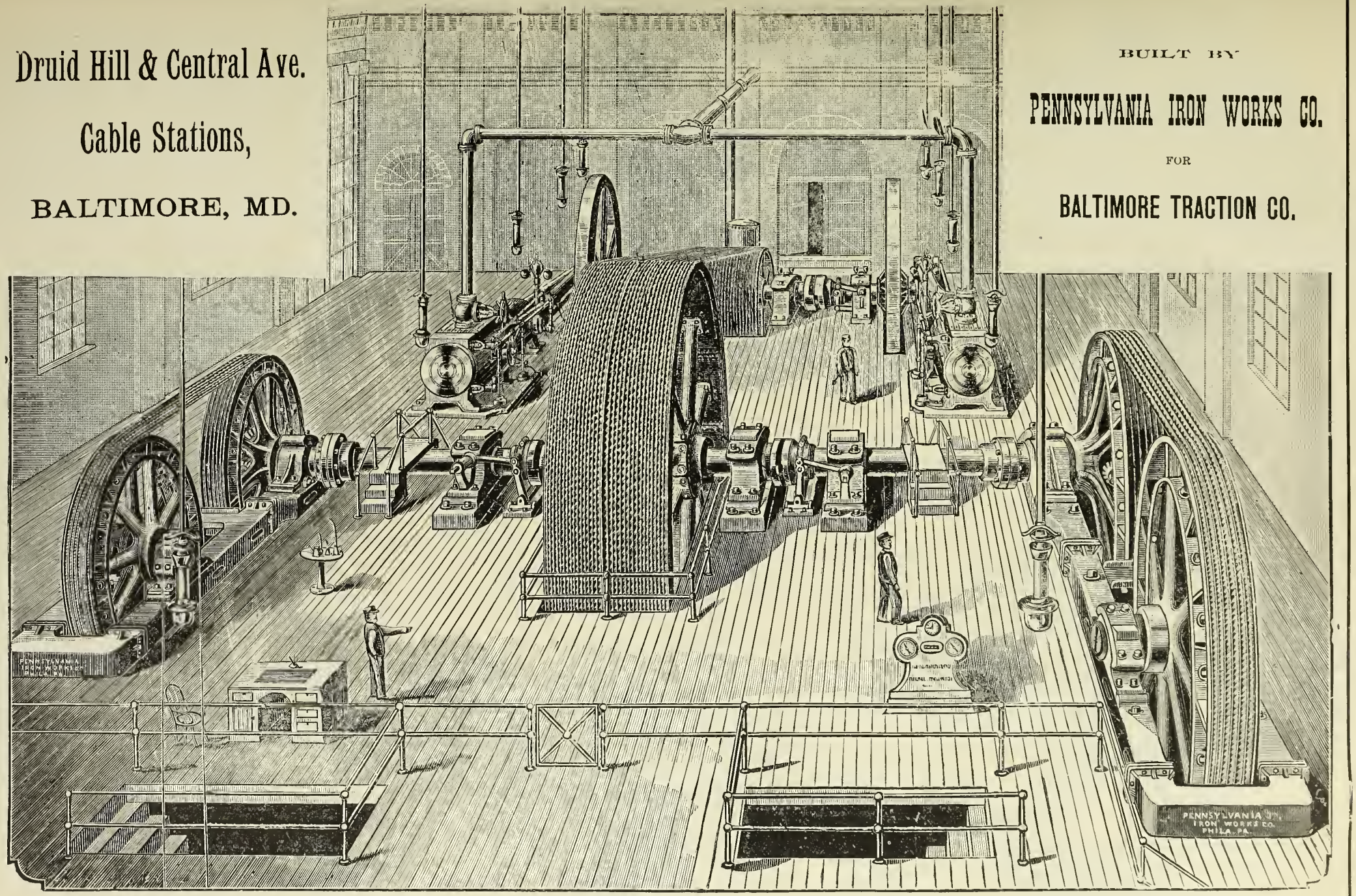
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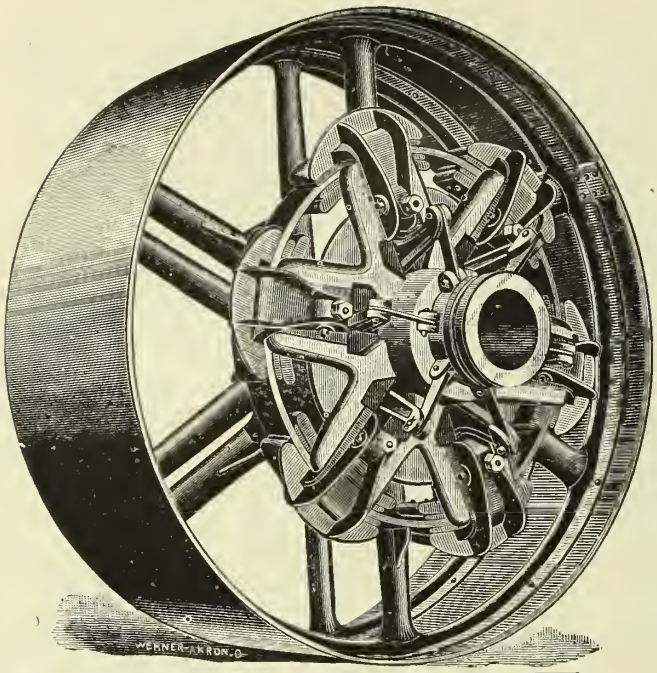
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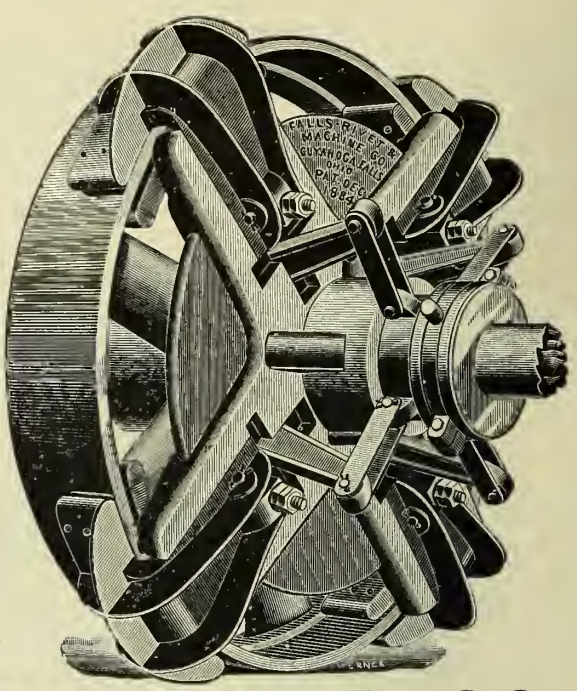
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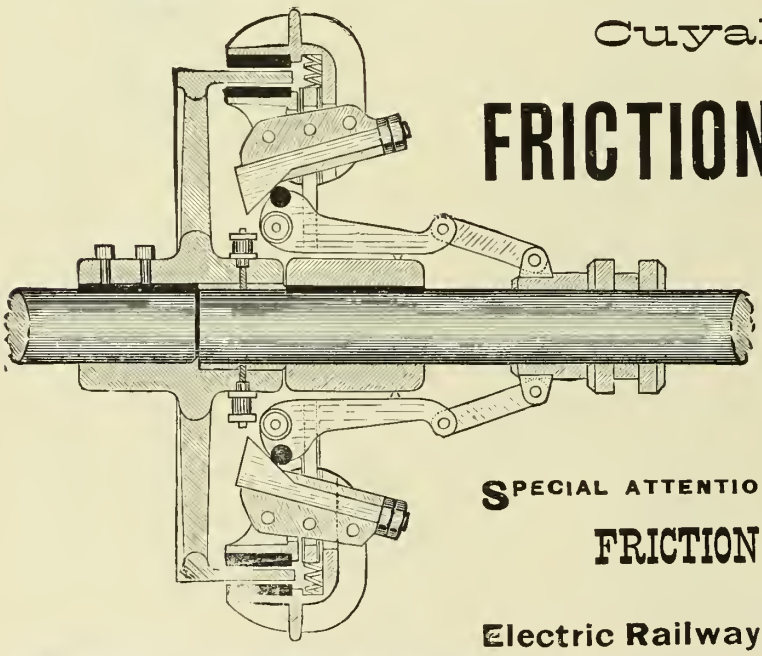
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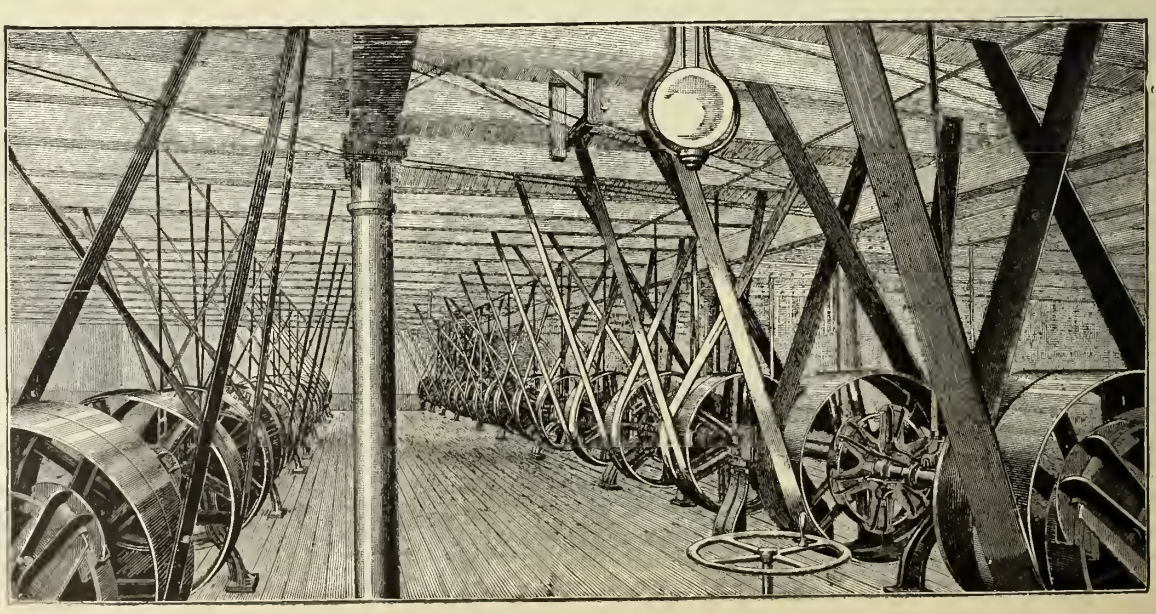
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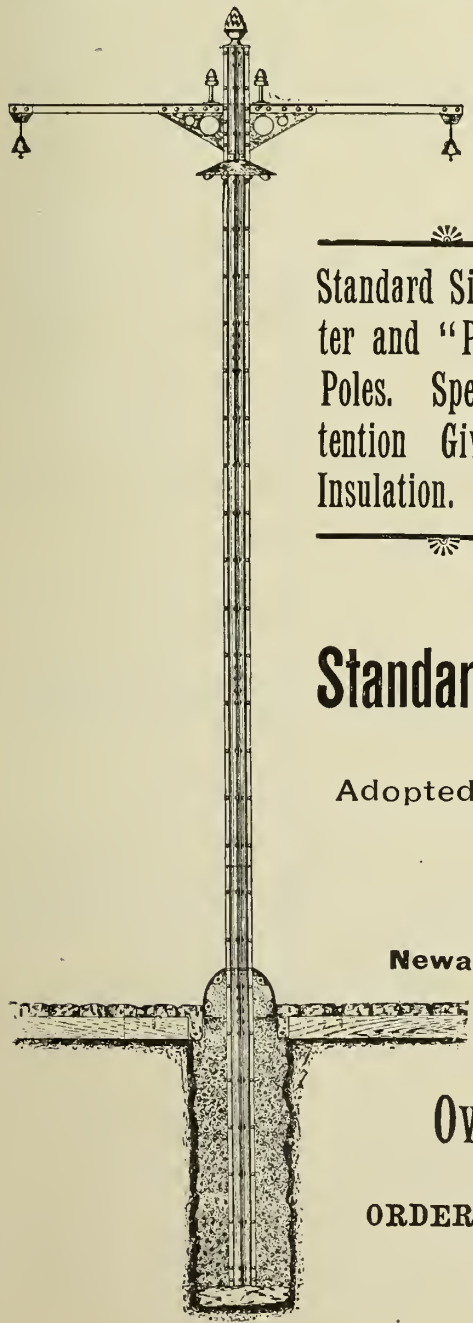
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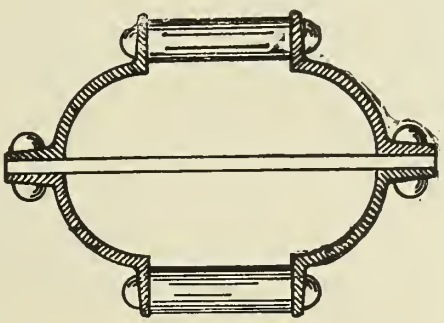
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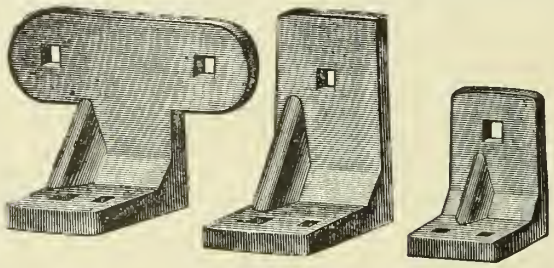
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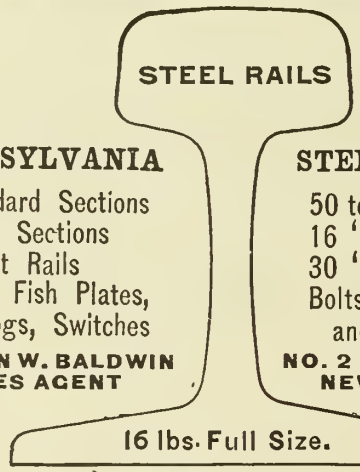
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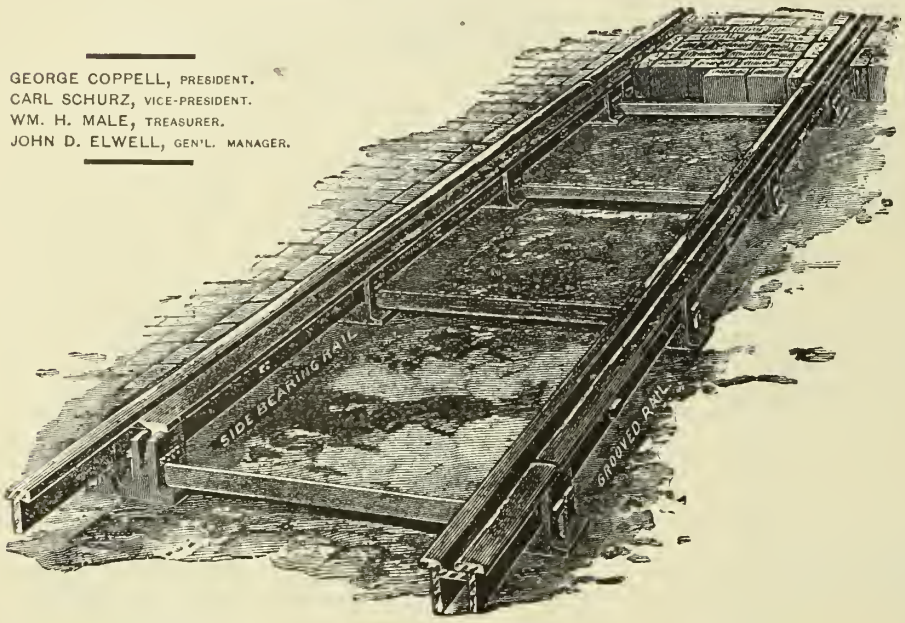
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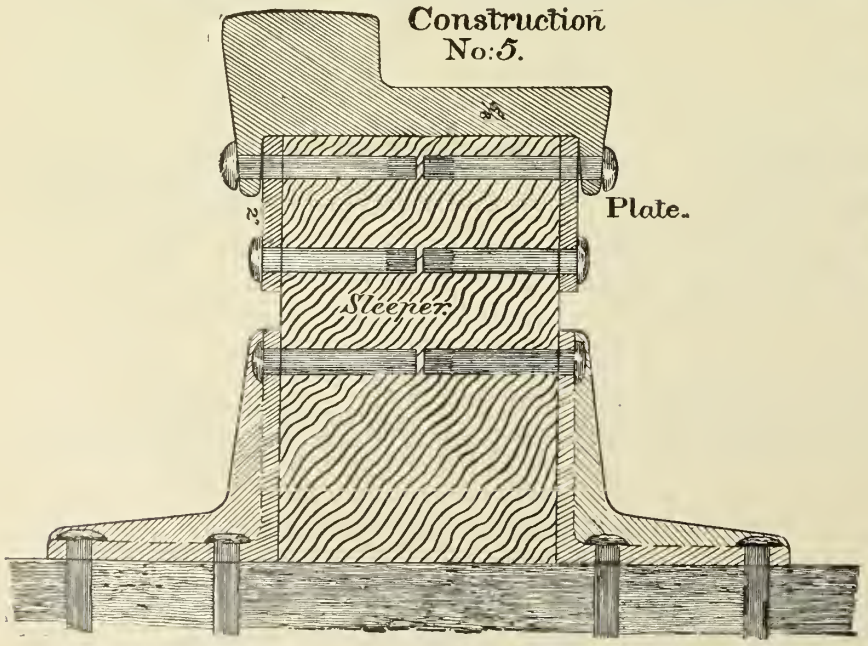
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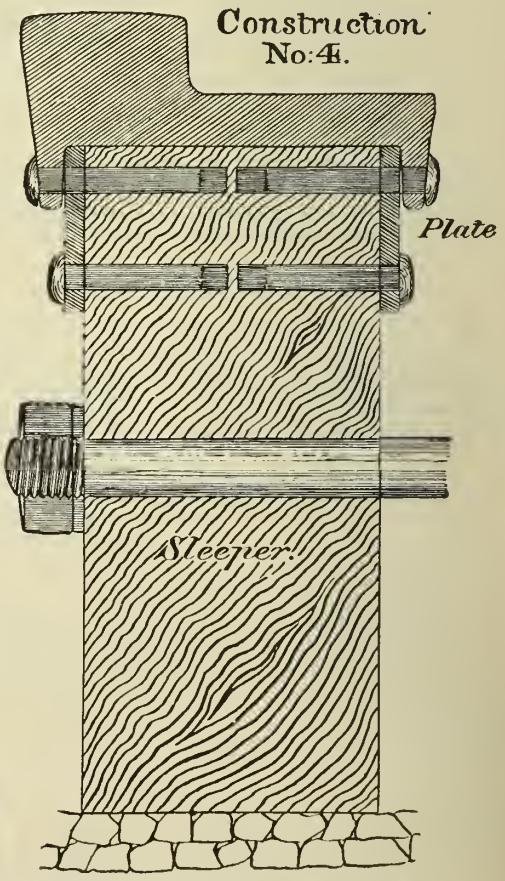
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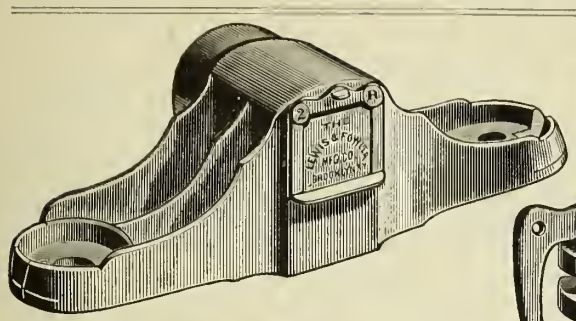
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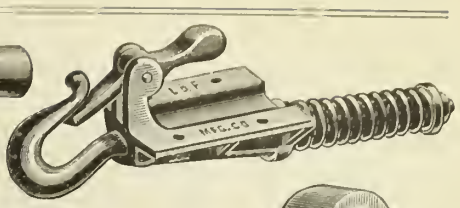


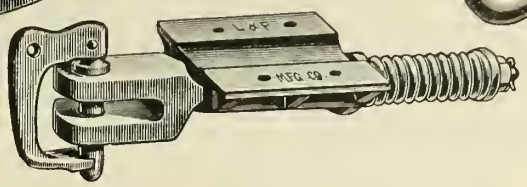


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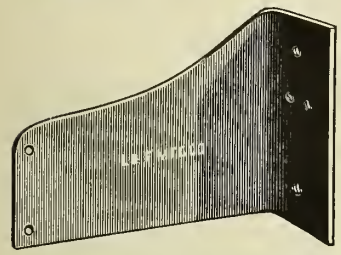


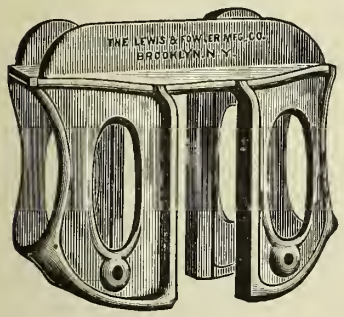


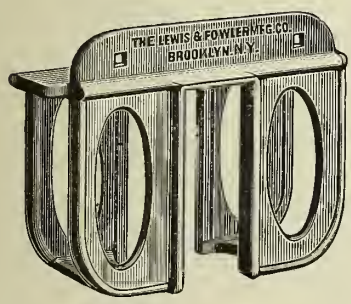


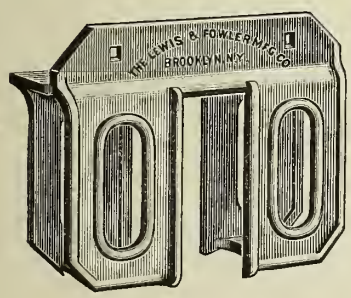












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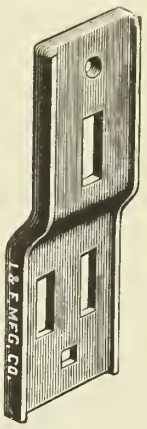
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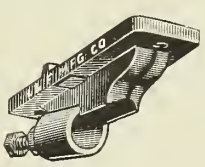




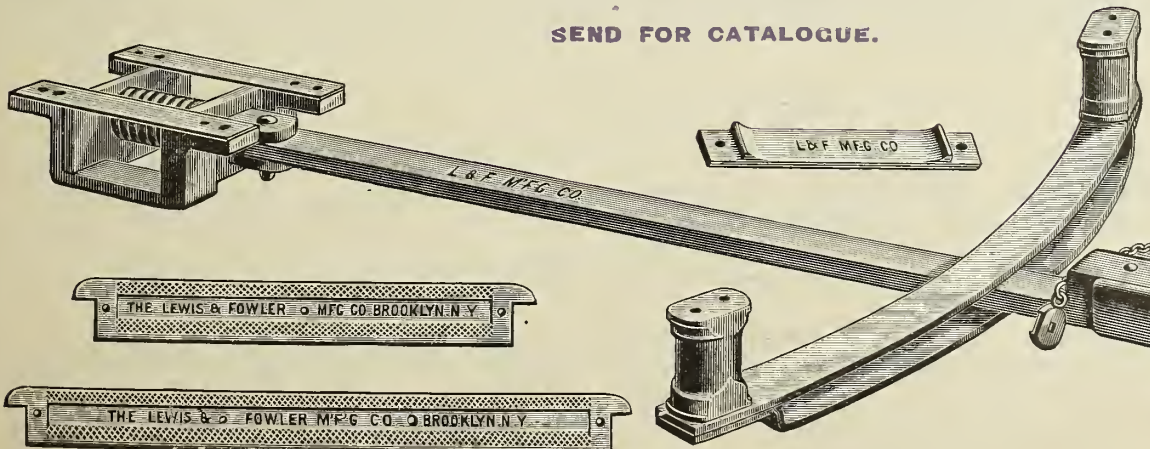












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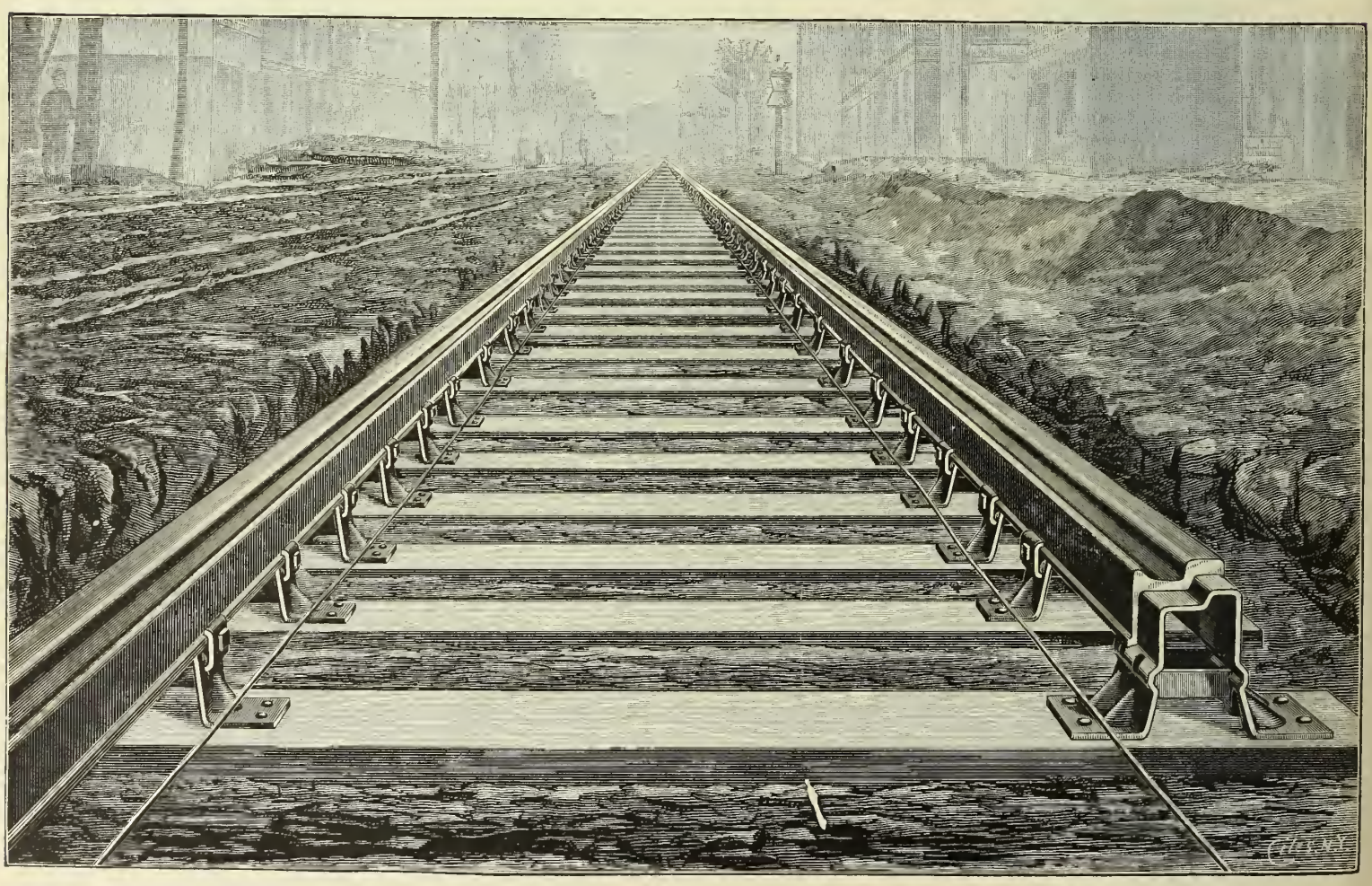
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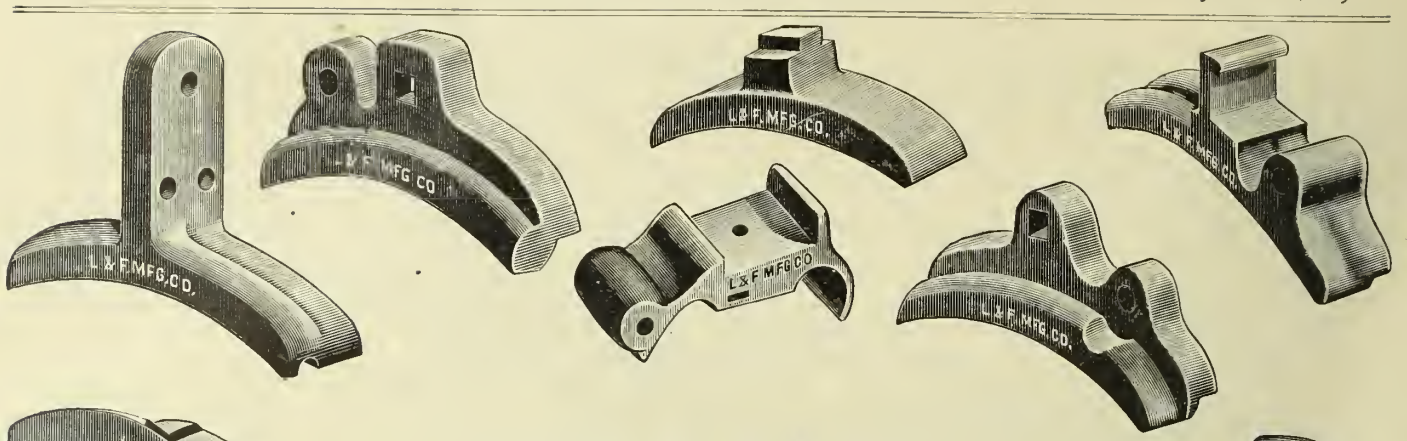
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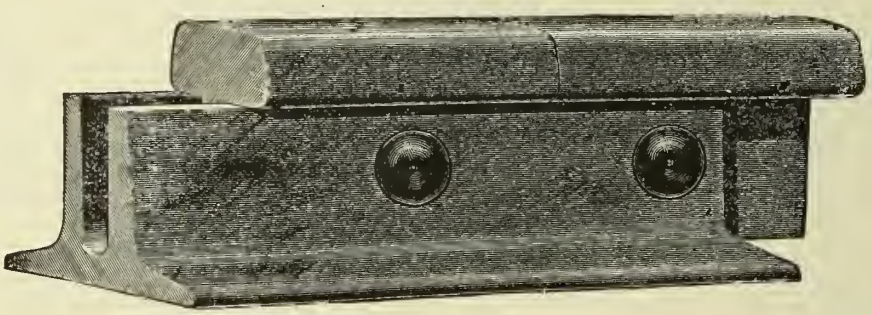
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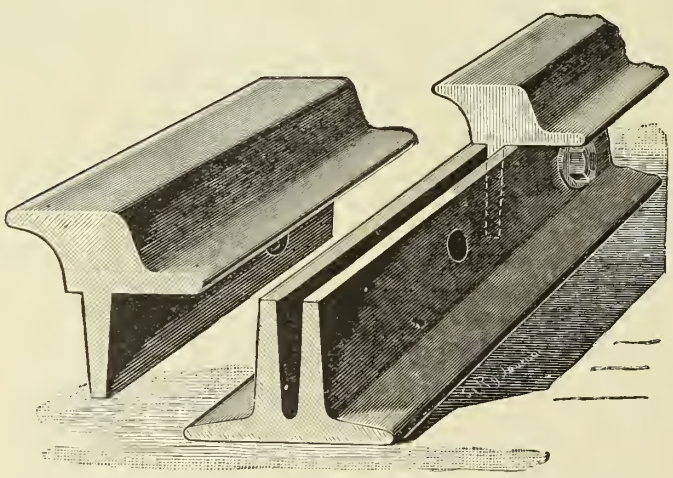
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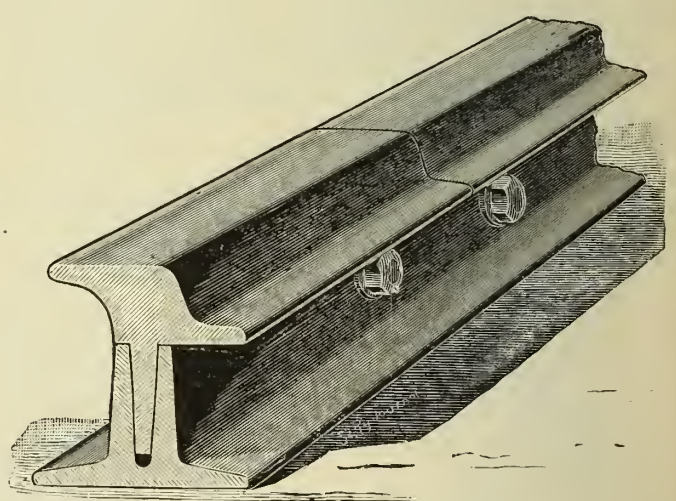
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RICHARD VOSE,
President & Treas.

JNO. C. N. GUIBERT,
Secretary.

RICHARD VOSE CAR SPRING COMPANY

MANUFACTURER OF

VOSE PATENT

"GRADUATED" CAR SPRINGS

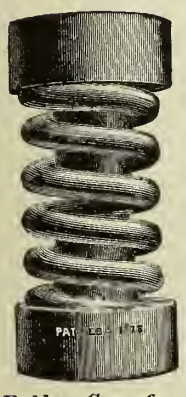
—FOR—

STREET RAILWAY CARS.

HORSE, CABLE AND ELECTRIC.

STANDARD

FOR THE **BEMIS** AND **THOMSON-HOUSTON** CABLE AND ELECTRIC TRUCKS, AND ADAPTED TO THE BEMIS, STEPHENSON, BRILL, JONES, RANDALL, BALTIMORE, LACLEDE, ST. LOUIS CAR CO., HIGLEY, VOLK, CHAPLIN, PECKHAM AND ALL OTHER TRUCKS AND BOXES.



Rubber Cone for Pedestal Gear.



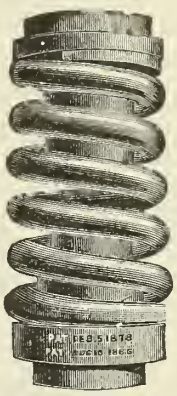
Rubber Cone for Post Gear.



Rubber and Iron Cone for Post Gear and Electric Trucks.



Top Cushion for Post Gear.



Rubber and Iron Cone for Pedestal Gear and Electric Trucks.

Your attention is respectfully called to the above cuts, showing different styles of Street Car Springs. The principle has been in use since 1878, and is the only one that insures perfect graduation.

ITS ESSENTIAL POINTS ARE:

1st. THE OUTER STEEL COIL CARRIES THE EMPTY CAR AND PARTIAL LOAD.

2d. THE INNER CONES ARE BROUGHT INTO REQUISITION ONLY WITH the LOAD.

For Electric Cars we recommend a Cone Shaped Steel Coil, with but one rubber cone and one iron cone. This from the fact that experience has taught that upon Electric Trucks, springs should be used that are not too elastic, and by use of one rubber only we accomplish this, while the iron cone holds the spring more firmly on the bolt, preventing the wearing of the hole in rubber cone, by the natural friction of the same.

We make springs of this or any description, and simply ask that you advise us thoroughly as to your desires, and weight to be applied to spring, with and without passengers, and we will assure a spring that will do the work and give perfect satisfaction.

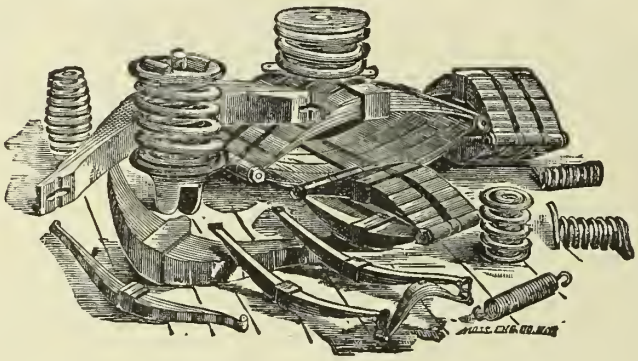
Represented by { GUS SUCKOW, New York.
A. W. SLEE, 500 American Central Building, St. Louis, Mo.
WM. P. WILLIAMS, 717 Phenix Building, Chicago, Ills.

AARON FRENCH, Chairman. J. E. FRENCH, V. Chairman. GEO. W. MORRIS, Gen. Manager. D. C. NOBLE, Sec. & Treas. P. N. FRENCH, Gen. Supt.

THE A. FRENCH SPRING CO., Limited,

PITTSBURGH, PA.

Office and Works,



21st & Liberty Sts.

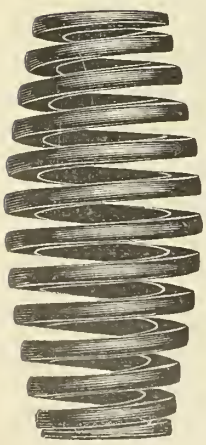
MANUFACTURERS OF BEST QUALITY OF

Crucible Cast Steel Elliptic and Spiral Springs of all Descriptions.



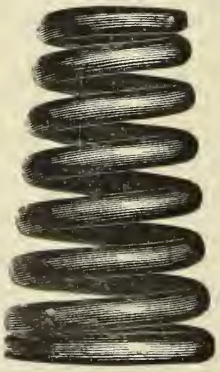
STREET CAR SPRINGS.

Street Car Buffer, Freight Bolster, Journal and Equalizing Bar Springs, Brake Release, Switch, Valve and Machinery Springs.



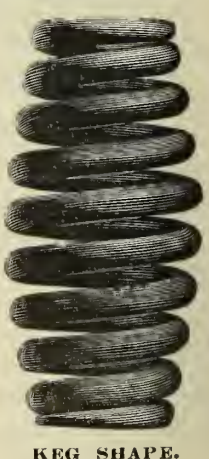
KEG SHAPE.
Patent.

These cuts show our Patent Graduated Street Car Springs, which are the only Graduated Springs complete within themselves, and independent of rubber or other auxiliary springs. They can be applied to any box or pedestal in use without necessitating any change whatever.



CONE SHAPE.

They are easy riding springs under a light or heavy load. Under a light burden the coils of larger diameter act before those on the ends, and as the load is increased the coils toward the ends come into action as they decrease in diameter. Trial sets will be furnished, and orders are earnestly solicited.



KEG SHAPE.
Patent.

AGENCIES:

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NEW YORK: 88 Boreel Building. BOSTON: 52 Mason Building.

DO YOU WANT SPRINGS

FOR

ELECTRIC, HORSE AND CABLE CARS?

We make them of CRUCIBLE Steel and Guarantee every one.

Spirals of any Required Size or Capacity Furnished Promptly. Graduated Springs to Fit any Truck or Box.

OUR SINGLE ELLIPTIC SPRINGS

Used in connection with Spirals are the easiest riding springs made for fast running Electric or Cable Cars.

Let us know what load each spring is to carry and we will give you what you want.

CHARLES SCOTT SPRING CO.

1028-1038 New Market St., Philadelphia, Pa.

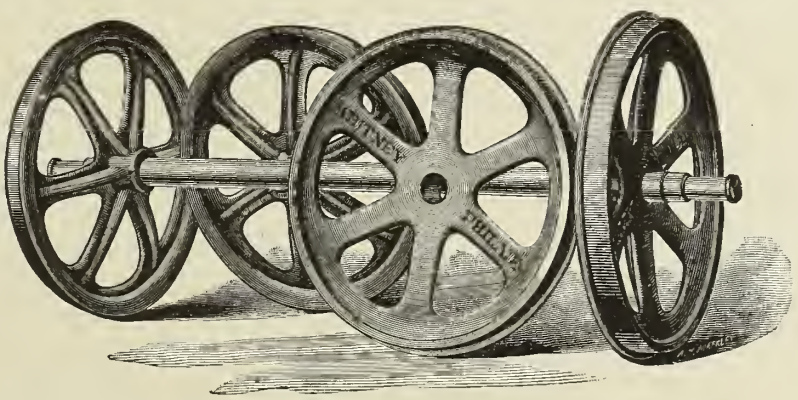
CHICAGO, 945 ROOKERY. ST. LOUIS, SOUTHERN HOTEL.

A. WHITNEY & SONS,

Philadelphia, Penn.

CHILLED CAST IRON CAR WHEELS,

Of all Kinds and Sizes and made only of the Best Charcoal Irons.



Street Railway Wheels made in Contracting Chills, Accurately Round without Grinding, and Uniformly, Deeply and Durably Chilled.

SPECIAL PATTERNS FOR CHILLED AND STEEL TIRED WHEELS FOR ELECTRIC AND CABLE ROADS.

NEW YORK OFFICE: 52 WALL STREET, NEW YORK.

THE BEMIS CAR BOX CO.,

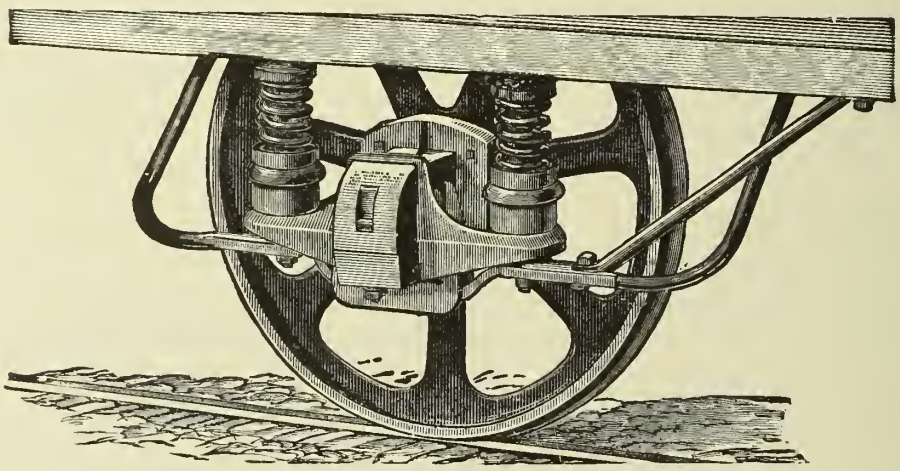
Manufacturers of

THE BEMIS

PATENT JOURNAL BOX AND GEAR,

FOR ALL KINDS OF

Street Railway Service on Horse, Cable or Electric Motor Cars.



Light Draft, Easy Riding, Durable, Economical. Brasses are warranted for 10 years, and Journal for 20 years. Requires oiling or inspection but once in 12 months. Boxes are positively dust proof.

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Sixth Ave. R. R., New York.
42nd St. & Grand St. Ferry Ry., New York.
Brooklyn City Ry.
Brooklyn Cross Town R. R.
Nostrand Ave. R. R. Co., Brooklyn, N. Y.
Rochester City & Brighton Ry.
Buffalo St. R. R.
Citizens' Pass. Ry., Pittsburgh.
Pittsburgh & Birmingham Pass. Ry.
Columbus Consolidated St. Ry.
Detroit City Ry.
Louisville City Ry.
Denver City Ry.
Milwaukee City Ry.
Cream City Ry., Milwaukee.
Minneapolis St. Ry.
St. Paul City Ry.
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Chicago Pass. Ry.
Grand Ave. Ry., Kansas City.
Metropolitan St. Ry., Kansas City.
East Cleveland St. R. R., Cleveland.
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SEND FOR CATALOGUE.

THE BEMIS CAR BOX COMPANY.

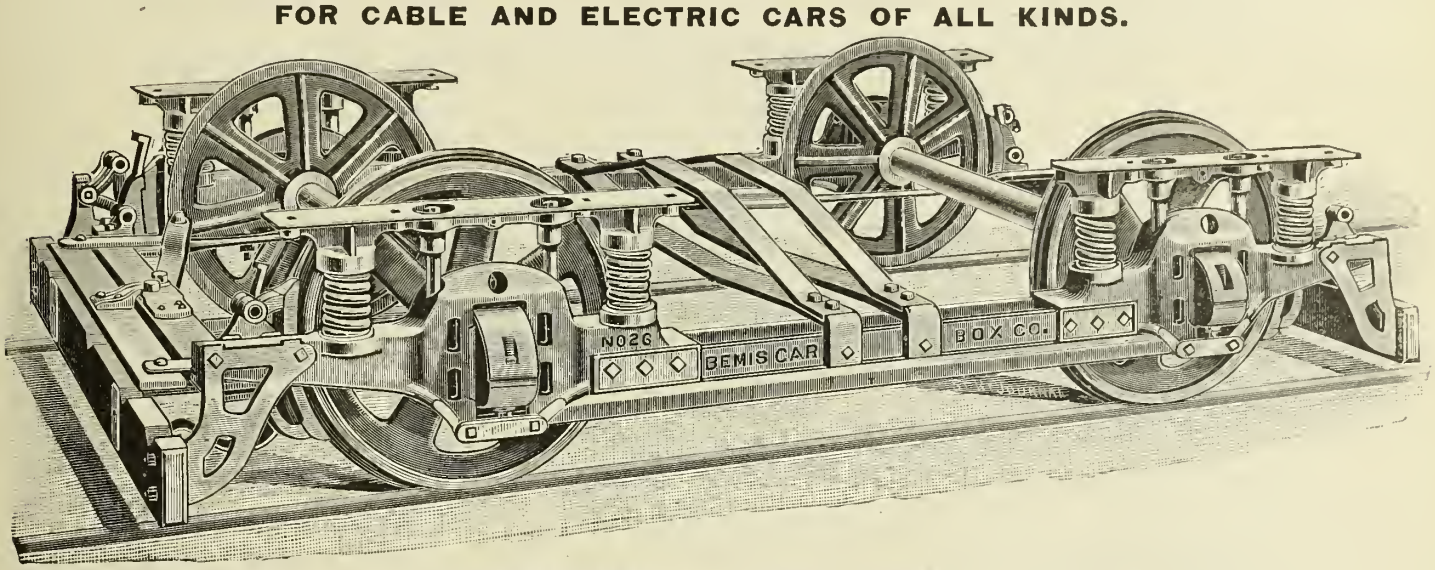
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— MANUFACTURERS OF —

THE BEMIS PATENT TRUCKS,

FOR CABLE AND ELECTRIC CARS OF ALL KINDS.

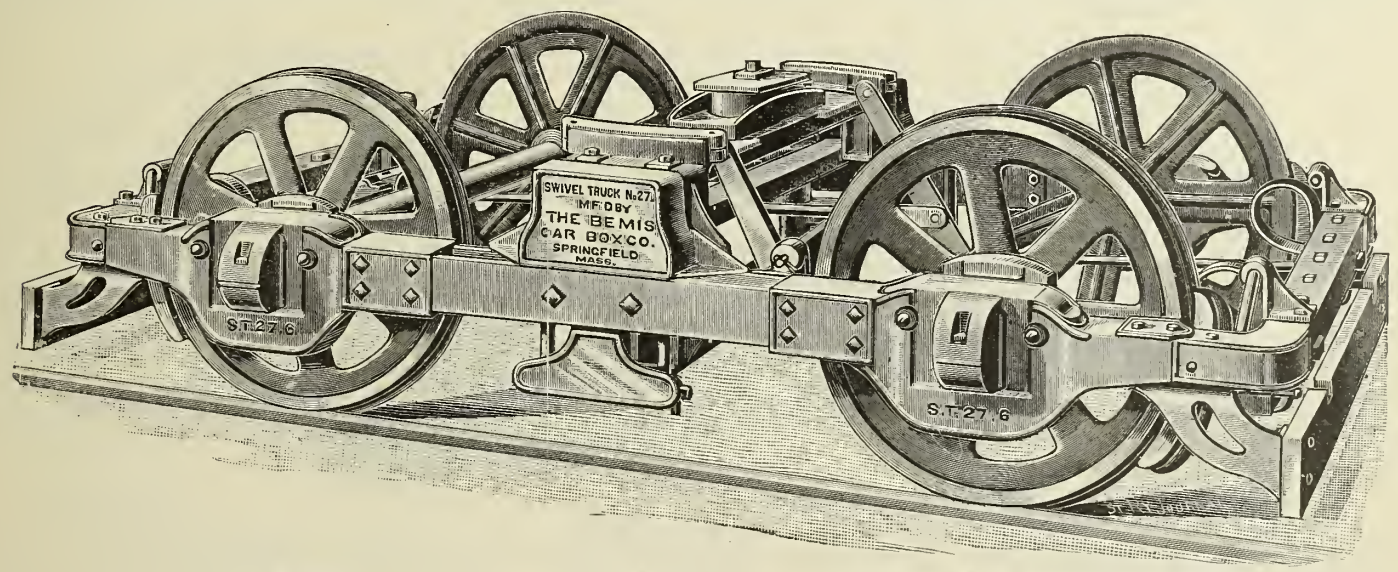


OUR NEW ELECTRIC TRUCK No. 26.

BOTH SINGLE AND DOUBLE TRUCK.

EVERY PART EASY OF ACCESS.

THOROUGHLY AND SUBSTANTIALLY BUILT.



Our New Electric Truck No. 27, for use with one or two motors for eight-wheel cars.

Special attention in construction is paid to the easy removal of all parts subject to wear, and which require replacing.

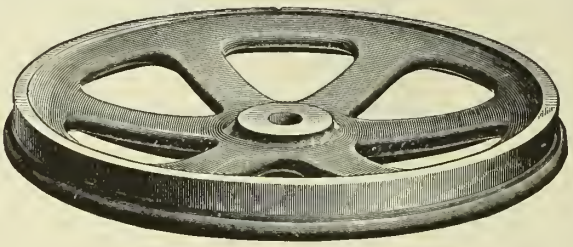
BEMIS CAR BOX CO.,

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"MACHINED" STREET CAR WHEELS

ALL WHEELS ARE BORED IN THE HUB, GROUND ABSOLUTELY TRUE ON THE TREAD AND BALANCED. THEY ARE GUARANTEED TRUE TO ONE SIXTY-FOURTH OF AN INCH.

In any kind of service, and particularly under the heavy electrical equipment of to-day, the use of perfectly true wheels is a most important consideration.



They result in smooth running cars, better contact with rails for passage of return current, quicker stops and increased mileage. We have thousands in use on all leading street railways of the country with most satisfactory results.

ALL WHEELS MADE UNDER OUR SYSTEM OF COMPARATIVE TESTS.

Wheels fitted to axles for Electrical Equipment to meet requirements of Thomson-Houston, Edison General, Short, Westinghouse and other companies. Our plant for turning out the very finest class of work promptly is complete, and we solicit your orders.

Repair Work of Every Description on Wheels and Axles done at short notice and at Reasonable Prices.

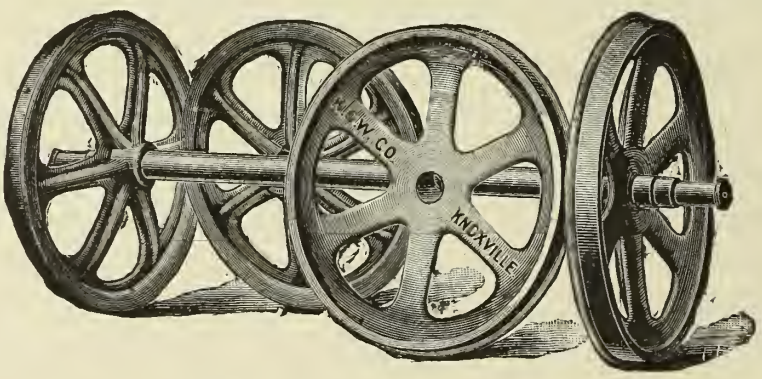
NEW YORK CAR WHEEL WORKS, BUFFALO, N. Y.

JOS. R. ELLICOTT, Gen. Agt.,
115 Broadway, New York.

P. H. GRIFFIN, Pres't,
Buffalo, N. Y.

KNOXVILLE CAR WHEEL CO.,

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CHILLED CAST IRON CAR WHEELS

FOR

Street Railways, Dummy Lines and Electric Cars.

WHEELS FITTED ON AXLES. **CORRESPONDENCE SOLICITED.**

SOLID STEEL WHEELS

FOR ELECTRIC AND CABLE CARS,

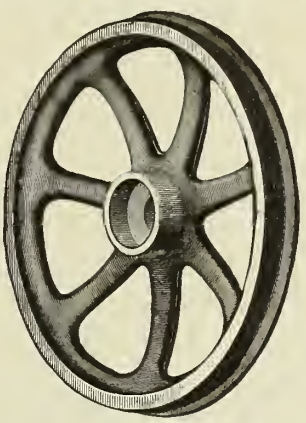
—MANUFACTURED BY THE—

AMERICAN STEEL WHEEL CO.,

JOHN C. PAUL, Pres't. SAMUEL GARWOOD, V. Pres. W. W. WHITCOMB, Sec'y & Treas. W. G. RICHARDS, Supt.

UNDER PATENTS COVERING AN ENTIRELY NEW AND IMPROVED PROCESS.

THIS METAL IS ESPECIALLY ADAPTED TO ELECTRIC CAR SERVICE, OWING TO THE INCREASED TRACTION GIVING THE MOTOR ADDITIONAL POWER.



WE CLAIM FOR THESE WHEELS: GREATLY INCREASED STRENGTH, CLOSER ADHESION TO THE RAIL AND EXCESS OF MILEAGE.

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J. C. BEACH, Vice-President, 31 Broadway, New York.

ALLEN PAPER CAR WHEEL CO.



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WORKS AT

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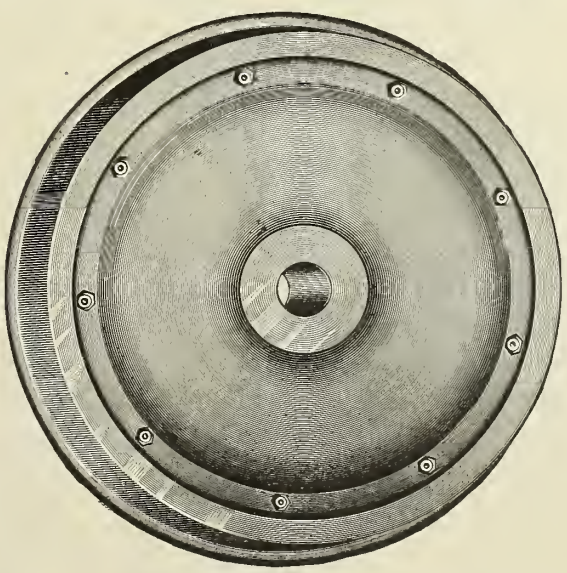
AND

PULLMAN, ILL.

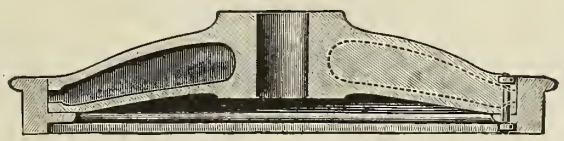
MANUFACTURERS

—OF—

STANDARD



STEEL TIRED

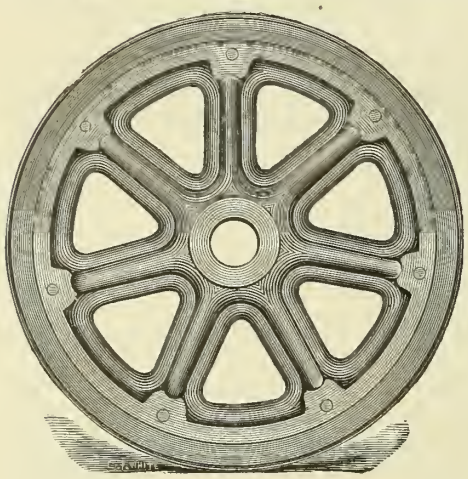


Noiseless Wheels

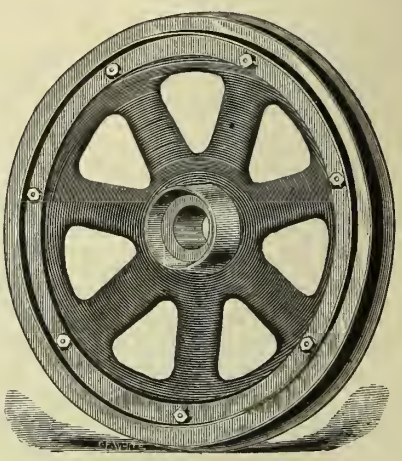
ESPECIALLY ADAPTED FOR USE ON ELECTRIC MOTORS AND CABLE CARS.

Absolute Safety and Ultimate Economy Guaranteed. **Correspondence Solicited.**

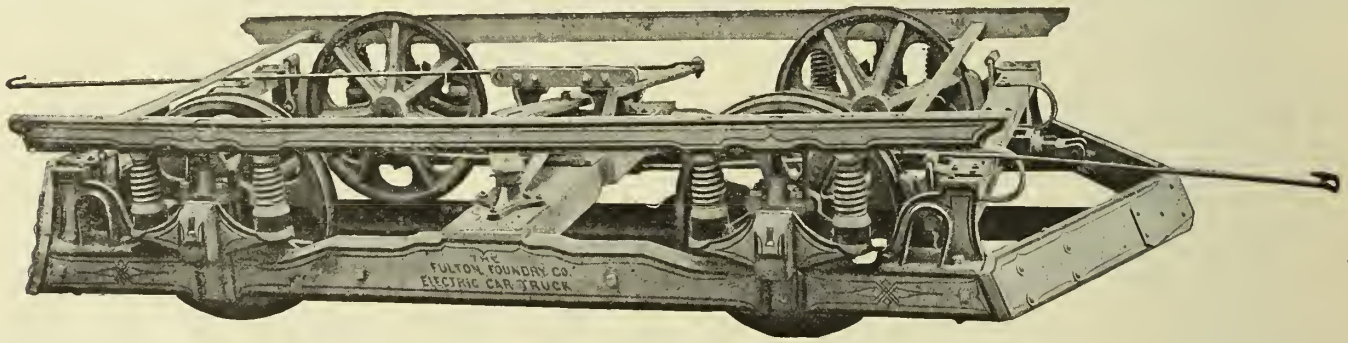
A GREAT SUCCESS



It Will Outwear Any Five Wheels of Any Other Kind.



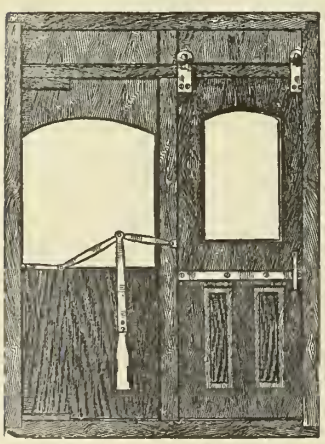
Acknowledged by Managers of the Leading Street Railroads of this country, who have seen it, that it is the Best and Cheapest Wheel for Electric Motors made in this country.

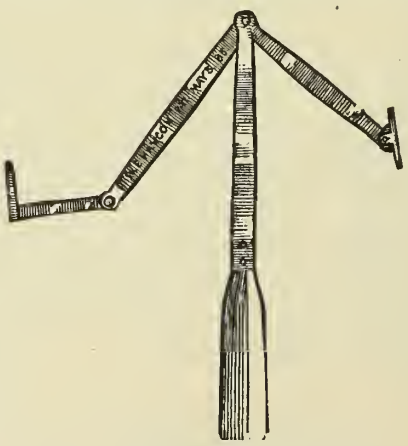


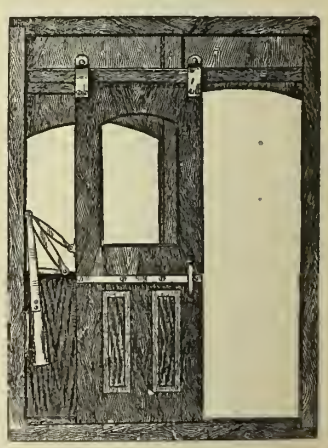
NEW ELECTRIC CAR TRUCK.

STREET RAILWAY SUPPLIES.

Carpenter's Patent Turn-tables. Carpenter's Transfer Tables. Dealers in all kinds of Girder, Side Bearing or T Rails. Wheels and Axles of all Sizes Fitted Promptly. Curve Rail, Turn-outs, Cross-overs, Joint Plates, Rail Fastenings, Spikes.







HAYCOX PATENT DOOR FASTENER.

MOTOR SUPPLIES.

Split Gear, Iron and Steel Mixture. Intermediate Gear, Iron and Steel Mixture. Intermediate Pinion, Bronze or Steel. Armature Pinion, Bronze or Steel. Brass or Bronze Bushings. Brass or Bronze Bearings.

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THE FULTON FOUNDRY CO.,

202 Merwin Street, CLEVELAND, O.

W. S. G. BAKER, President and Treasurer. J. PAUL BAKER, Secretary.

THE BALTIMORE CAR WHEEL COMPANY,

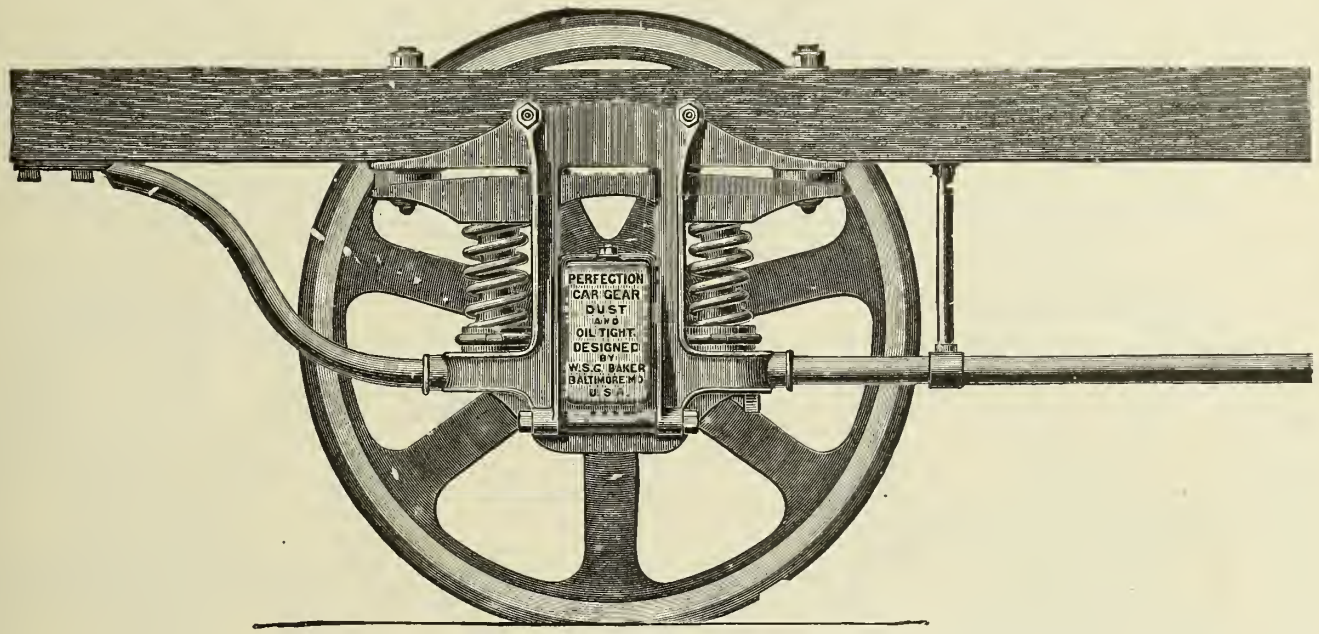
MANUFACTURERS OF

CHILLED WHEELS

Of ALL PATTERNS AND SIZES, for EVERY SERVICE and WITH or WITHOUT AXLES.

CAPACITY, 400 WHEELS PER DAY.

AND FLEXIBLE SUSPENDED CAR GEAR.

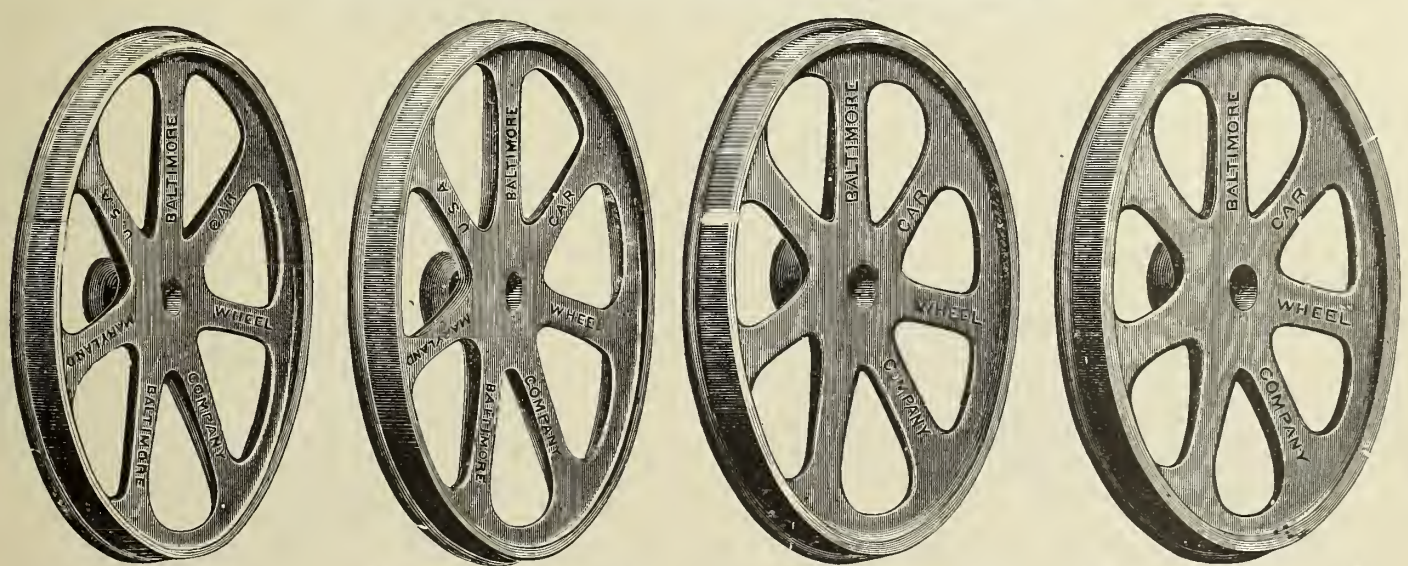


ADVANTAGES.

Absolute exclusion of dust, and retention of oil, economy of oil, no waste packing, durability of bearings and journals, with one oiling in twelve months, bearings and journals will last ten years. Easy riding, loaded or unloaded, long spring range, and perfect insulation without objectionable spring-bolts. Economy in and facilities for repairs. Flexibility, enabling a car to pass through curves as easily as upon straight track, consequently saving horse-flesh.

Adopted as Standard by the Leading Roads of the World.

STREET CAR WHEELS.



FOR LIGHT ONE-HORSE CAR. 140 Pounds.

FOR HEAVY ONE-HORSE CAR. 160 Pounds.

FOR LIGHT TWO-HORSE CAR. 180 Pounds.

FOR HEAVY TWO-HORSE CAR 200 Pounds.

OFFICE: FULTON JUNCTION, BALTIMORE, MD., U. S. A.

GLOBE IRON WORKS,

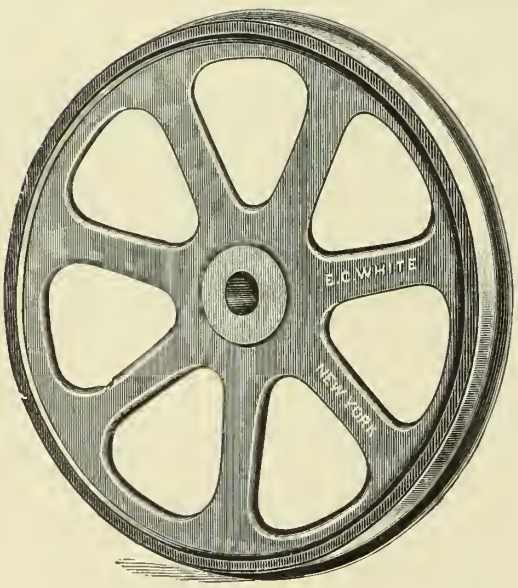
ESTABLISHED BY M. M. WHITE & CO., 1857.

EDWARD C. WHITE,

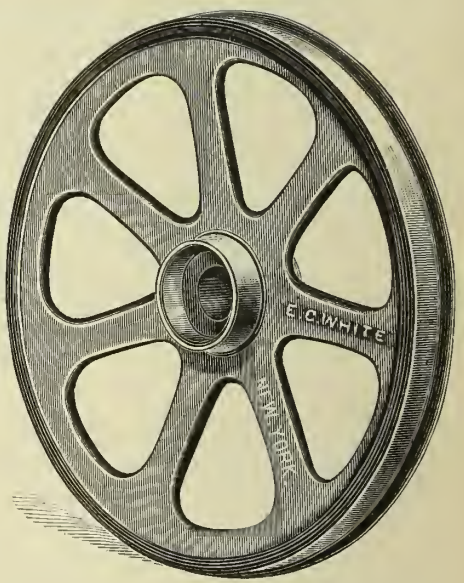
—MANUFACTURER OF—

CHILLED STREET CAR WHEELS,



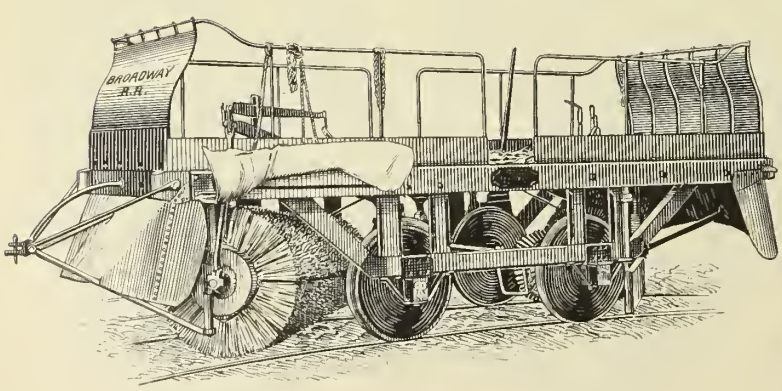


FOR HORSE CABLE AND ELECTRIC POWER.



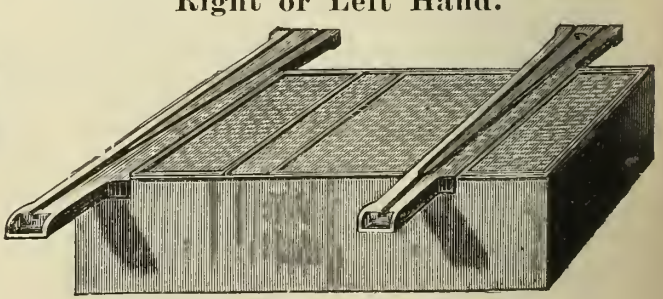
IMPROVED SWEEPER.

With Cylinder Broom and Plow Attachment. Adapted to all Classes of Street Railway Service.



AUTOMATIC SWITCH.

Right or Left Hand.



OFFICE AND WORKS:

556 West 34th St., - NEW YORK.

ROCHESTER CAR WHEEL WORKS

MAKE

STREET CAR WHEELS

FROM

SALISBURY IRON

IN THE

BARR CONTRACTING CHILL.

THE ONLY METHOD

Of casting chilled iron wheels in which the chill is in any sense under the moulder's control. This improved method produces

ROUND WHEELS. { CAST ROUND. / NOT GROUND ROUND.

UNIFORMITY IN DEPTH OF CHILL ALL AROUND THE WHEEL.

Two points of vital importance when roads are operated with power—either electric or cable.

GROUND TREADS.—Our wheels are slightly ground on the tread to remove the burs or ridges left by the contracting chill, but no appreciable portion of the chill is taken off.

F. D. RUSSELL,

General Manager Street Car Wheel Department.

ROCHESTER CAR WHEEL WORKS.

CHARLES T. CHAPIN, President and Treasurer.

CHARLES W. BARNUM, Vice-President, Lime Rock, Conn.

EDWARD B. BURGESS, Secretary.

Office and Works, EAST ROCHESTER.

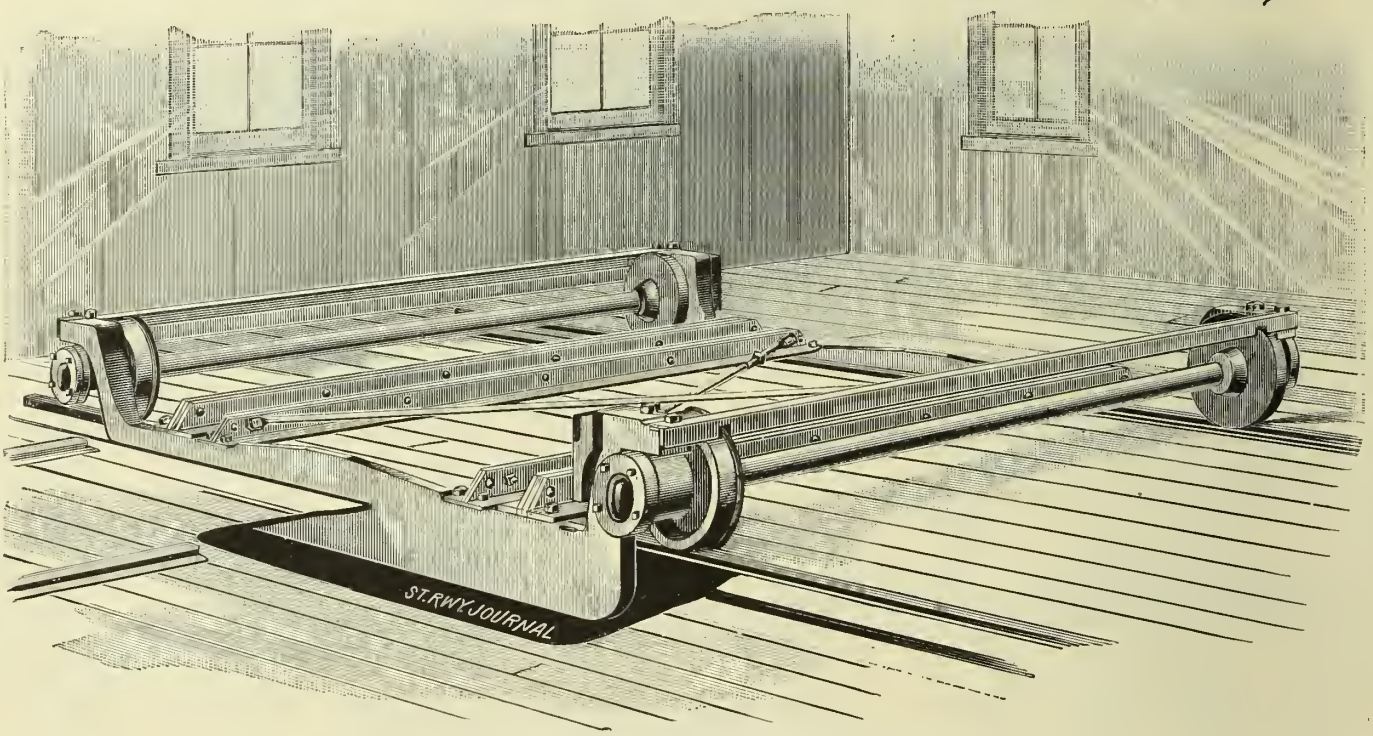
New York Office and Wheel Fitting Shop, 222 EAST 28th STREET.

DORNER & DUTTON,

CLEVELAND, O.

MANUFACTURERS OF STREET CAR WHEELS,

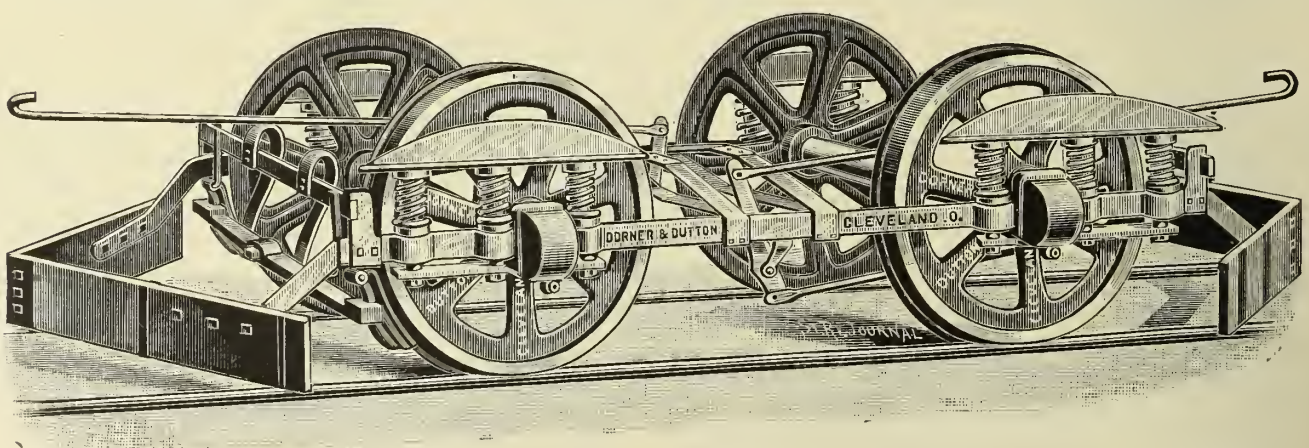
FORGED AND ROLLED AXLES,



C. HATHAWAY'S PATENT TRANSFER TABLE.

Roller and Brass Bearing Journal Boxes,

ELECTRIC MOTOR TRUCKS, GEARS AND PINIONS.



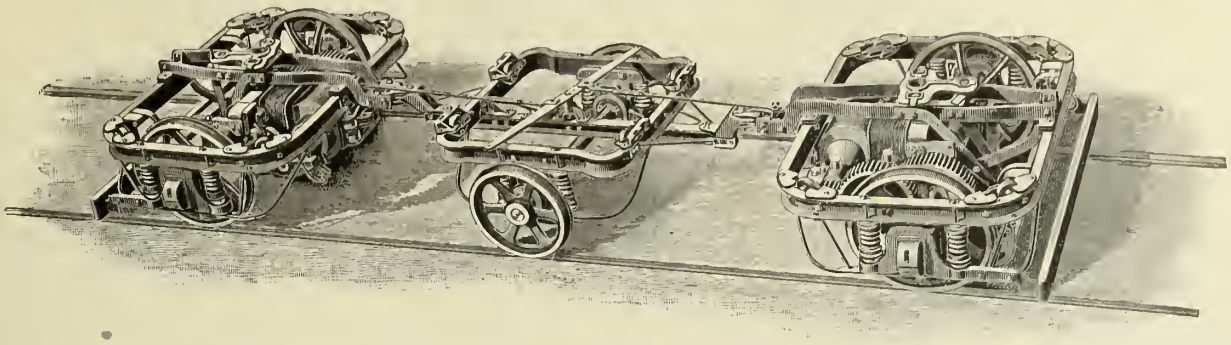
Du Pont Patent Motor Truck, Manufactured by Dorner & Dutton, Cleveland, O.

Track Cleaners, Turn Tables, Transfer Tables

ALL KINDS OF CASTINGS AND FORGINGS.

Sole Manufacturers of the Clarke Patent Track Cleaners.

ROBINSON RADIAL TRUCK



FOR ALL STANDARD MOTORS.

WEST END STREET RAILWAY COMPANY.
ELECTRIC DEPARTMENT,

WILLIAM ROBINSON, Esq., 180 Summer St., Boston.

81 MILK ST., BOSTON, October 7, 1891.

Dear Sir:—Some time ago we made a test with a Robinson Radial car in Cambridge, to determine whether it would be possible to operate a car of this sort with one motor. In order to make the test, one of the motors was disconnected and the axle gearing taken off, so that the car was operated entirely by a single S. R. G. Thomson-Houston motor of 15 H. P.

We had no difficulty in making time over the Cambridge line, at one point of which there is a 6½ per cent. grade. During the test the car was loaded with 15,000 lbs of meal, which is equivalent in weight to a maximum load of passengers.

From the Tests it was shown that enough traction can be obtained from one pair of wheels, with the Robinson Truck, to operate under all conditions of travel which might arise in the summer months.

Yours truly, F. S. PEARSON, Chief Eng'r Steam and Electrical Dep't.

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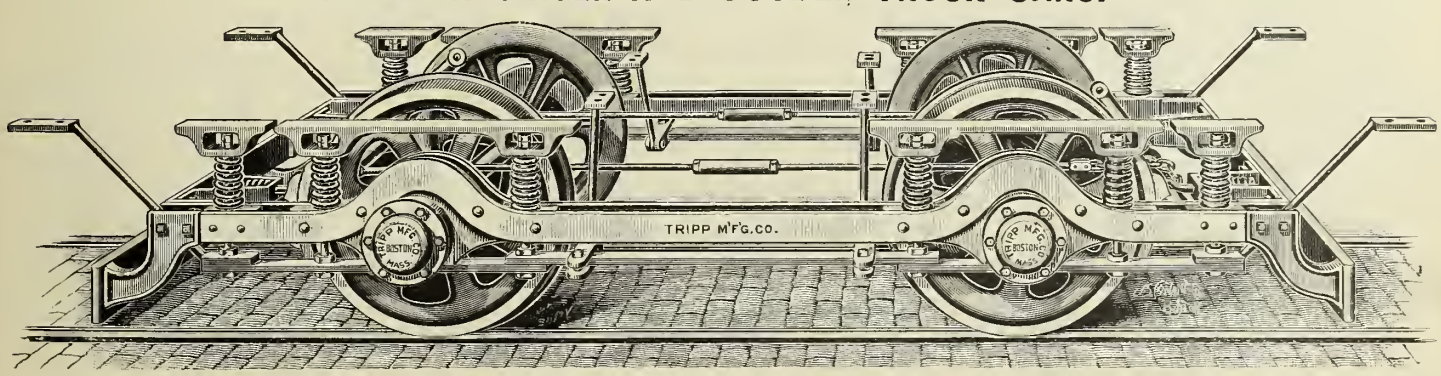
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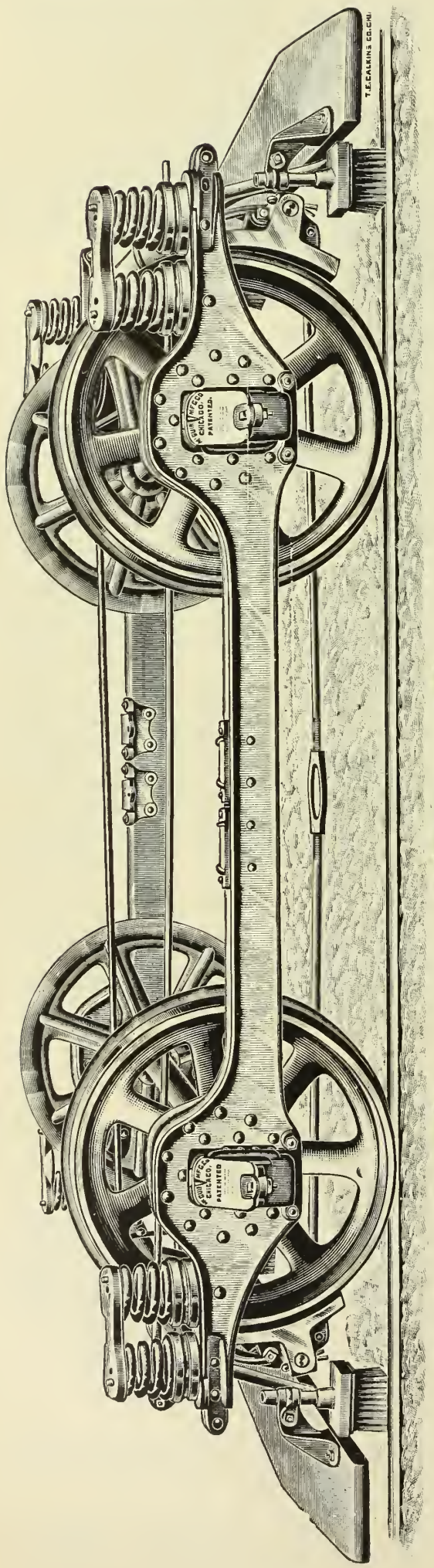


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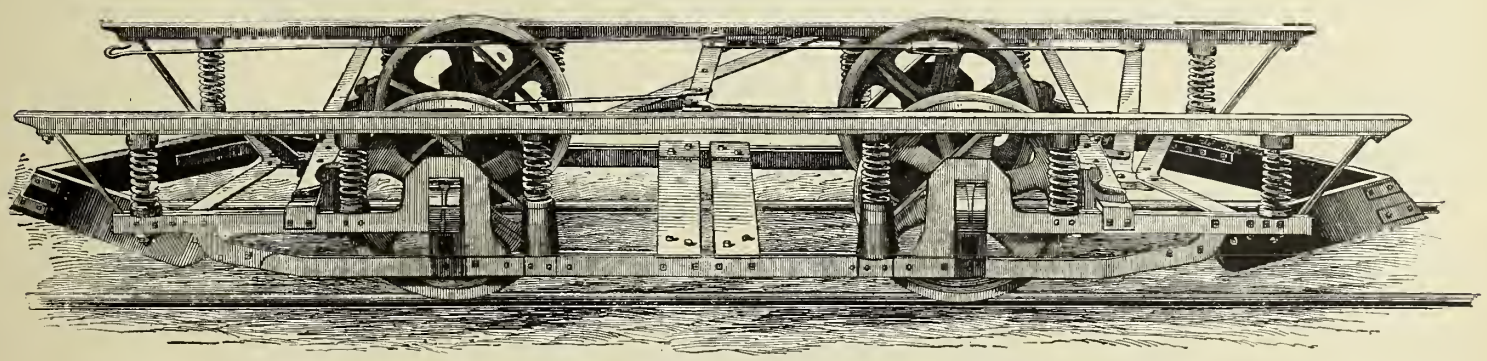
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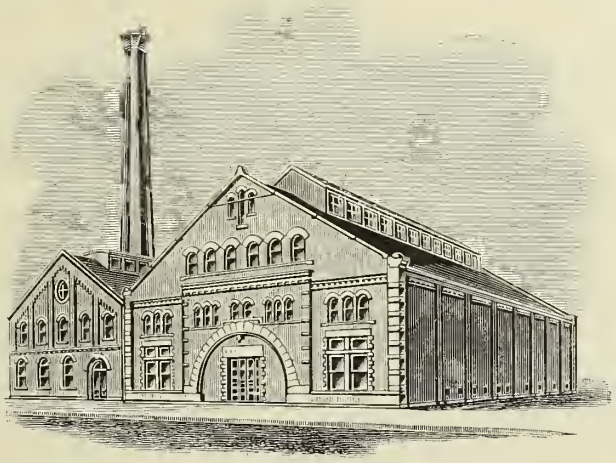
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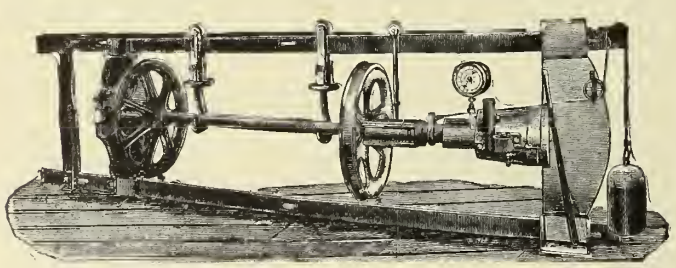
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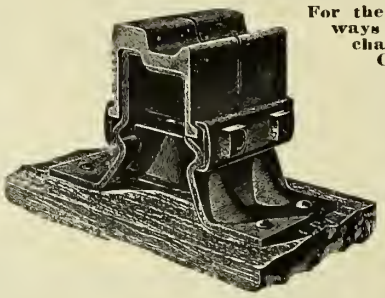
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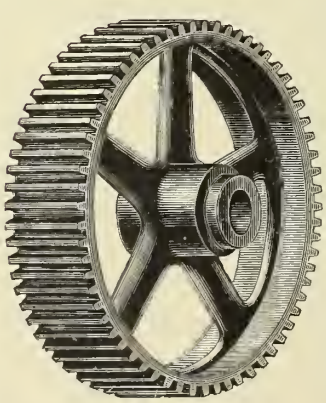
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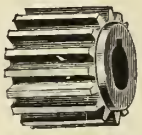
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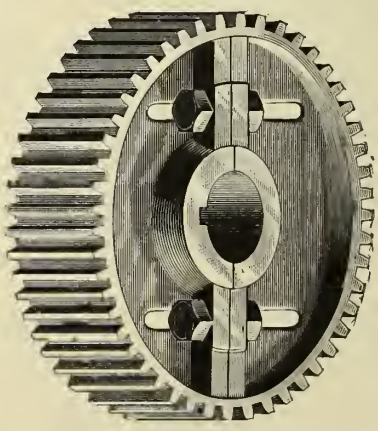
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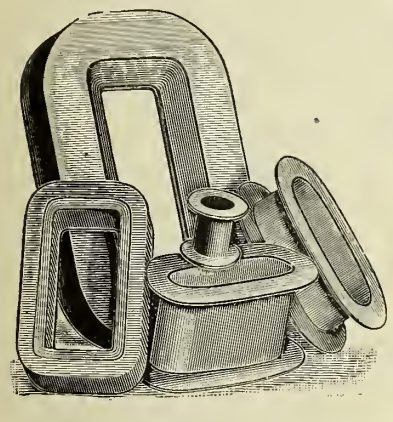
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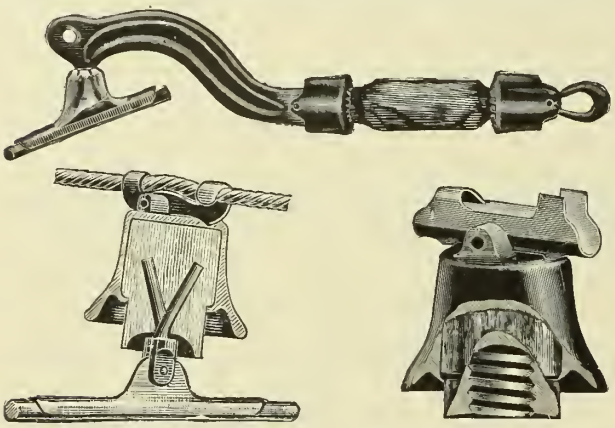
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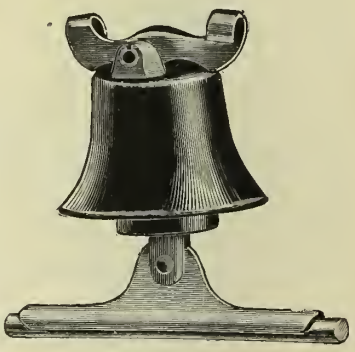
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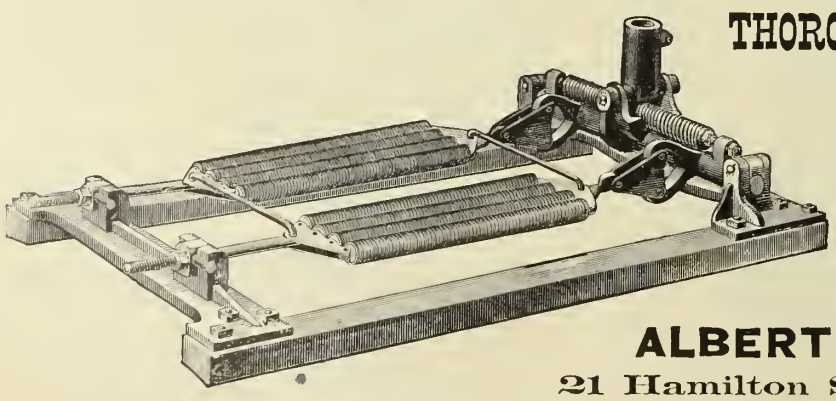
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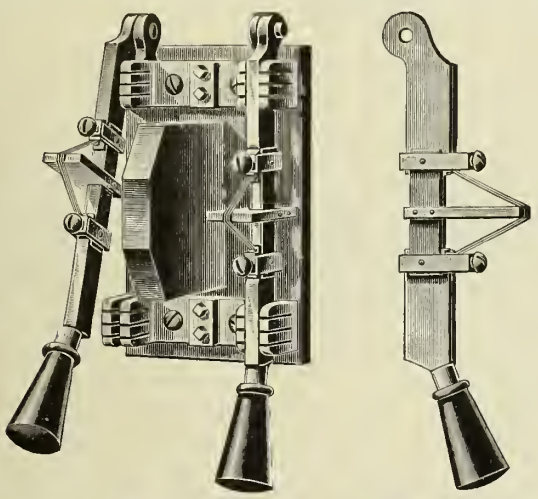
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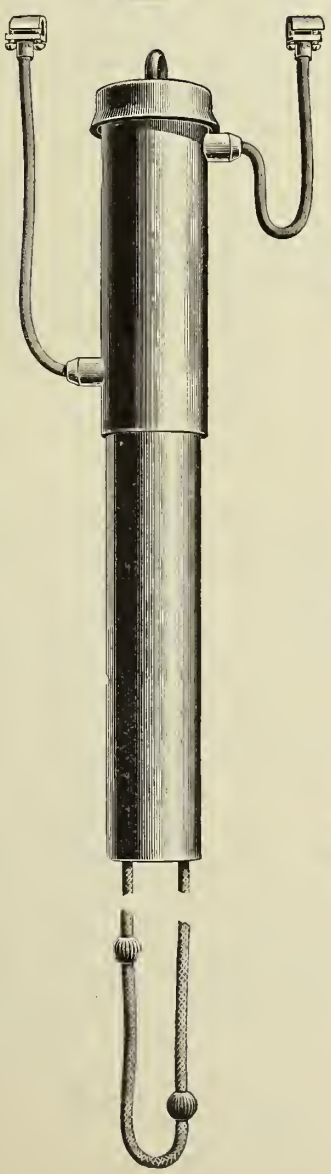
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CLEVELAND SECTION SWITCH,

FOR POLE USE. NON-FLASHING.

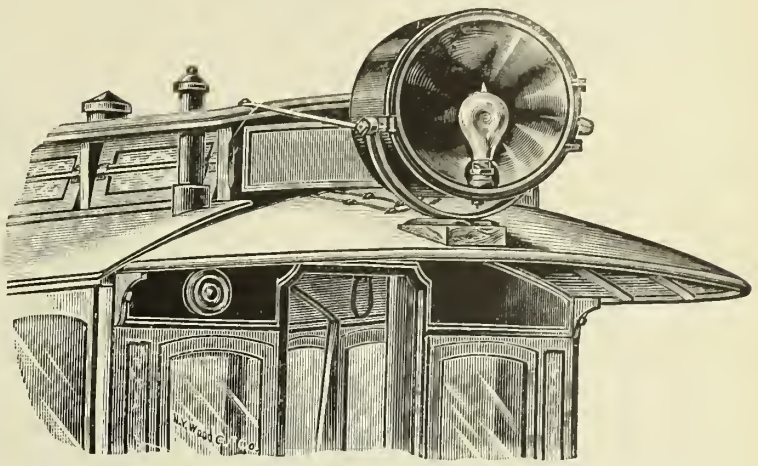


Forest City Electric Works,

GENEVA, O.

SUPPLIES FOR ANY SYSTEM!

ELECTRIC AND OIL HEADLIGHTS, all parts interchangeable.
CHANGEABLE PILOT LIGHTS, Three Colors.
WEATHERPROOF LINE WIRE.
SILICON BRONZE TROLLEY WIRE.
LINE APPLIANCES FOR ANY SYSTEM.



OIL CUPS FOR MOTOR BEARINGS, will run 4 days without refilling
DOUBLE FUSIBLE CUT-OUT BOXES Saves Armature.
HARD AND SOFT DRAWN COPPER WIRE.
MAGNET WIRE. MOTOR COVERS.
Materials of all Description Used in Connection with Street Railways

AT REASONABLE PRICES.

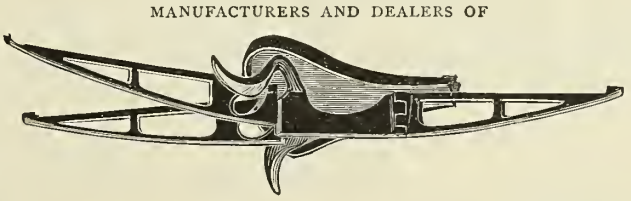
Send us specifications for goods required and we will quote you figures that will secure the order. We send out nothing but the best material.

CHAS. M. RUMRILL,
109 LIBERTY ST., NEW YORK.

Our Motor Covers have been adopted by the Edison Co., and are also largely used by T.-H. roads. Oil cups in use on over fifty railways.

Pierce Bros. & Co.

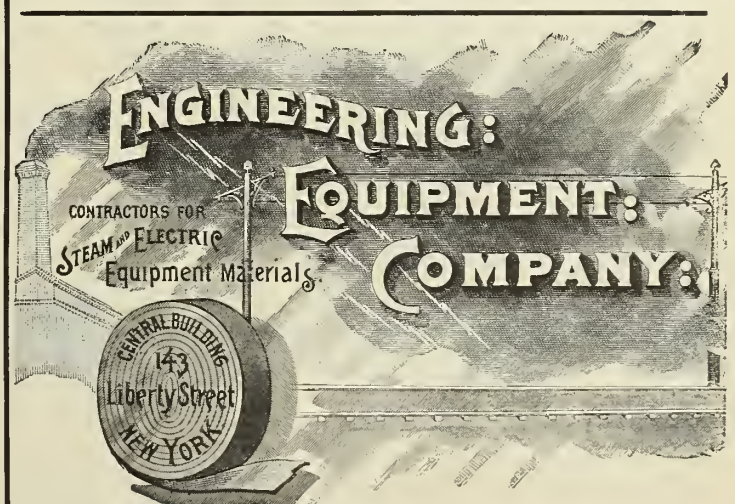
MANUFACTURERS AND DEALERS OF



Electric Railway Supplies,

LEOMINSTER, MASS.

Send for Illustrated Circular and Price List.



143 Liberty St., New York. 126 Pearl St., Boston.

HEADQUARTERS

GEARS.

PINIONS.

BEARINGS.

NUTTALL TROLLEY.

Trolley Wheels and Parts.

Rawhide Pinions.

R. D. NUTTALL COMPANY,

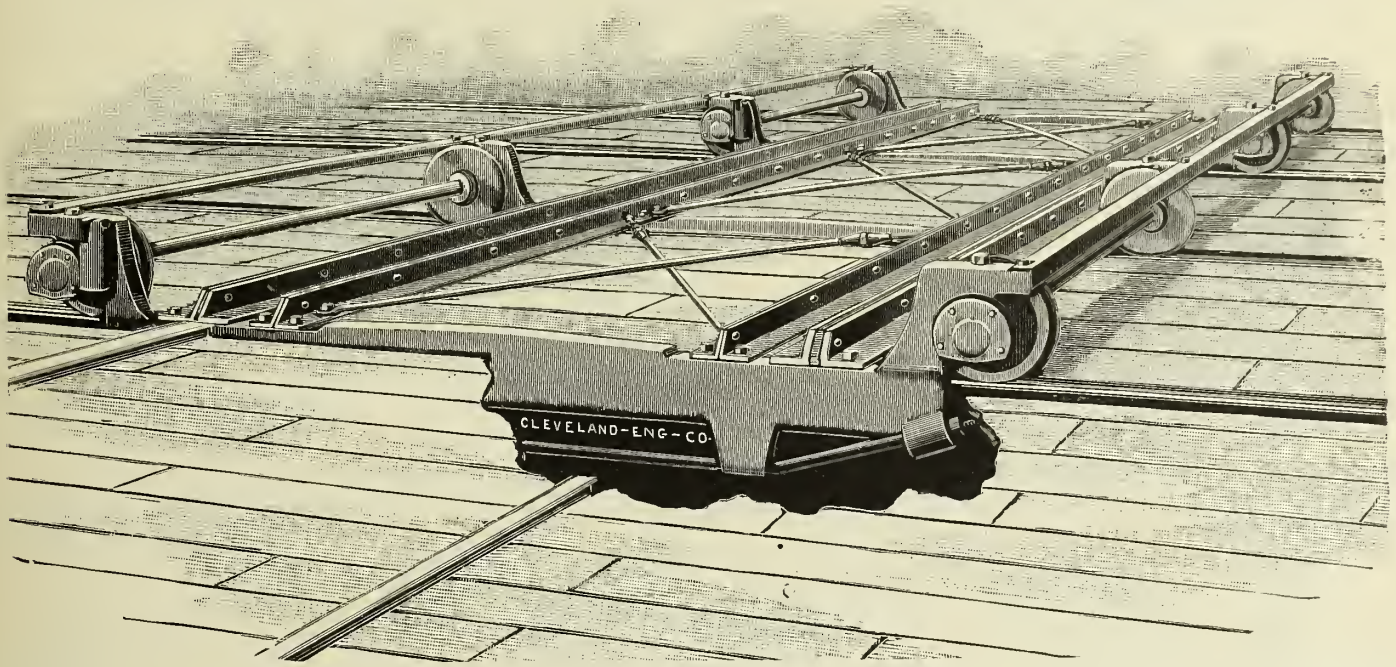
ALLEGHENY, PA.

ALFRED G. HATHAWAY.

SOLE MANUFACTURER OF THE

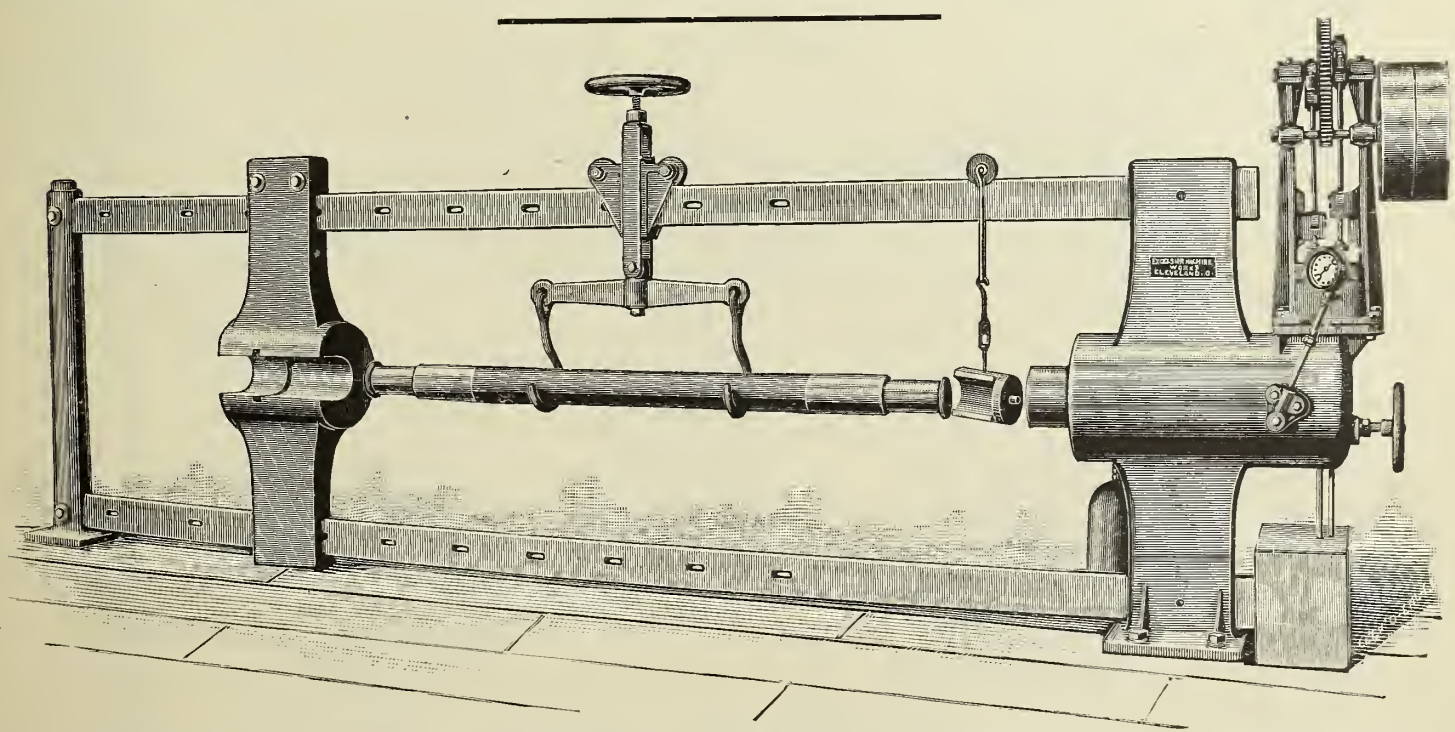
C. Hathaway Patent Transfer Tables,

14 Case Block, Cleveland, O.,



Keeps constantly on hand a large supply of Rails, Spikes, Switch Castings and Street Railway Material.

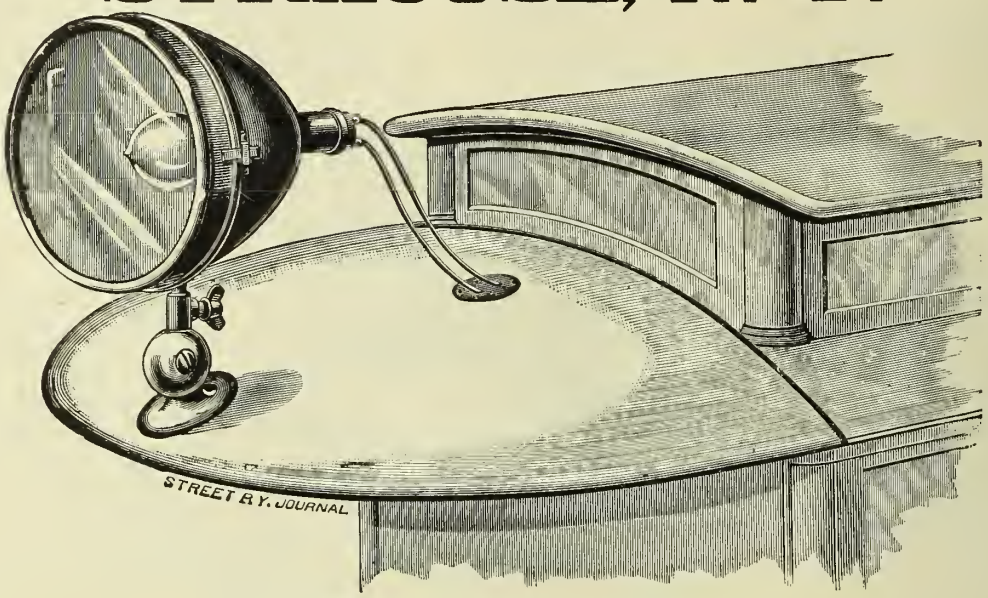
ALSO MANUFACTURES THE LATEST IMPROVED TURN TABLE.



A FULL LINE OF WHEEL PRESSES, PUNCHES, SHEARS, AND MACHINIST TOOLS KEPT IN STOCK.

STEAM GAUGE & LANTERN CO.

SYRACUSE, N. Y.



MANUFACTURERS OF

Electric Car and Cable Car Headlights.

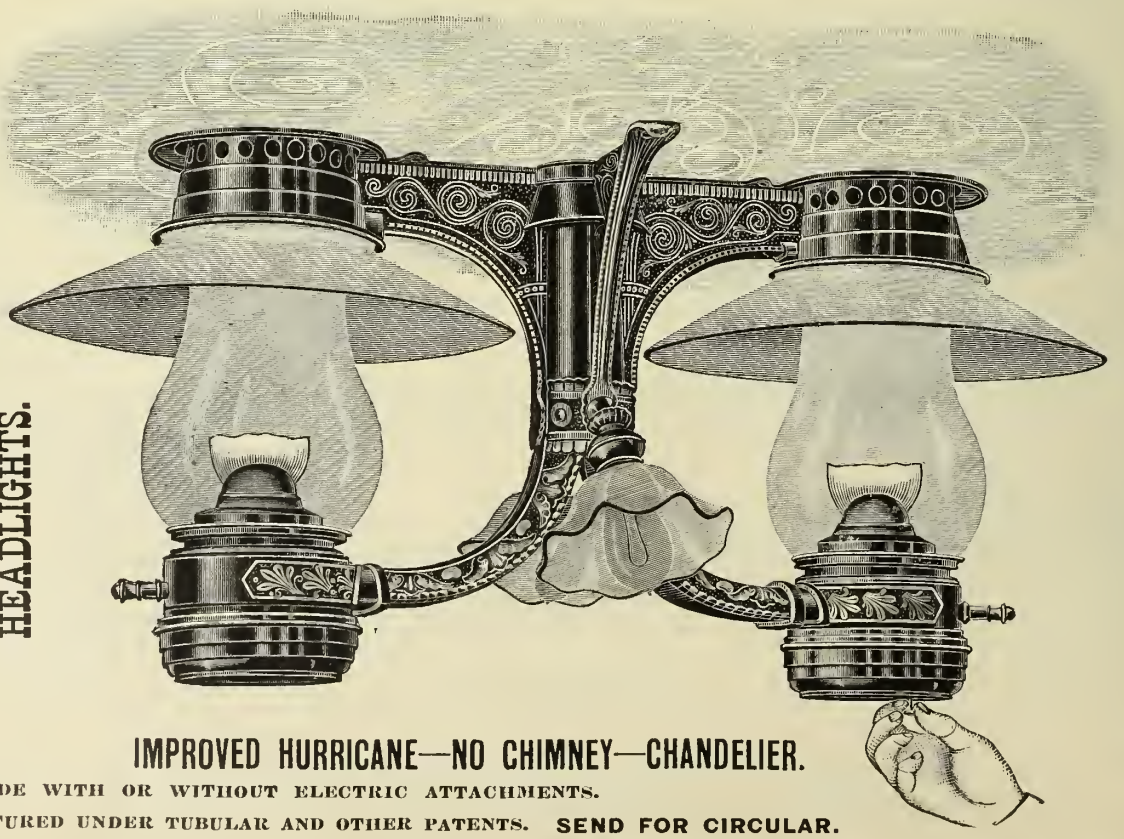
TUBULAR LAMPS FOR STREET CAR STATIONS.

Illustrations Sent on Application.

THE DAYTON MANUFACTURING COMPANY,

— DAYTON, OHIO. —

MANUFACTURERS OF
STREET CAR TRIMMINGS, LAMPS AND HEADLIGHTS.



DEALERS IN
CAR FURNISHINGS.

IMPROVED HURRICANE—NO CHIMNEY—CHANDELIER.

MADE WITH OR WITHOUT ELECTRIC ATTACHMENTS.

MANUFACTURED UNDER TUBULAR AND OTHER PATENTS. SEND FOR CIRCULAR.

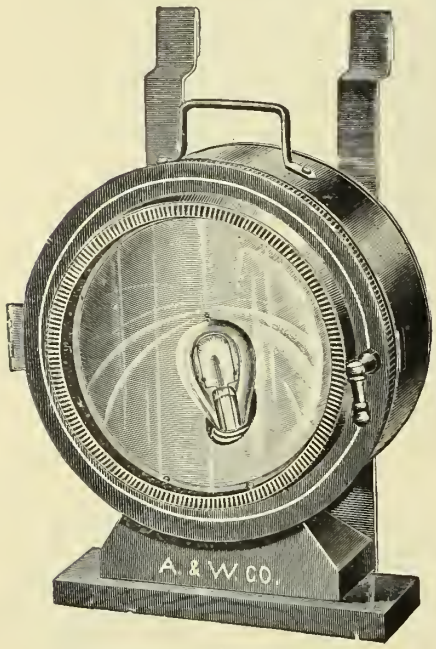
SMITH OF NEW YORK.



THE

ADAMS & WESTLAKE CO.,

CHICAGO, ILL.



STYLE "A" HEADLIGHT.
Made with 8, 10, 12 or 13½ in. Reflectors.

WE MANUFACTURE

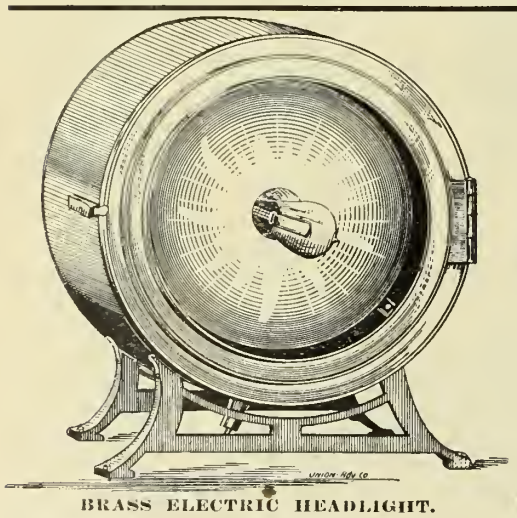
HEADLIGHTS,
CENTER LAMPS,
AND HOOD LIGHTS

FOR ELECTRIC, CABLE AND STREET RAILWAYS.

WE CARRY IN STOCK A COMPLETE LINE OF CHIMNEYS, BURNERS, WICK AND GLOBES.

Circular illustrating the latest designs in electric and oil headlights and fixtures, furnished upon application.

Main Office and Works, Chicago, Ill. **Eastern Office. 115 Broadway, New York.**



BRASS ELECTRIC HEADLIGHT.

THE

Star Headlight Co.

Office and Factory, 13 Allen St., Rochester, N. Y.

MANUFACTURERS OF

HEADLIGHTS

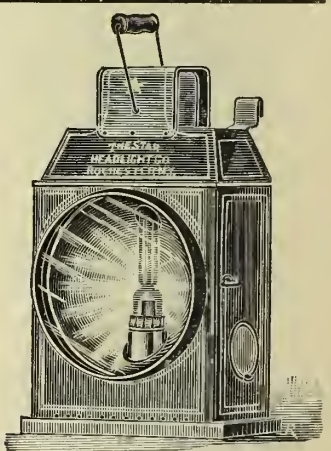
OF ALL DESCRIPTIONS.

—AGENTS:—

F. O. DEWEY CO., Boston. H. F. LOVELL, New York.
WM. C. PULLMAN, Chicago. JULIUS LEFMANN, St. Louis.
J. R. LEHMER, Omaha.
R. C. HOFFMAN & CO., Firemen's B'ld'g, Balt., Md.

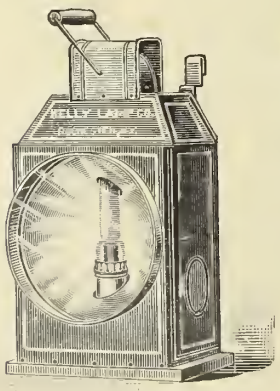
SEND FOR SAMPLES. CORRESPONDENCE SOLICITED.

☞ Information and Prices Sent on Application. ☜



10 in. SQUARE KEROSENE HEADLIGHT.

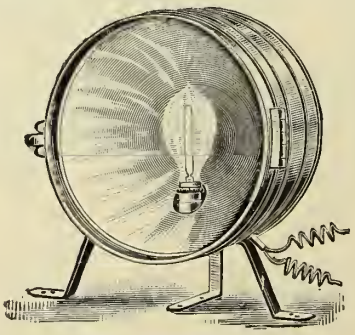
KELLY LAMP CO., Rochester, N. Y.



Standard Square Headlight.

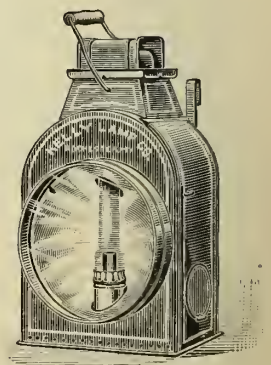
Manufacturers of

CABLE and MOTOR CAR HEADLIGHTS.



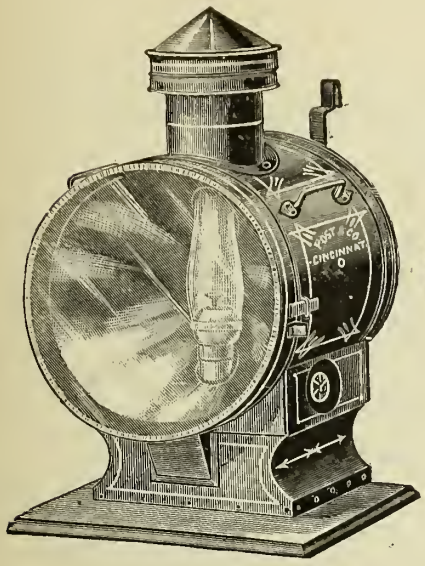
Electric Headlight.

Burners, Chimneys, Wicks, ETC.



The Kelly Oval-Top Headlight.

PRICES OR OTHER INFORMATION FURNISHED ON APPLICATION.



No. 2.

The Most

Substantial

HEADLIGHTS

Of their Class

—IN—

The Market.

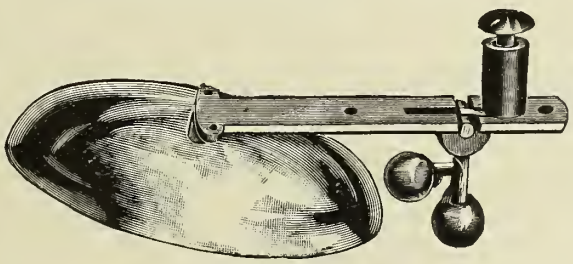


STANDARD, or No. 1.

POST & CO., Cincinnati, Ohio, U. S. A.

MAKERS OF

Street Car Lamps,



Headlights, Gongs,

Patent Applied For.
No. 4.
PLATFORM or FOOT PUSH GONG.
Simple, Compact and Durable.

And Trimmings of All Kinds.

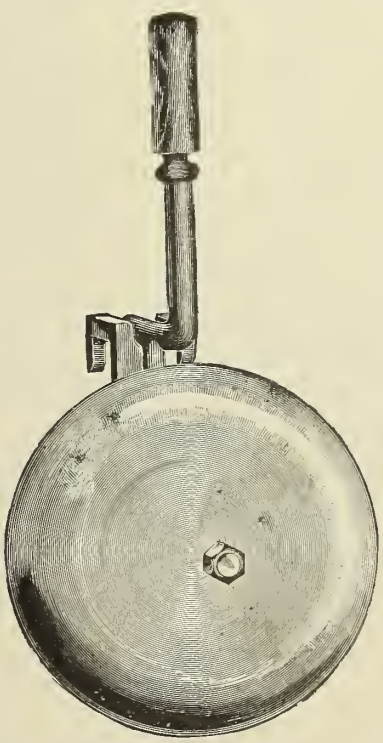


No. 37.
END LAMP.



No. 50.
END LAMP.

THESE ARE DESIRABLE SUBSTITUTES FOR END BOX LAMPS.



Patent Applied For.
No. 5.
DASH GONG.



THE

MEAKER

PORTABLE and STATIONARY REGISTERS

SIMPLE! DURABLE! RELIABLE!

THIS is a Double Register, being so constructed that the statement (settlement numbers) may be visible or not, at will, by the simple use of a key. It is impossible to change the direction signal without cancelling the fares recorded at the trip window, and said cancellers can only be removed by a return to zero. It is also impossible to ring the bell without registering, or register without ringing the bell. The pull cords will be placed on both sides of the car, without extra charge, if desired. The machine is made strong in all its parts, and being constructed without wheels, is not subject to the same wear as cogged devices.



THE IMPROVED STATIONARY.

Our Registers have been adopted by over Sixty Street Railway Companies. For Reference, Terms, Etc., address

THIS Register can be read correctly from any part of the car.

Fac-simile of Figures Used.



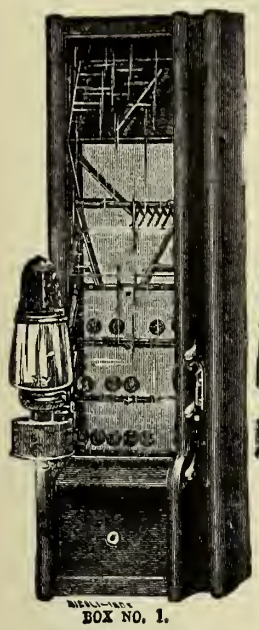
MEAKER MANUFACTURING CO.,

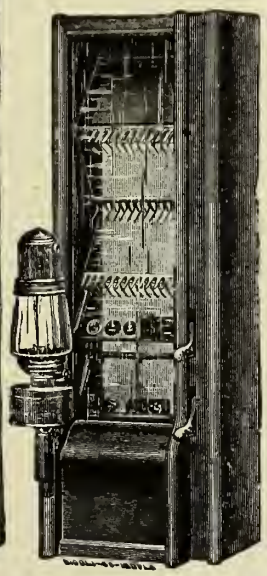
134 WEST WASHINGTON STREET,

CHICAGO.

Successors to Railway Register Company.

TOM L. JOHNSON'S
NOW
St. Louis Car Company's
IMPROVED FARE BOX.


BOX NO. 1.


BOX NO. 2.

Patented Oct. 14, 1873.

CHEAPEST AND BEST.

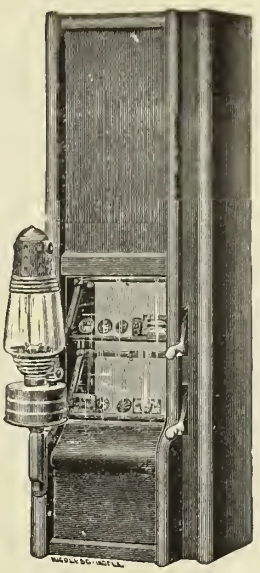
Fares Cannot be Extracted or boxes Robbed without violence.

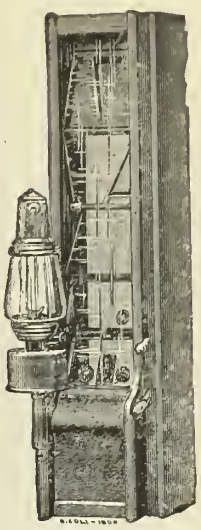
Roads Equipped with Boxes on Trial, and if not satisfactory, returned without any expense to the company trying them.

Ornamental to any Car.

Special Sizes built to order.

NOTICE.—All parties are cautioned against using fare boxes recently placed on the market which are direct infringements on our patents.


BOX NO. 3.


CHARIOT PATTERN.

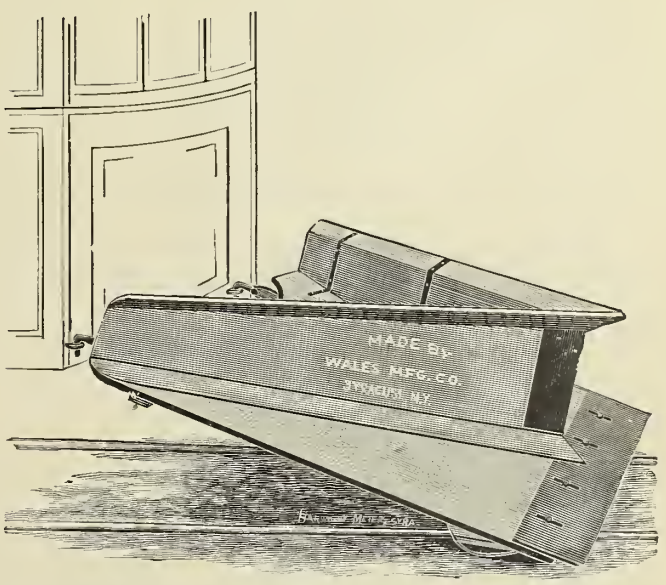
REDUCED PRICES. **Write for Descriptive Circular and Price List**

St. Louis Car Company,

MANUFACTURERS OF ALL KINDS OF HORSE, ELECTRIC, CABLE AND ALL OTHER MOTOR CARS.

3023 North Broadway, St. Louis, Mo.





SNOW PLOW

For Cable and Electric Roads.

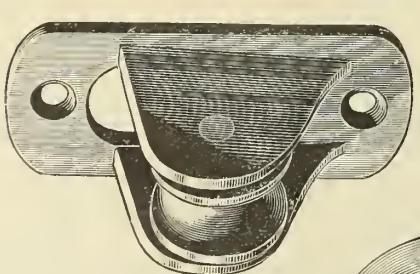
WALES MFG. CO., SYRACUSE, N. Y.



(THIS CUT IS ABOUT HALF SIZE.)

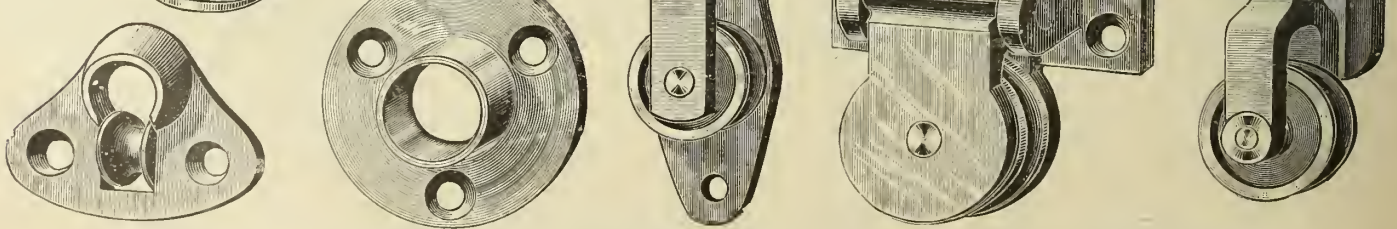
THE STANDARD

Is the best register for recording fares on street cars, because it gives two reports, one on the face and one inside, inaccessible to the conductor. The inside report is perforated on a paper dial, divided into trips, and is removed at the end of each day and compared with the returns, thus making a positive check on all who handle the fares. Our registers have been used for years all over the United States, South America, Europe and elsewhere.



REGISTER TRIMMINGS.

In Bronze and Coppered Iron; also Round Belting.



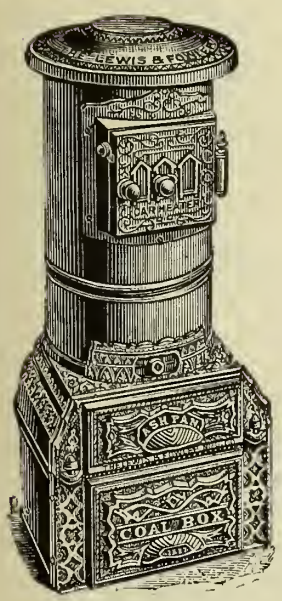
STANDARD INDEX & REGISTER CO., 138 Fulton St., New York.

JOHN W. FOWLER, Prest. DANIEL F. LEWIS, Treas.

THE

LEWIS & FOWLER MFG. CO.

BROOKLYN, N. Y., U. S. A.



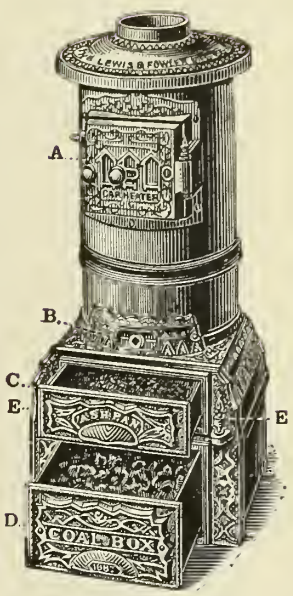
FOWLER'S

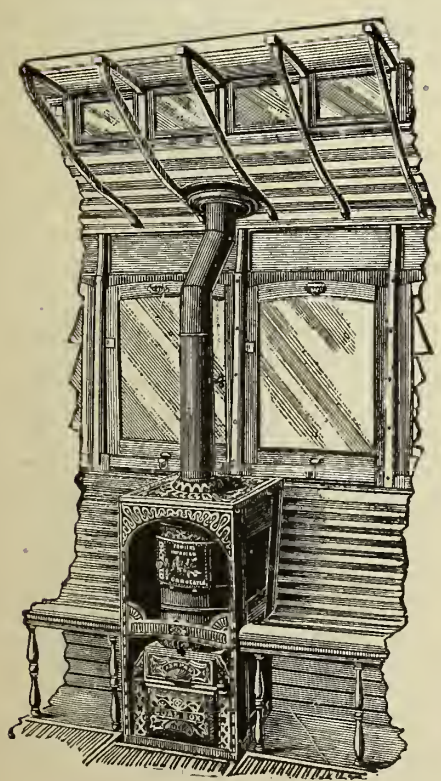
PATENT IMPROVED

Street Car Heater

—AND—

STOVE BOX.





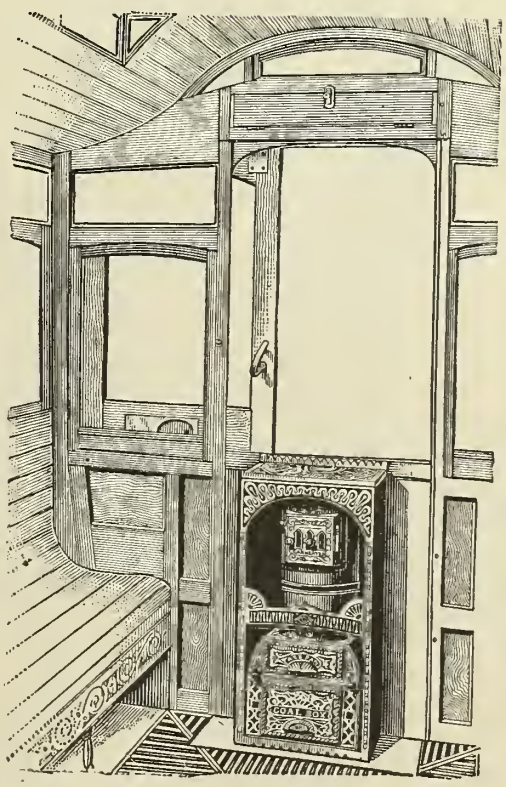
EXPLANATION OF CUTS.

No. 1.—Car Heater is designed for one horse or fare box cars, to be fitted as shown in cut No. 4—when car is operated only from one end. This design does away with the cutting out of seat and does not interfere with the seating capacity, projecting only 7 in. into the car. Height of box and stove over all, 2 ft. 10 in. Width of box, 16 in.

No. 2.—Car Heater is designed for large car—can be used in small cars when operated from both ends. To be fitted as shown in Cut No. 3. Size of box for Cut No. 2. Width, 16 and 18 in. Height of box, 2 ft. 10 in.

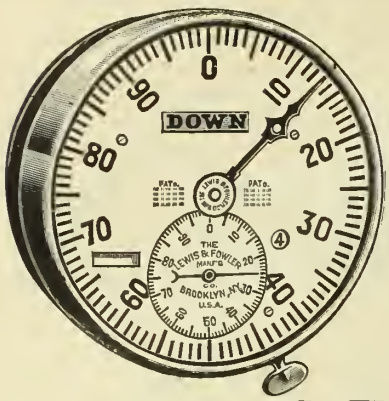
A—Door, sliding or swinging.
B—Shaker and Improved Grate.
C—Ash pan.
D—Coal box. (Which holds one hod of coal, shovel and shaker).
E E—Slides to regulate draft.

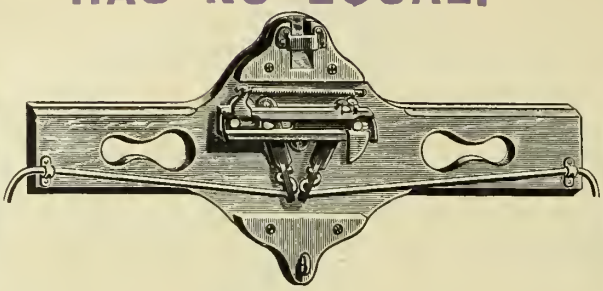
The cost of using this heater is $6\frac{7}{10}$ cents per day, as demonstrated by actual tests. Price of coal figured at $5.25 per ton.



SEE PAGES 55, 56, 58, 94, 119, 120.

HAS NO EQUAL.







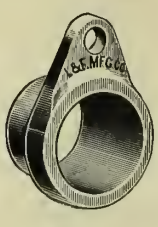
THE

LEWIS & FOWLER

MFG. CO.,

BROOKLYN, N. Y.



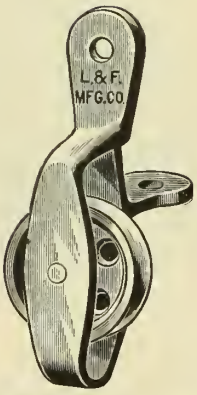


Patentees and Sole Manufacturers of

The Improved "Alarm"

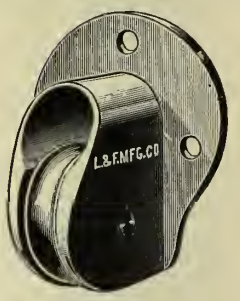
PASSENGER REGISTER





ACKNOWLEDGED TO BE

The Safest and Most Complete Register in the World.





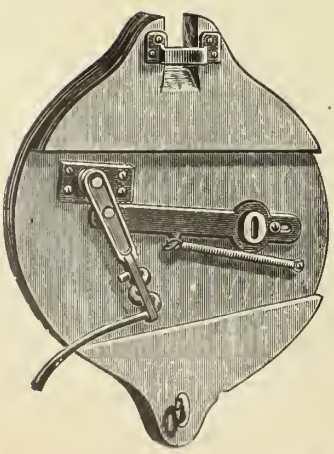
HAS BEEN ADOPTED BY

500 RAILROAD COMPANIES

SEND FOR

LIST OF RAILROAD COMPANIES THAT HAVE PURCHASED OUR REGISTER.

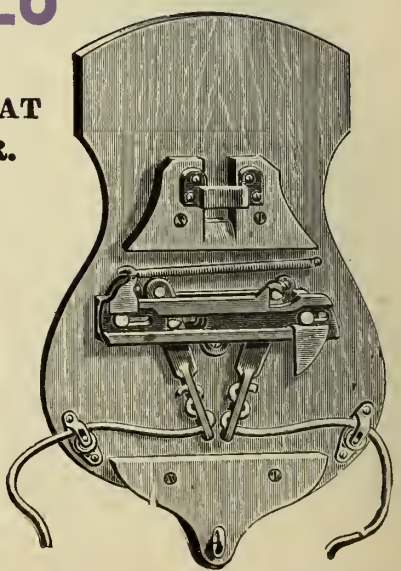
Descriptive Circular Mailed on Application.











HAS BEEN ADOPTED BY 500 RAILROAD COMPANIES

SEE PAGES 55, 56, 58, 93, 119, 120.

RAILWAY REGISTER

MANUFACTURING COMPANY.

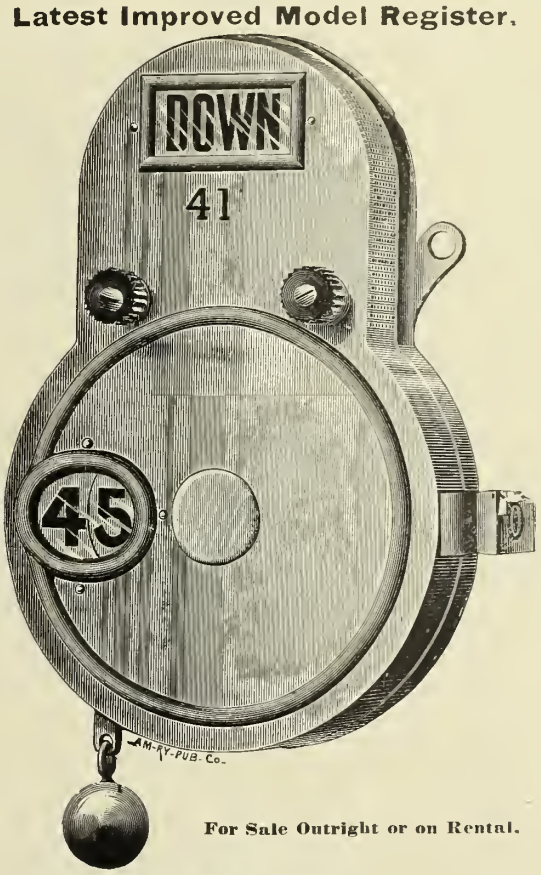


MANUFACTURERS AND OWNERS OF THE

Latest Designs, Improvements and Inventions in Registers, Indicators, Classifiers and Punches, for the Recording of Fares Collected on Street and Steam Railroads.

This company owns over 100 Patents embracing all the Valuable Features of Fare Registers, Indicators, etc., and was awarded three Medals at the Chicago Exposition of Railway Appliances.

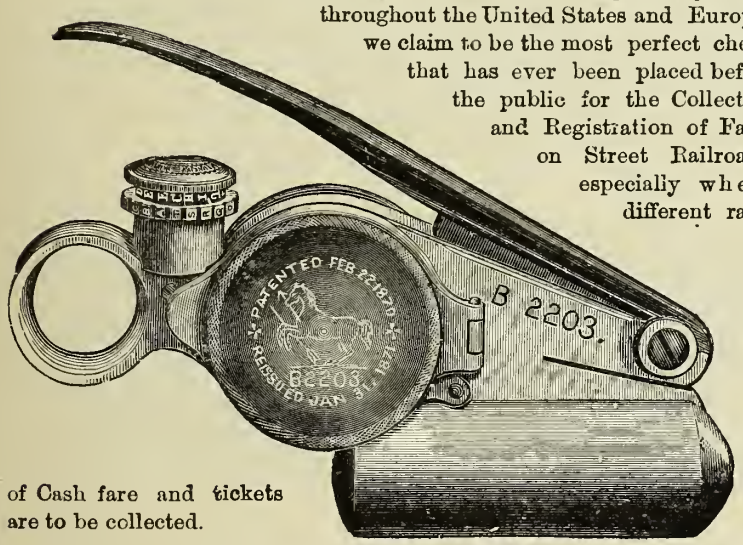
Latest Improved Model Register.



For Sale Outright or on Rental.

The Alarm Registering Punch.

This Register, which is so generally used throughout the United States and Europe, we claim to be the most perfect check that has ever been placed before the public for the Collection and Registration of Fares on Street Railroads, especially where different rates



of Cash fare and tickets are to be collected.

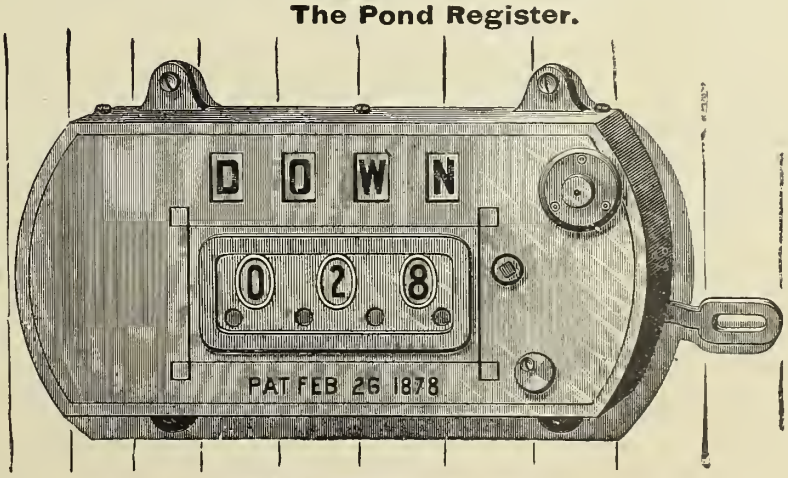
The Monitor Register.



For Sale Outright or on Rental.

Railway companies desiring to use a Stationary Register will consult their own interest by examining this Register before adopting any of the cheap devices now offered as it is the most Reliable Register of its kind. For further particulars address

The Pond Register.



For Sale Outright or on Rental.

SPECIAL ATTENTION PAID TO EXPORT ORDERS.

EDWARD BEADLE, Manager, 1193 Broadway, New York City, N. Y.

THE UNITED STATES
STEAM & STREET RAILWAY ADVERTISING CO.

CARLETON & KISSAM, Proprietors.

WILLIAM F. CARLETON.
BOSTON, MASS.

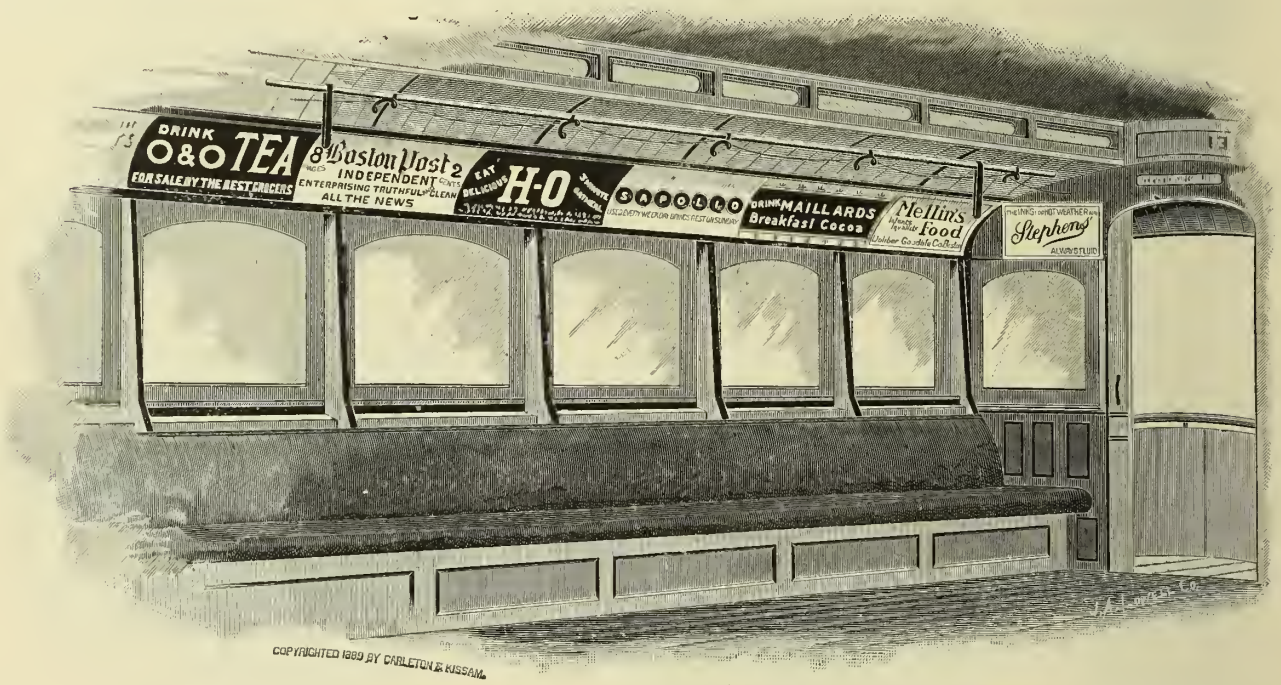
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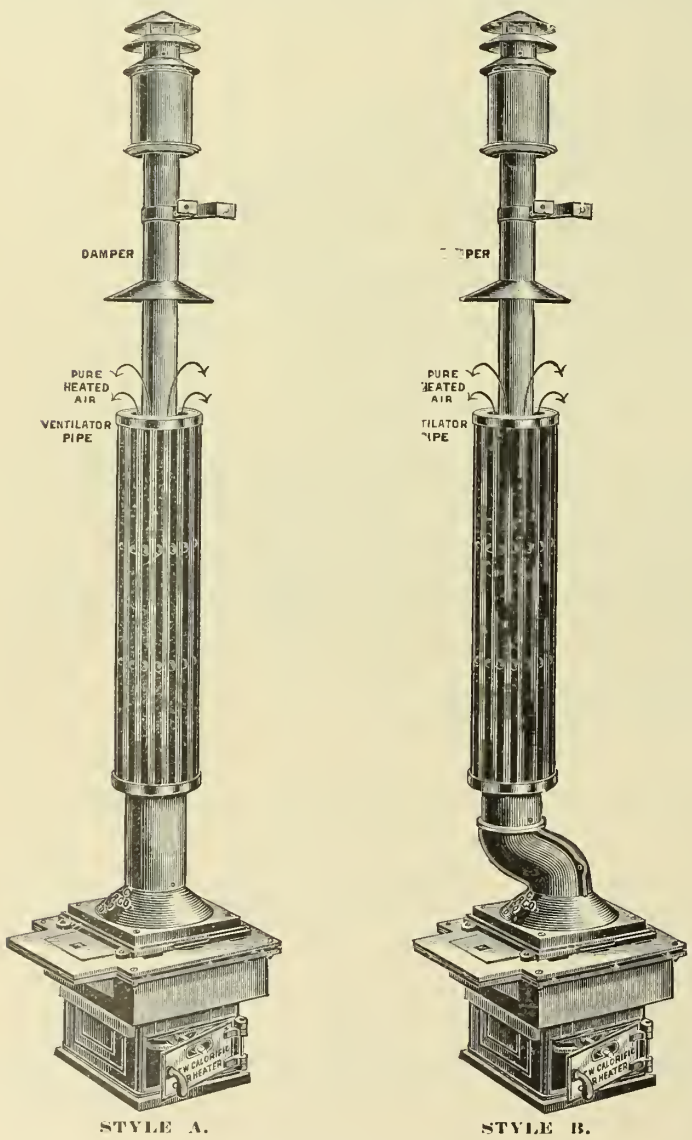
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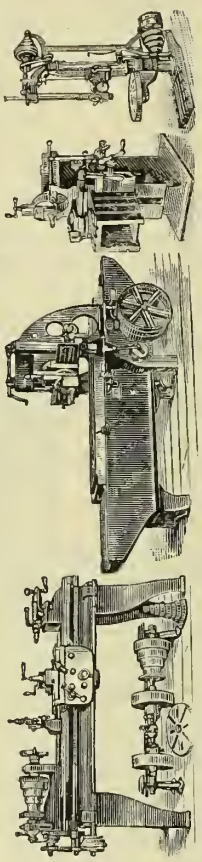
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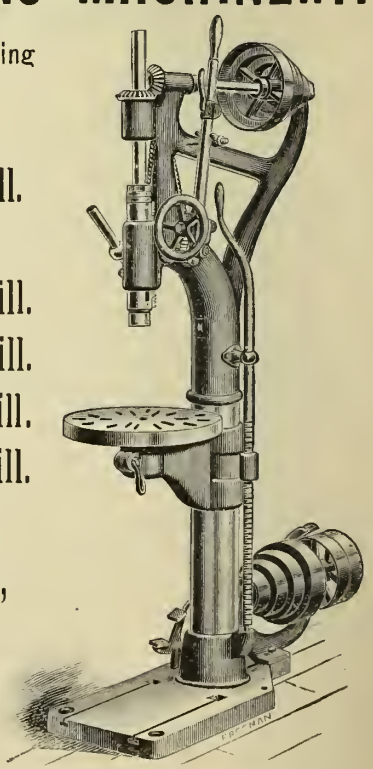
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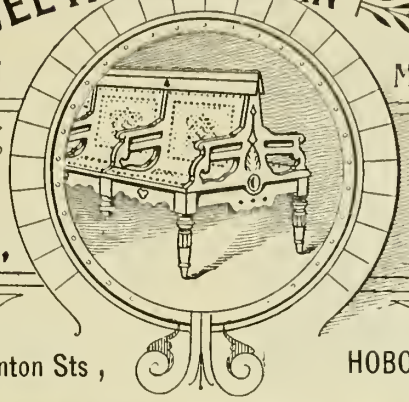
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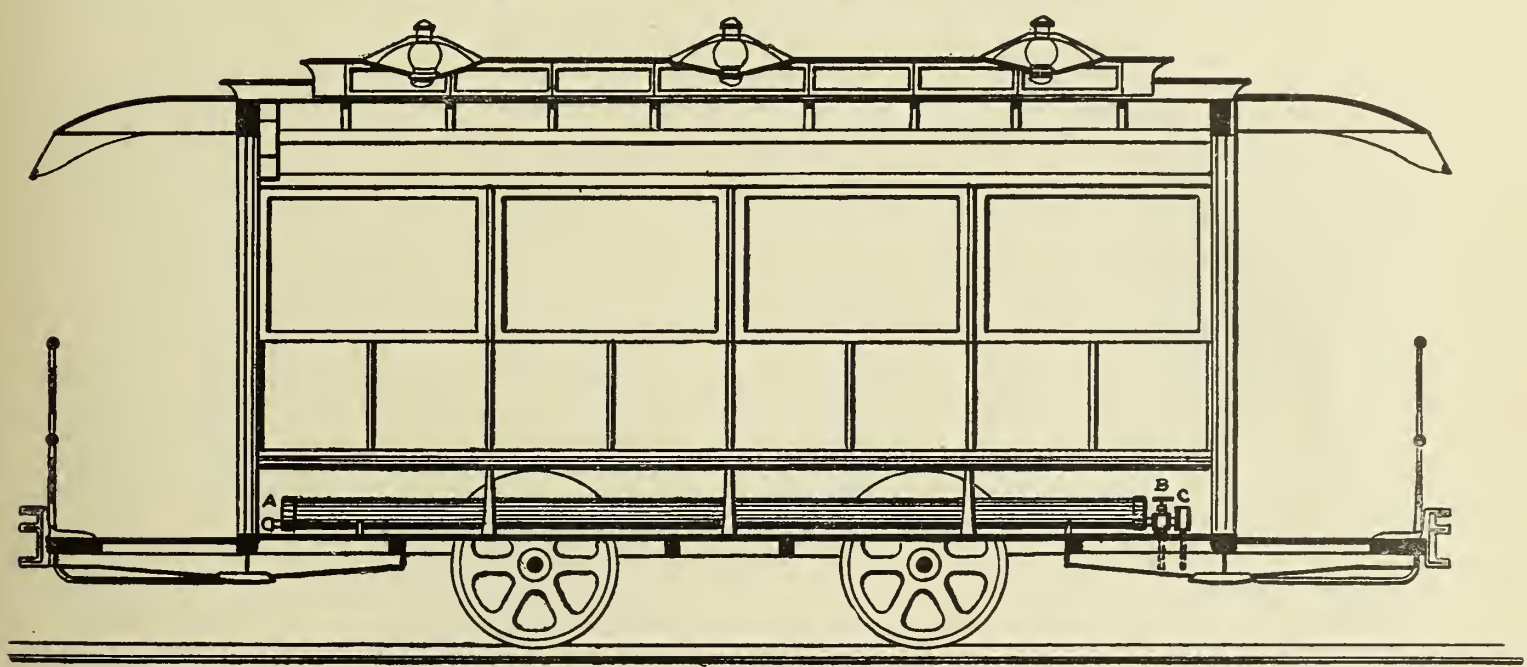
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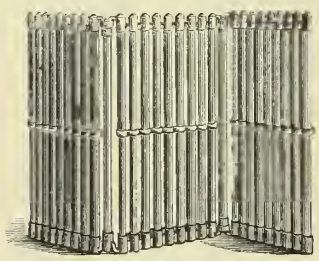
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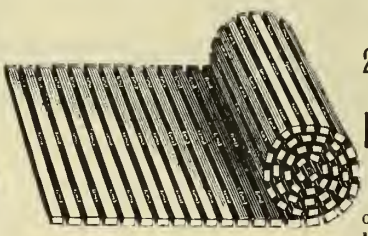
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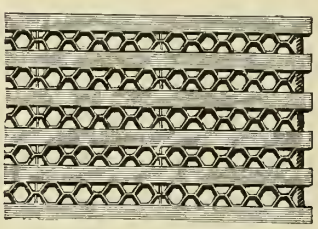
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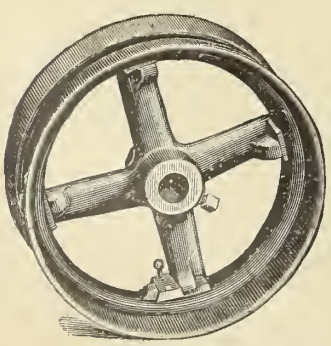
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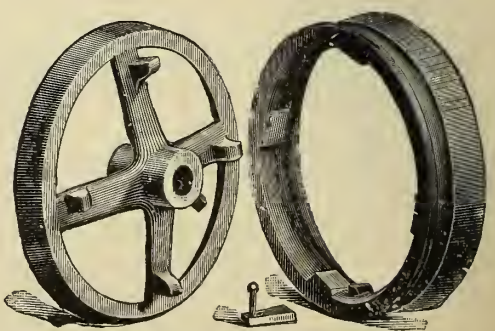
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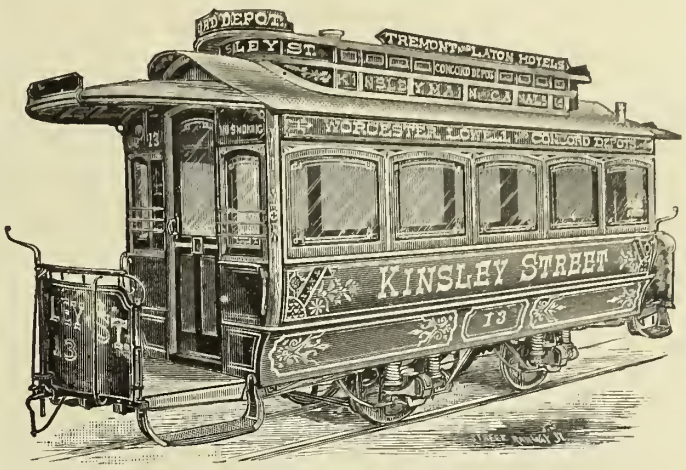
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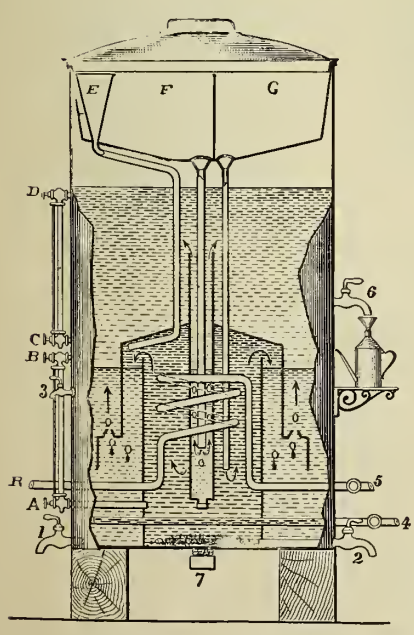
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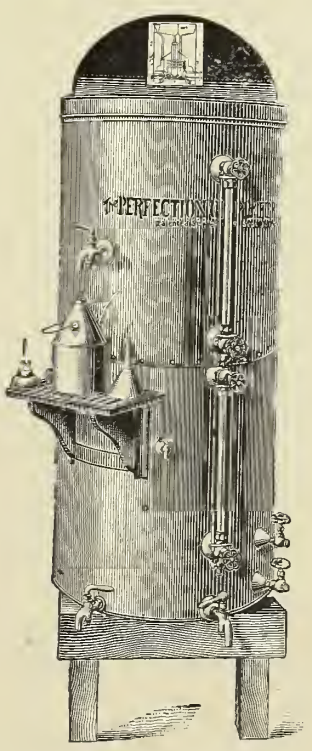
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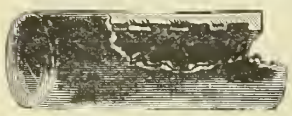
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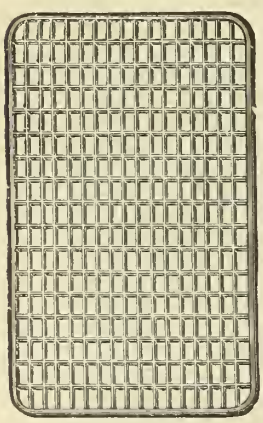
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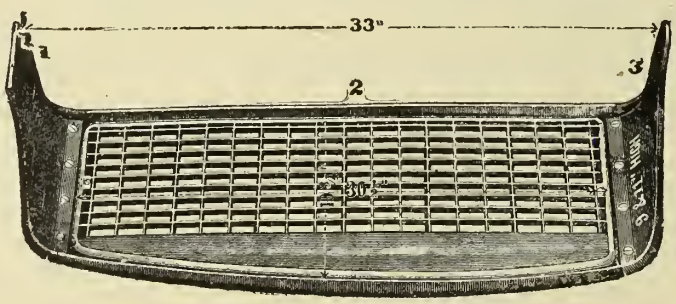
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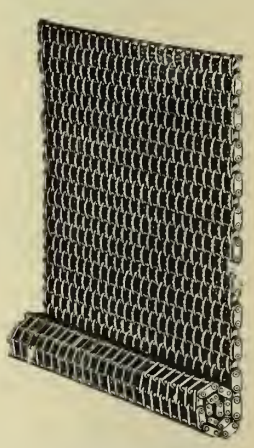
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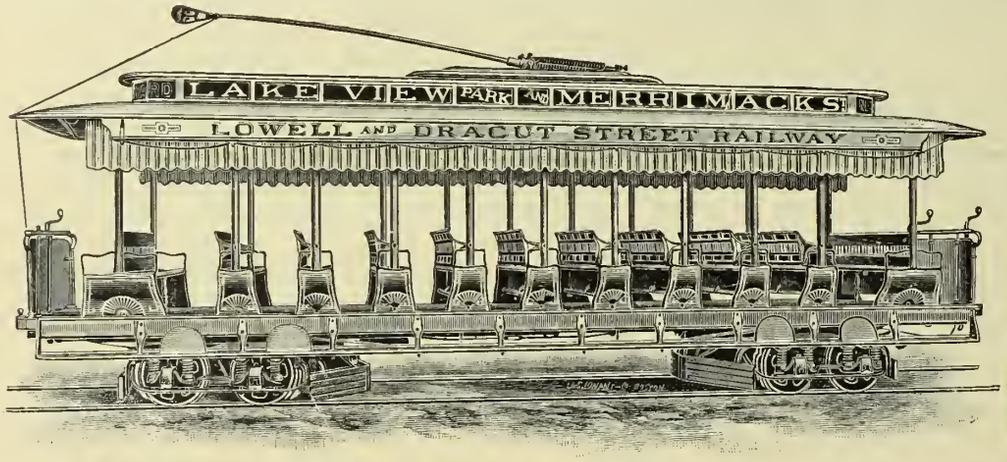
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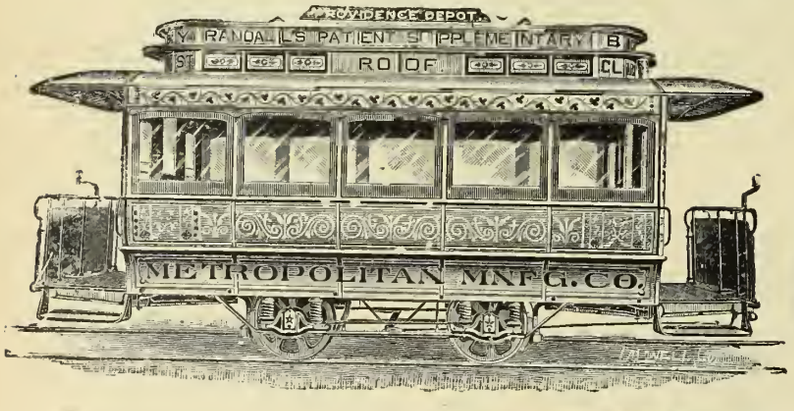
OF

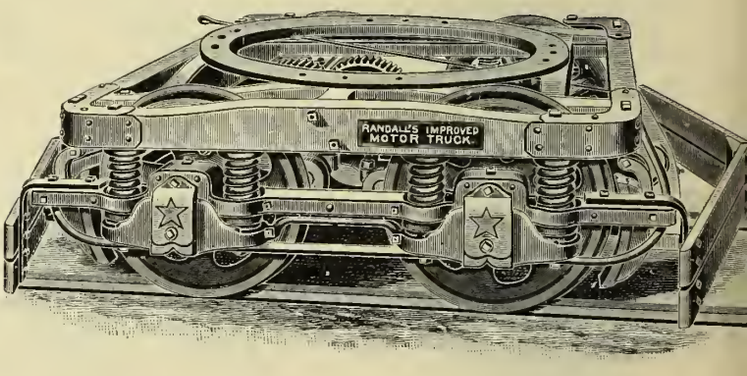
STREET

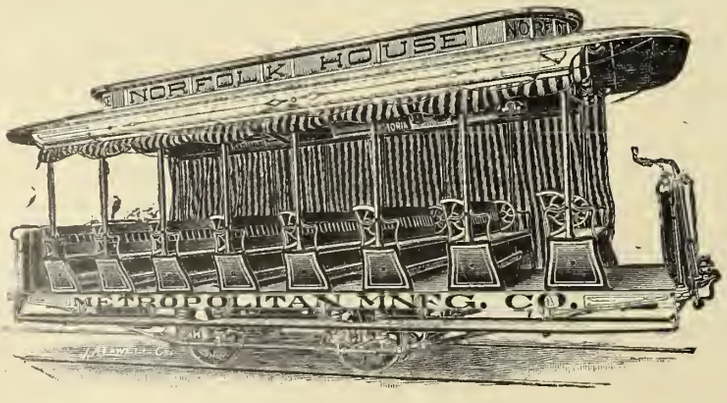
AND

ELECTRIC

CARS







RANDALL'S

IMPROVED PATENT

JOURNAL BOX AND GEAR

Brake Ratchets and Dogs, Gradnating Spiral Springs, Self-Loading and Dumping Snow Sleds, Girdles, Rails, Frogs and Switches for Cable, Street and Electric Railways.

I. H. RANDALL, - - BOSTON, MASS.

OFFICE AND WORKS, 1131 TREMONT STREET.

THE

AMERICAN CAR CO.

WM. SUTTON, President.
EMIL ALEXANDER, Secretary.

STRICTLY

HIGH CLASS

PASSENGER

CARS

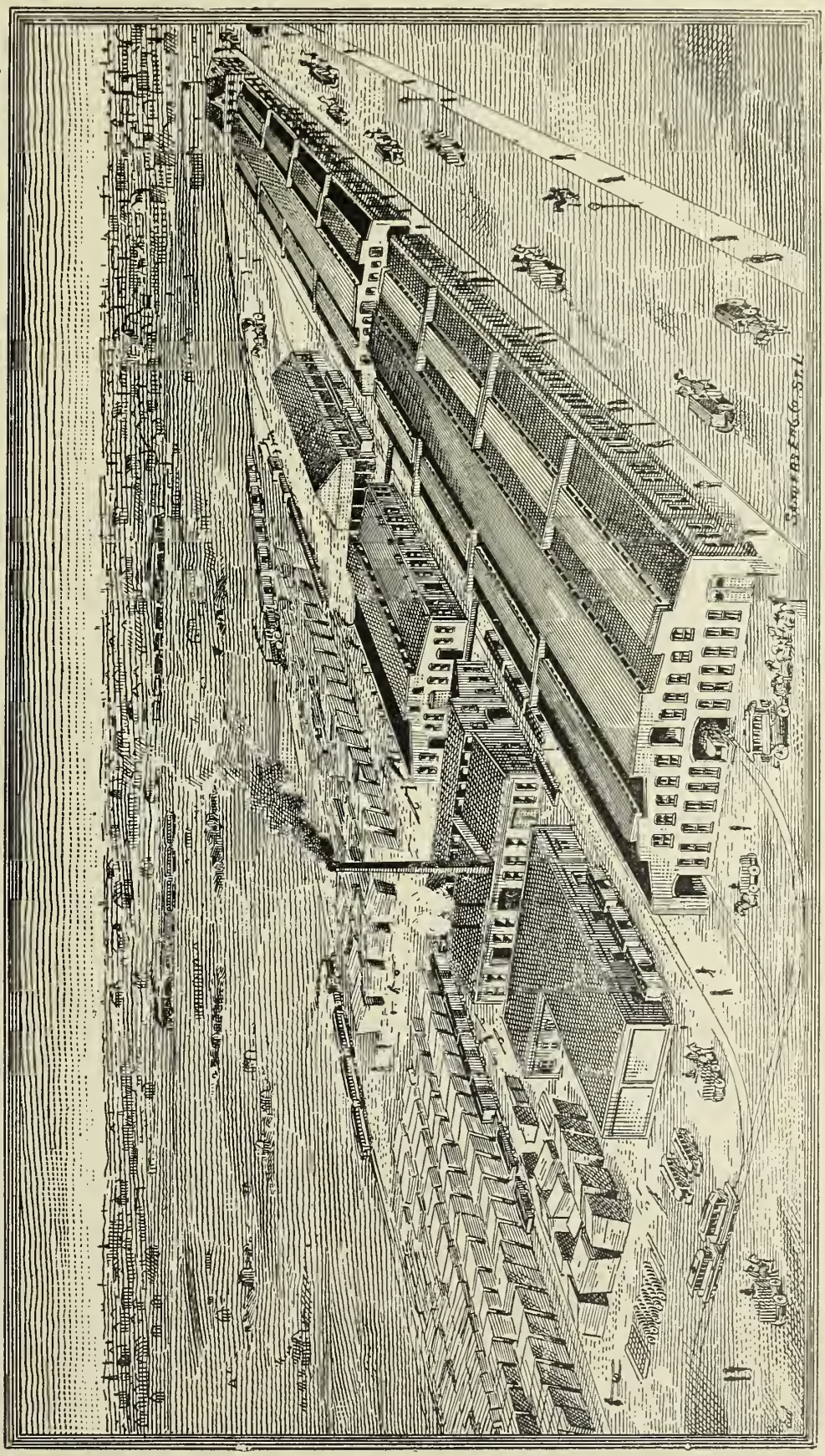
FOR

Early Delivery

Extensive Shops.

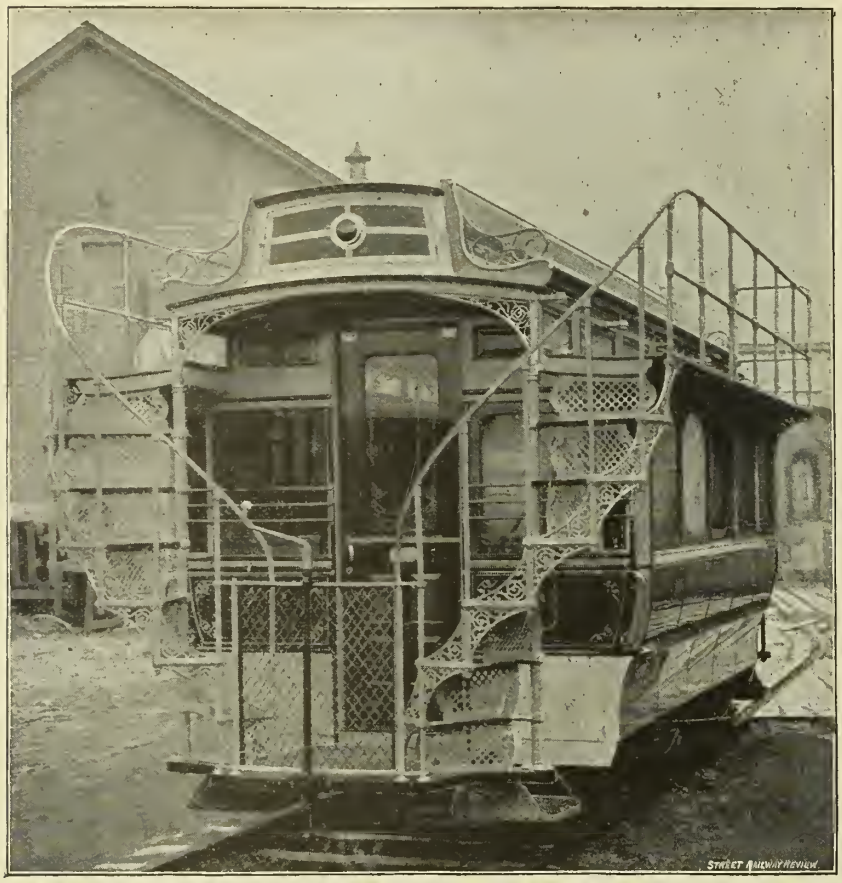
New Machinery.

Correspondence Invited.



203 American Central Bldg., ST. LOUIS, MO.

THE SESSIONS CAR



FOR

STREET RAILWAY SERVICE

Carrying Capacity Doubled.

Thus dispensing with excessive equipment on crowded lines.

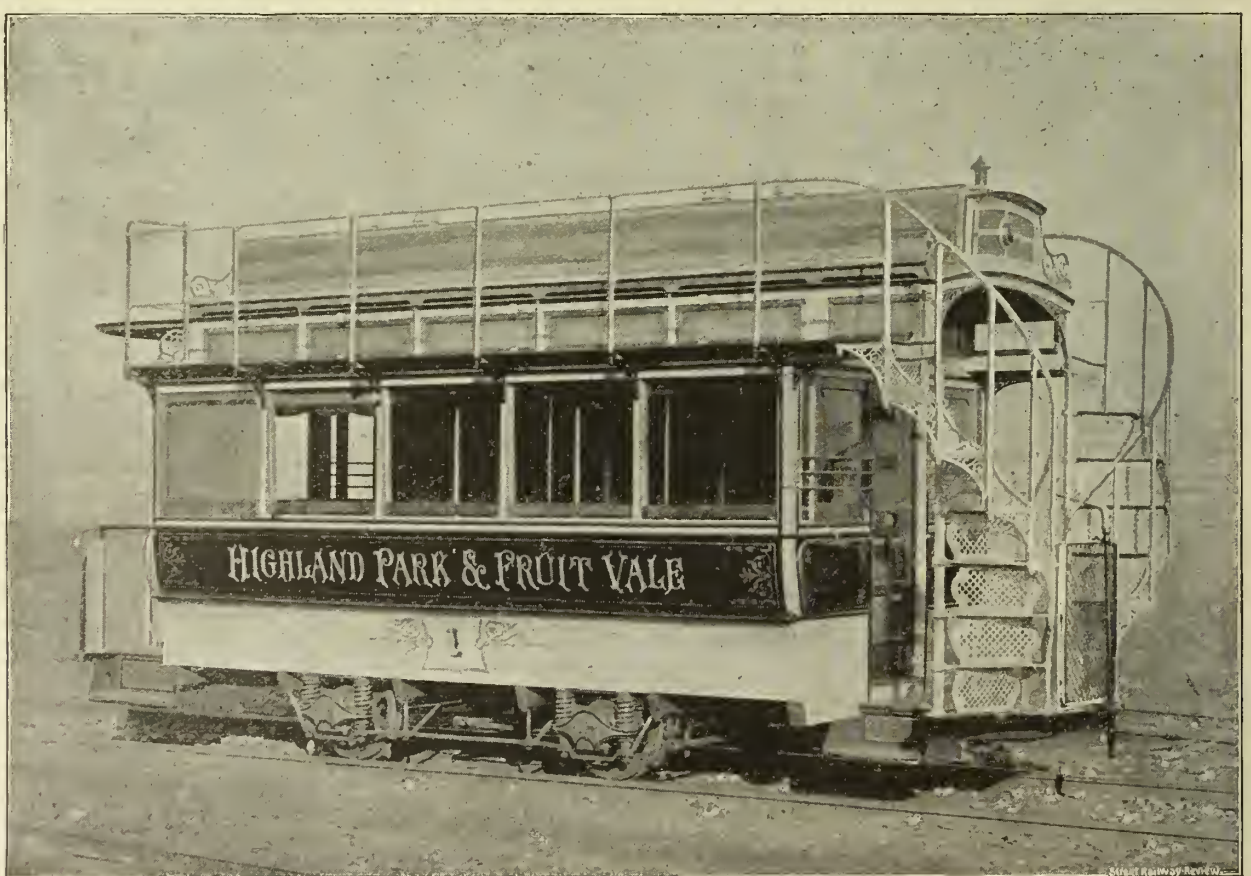
Entire Space Utilized at a Decrease in Height and Weight of Cars.

COST BUT LITTLE MORE THAN THE ORDINARY CAR OF ONE-HALF CAPACITY.

Attractive in appearance; Therefore invites patronage.

Offers to the passenger all the combined comforts of modern invention.

☞ 14 ft. Sessions Car Seats 44 Passengers.
☞ 16 " " " " 48 "
24 " " " " 76 "
etc., etc.



SESSIONS PASSENGER CAR CO.,

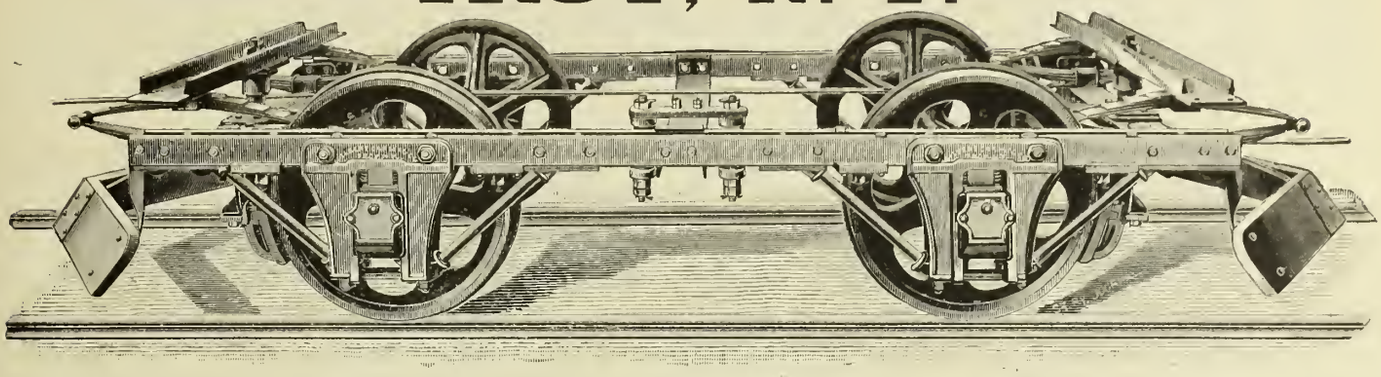
45 Lake Side Building, cor. Clark & Adams Sts.

DETAILED INFORMATION ON APPLICATION.
CORRESPONDENCE SOLICITED.

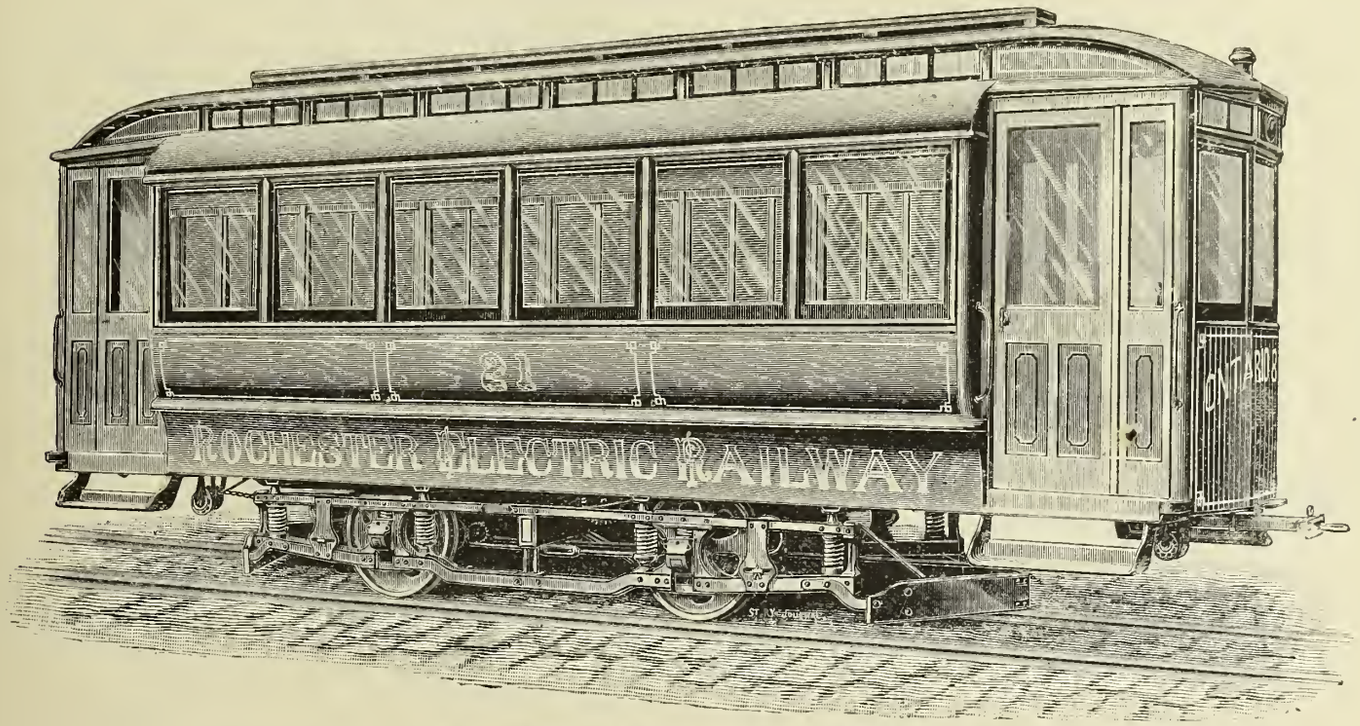
CHICAGO, ILL.

THE GILBERT CAR MFG. CO.

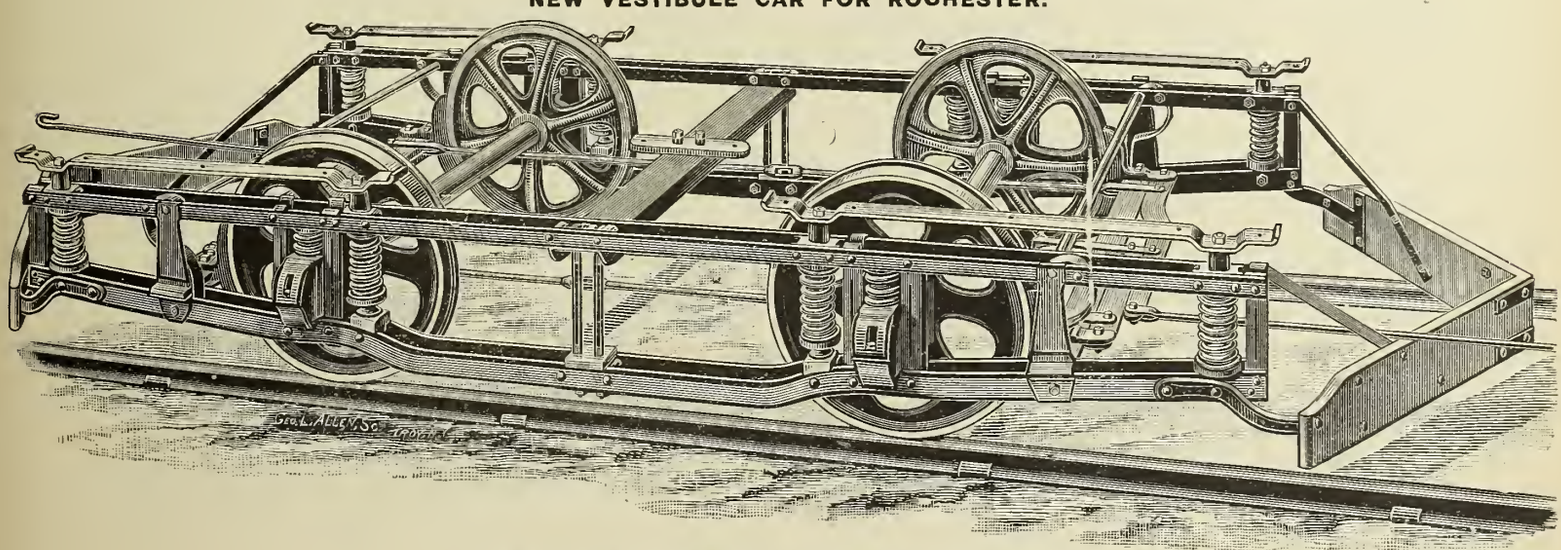
ESTABLISHED 1820. **TROY, N. Y.** INCORPORATED 1879.



THE TAYLOR TRUCK.



NEW VESTIBULE CAR FOR ROCHESTER.



THE MANIER PATENT NON-OSCILLATING TRUCK.

NEW YORK OFFICE:

Union Trust Co. Building, 80 BROADWAY, NEW YORK.

Brownell's Accelerator

WILL HASTEN

EARNING OF DIVIDENDS

BECAUSE

YOU CAN CARRY BIG LOADS

WITH LEAST DEAD WEIGHT.

YOU CAN MAKE QUICK TIME,

FOR PASSENGERS GET ON AND OFF QUICKLY.

YOU CAN AVOID ACCIDENTS,

FOR CONDUCTORS CAN ASSIST PASSENGERS UNTIL FIRMLY ON THEIR FEET.

YOU CAN PLEASE THE PUBLIC,

(AND LADIES ESPECIALLY) FOR PASSENGERS ARE NOT INCONVENIENCED BY PERSONS PASSING OVER PLATFORMS.

BROWNELL CAR COMPANY,

ST. LOUIS, MO.

Established 1857. Incorporated 1875.

SENTIMENT or DIVIDENDS.

WHICH?



PATENTED NOVEMBER 3, 1891.

NOTICE PASSENGERS GETTING IN OR OUT OF OLD STYLE CAR WITH A FEW PERSONS STANDING ON PLATFORM, AND THEN THINK OF THE ACCELERATOR.

The Superintendent of one of the largest Cable Railroads said, after making a trial trip with

THE ACCELERATOR.

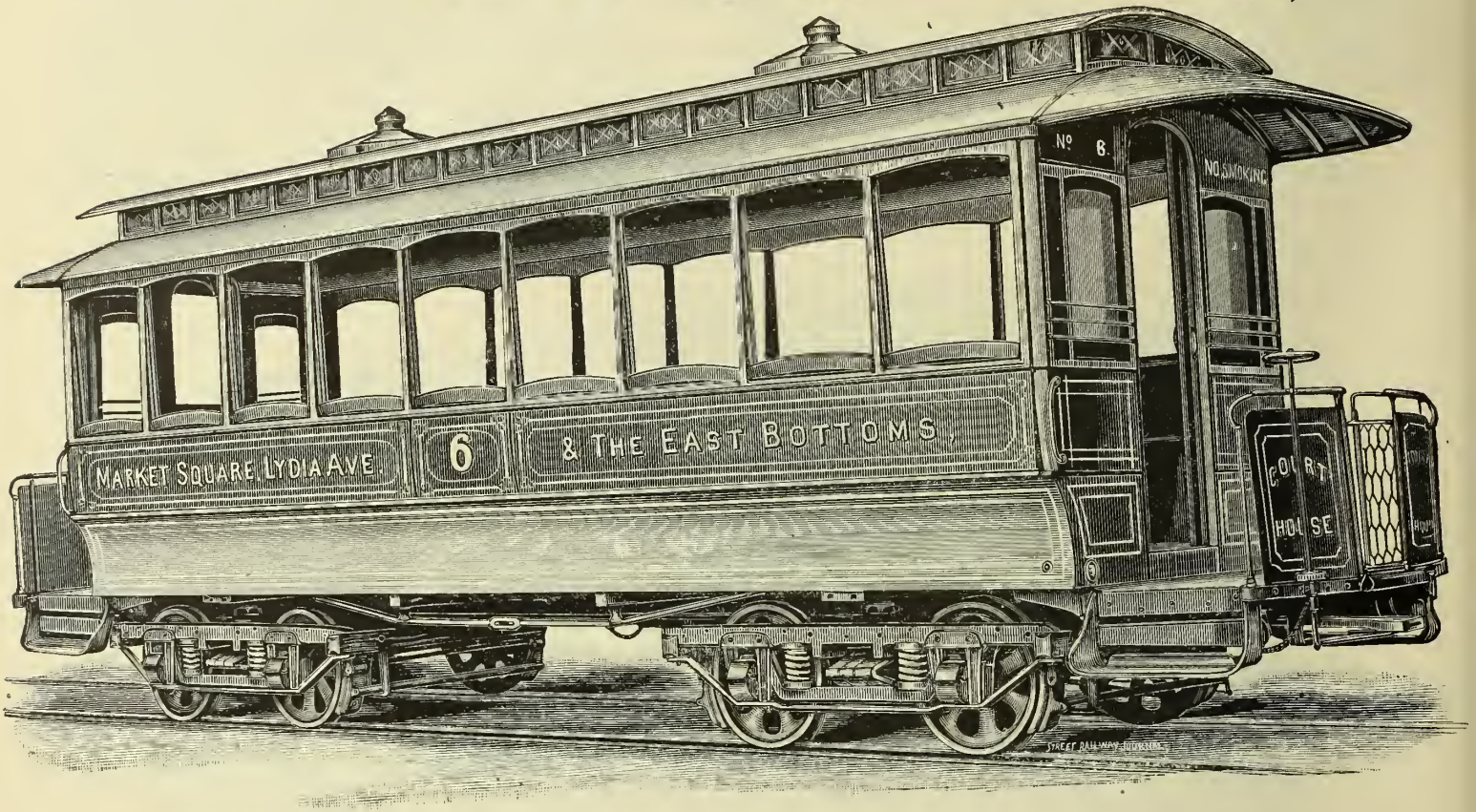
"I am pleased with this car and want the President of our road to see it, **FOR HE KNOWS A GOOD THING WHEN HE SEES ONE.**"

BROWNELL CAR COMPANY,

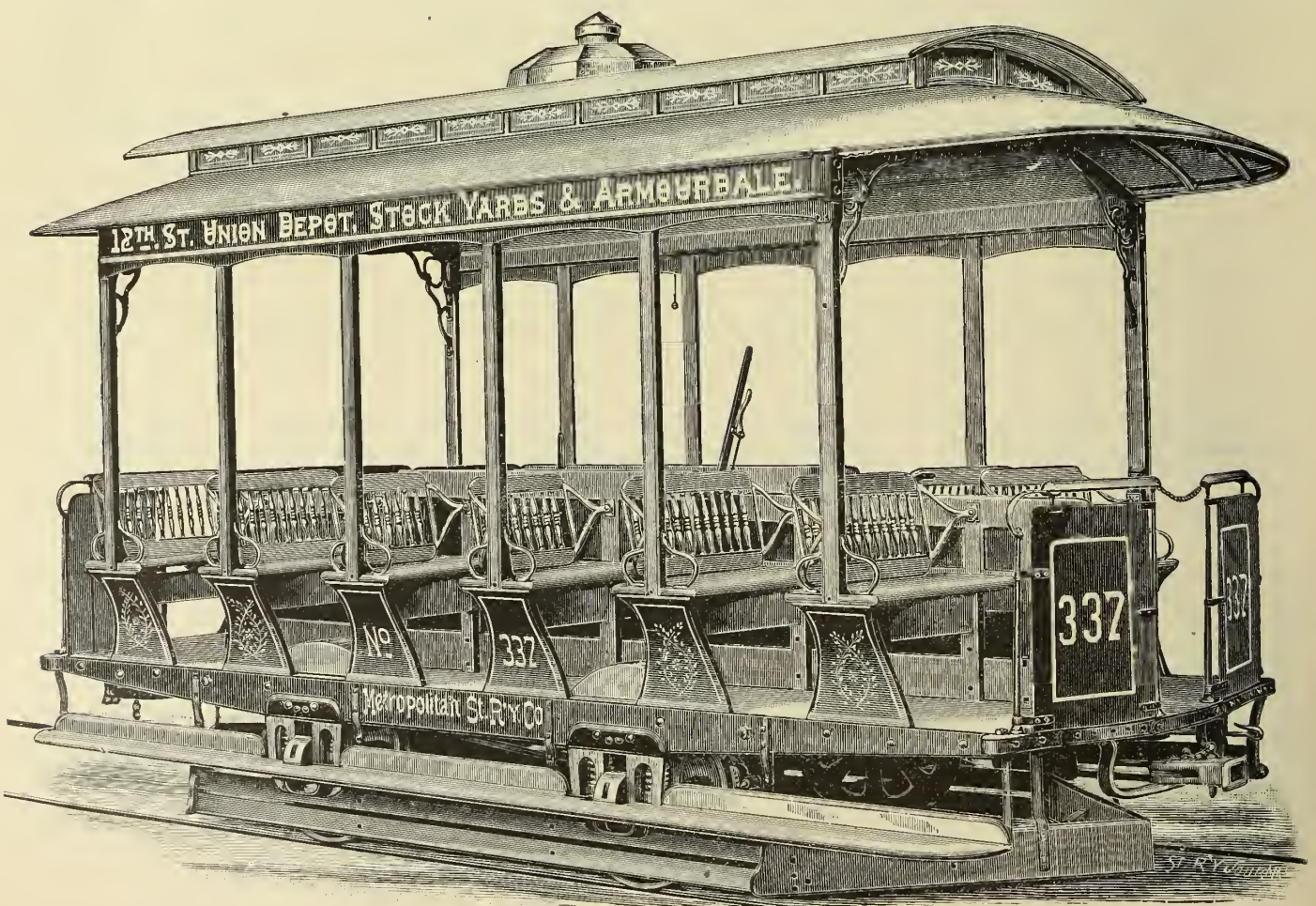
ST. LOUIS, MO.

Established 1857. **Incorporated 1875.**

THE LACLEDE CAR CO. St. Louis, Mo.

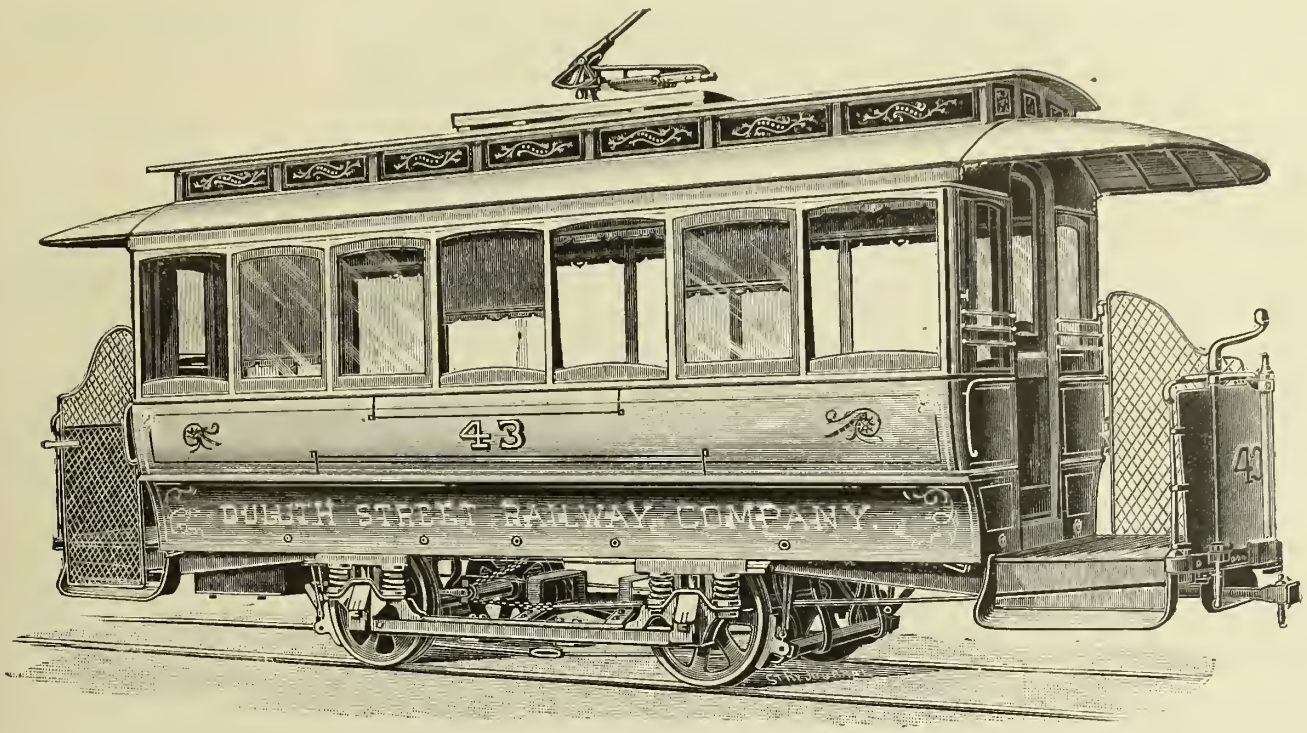


Builders of Street Railway Cars of Every Description



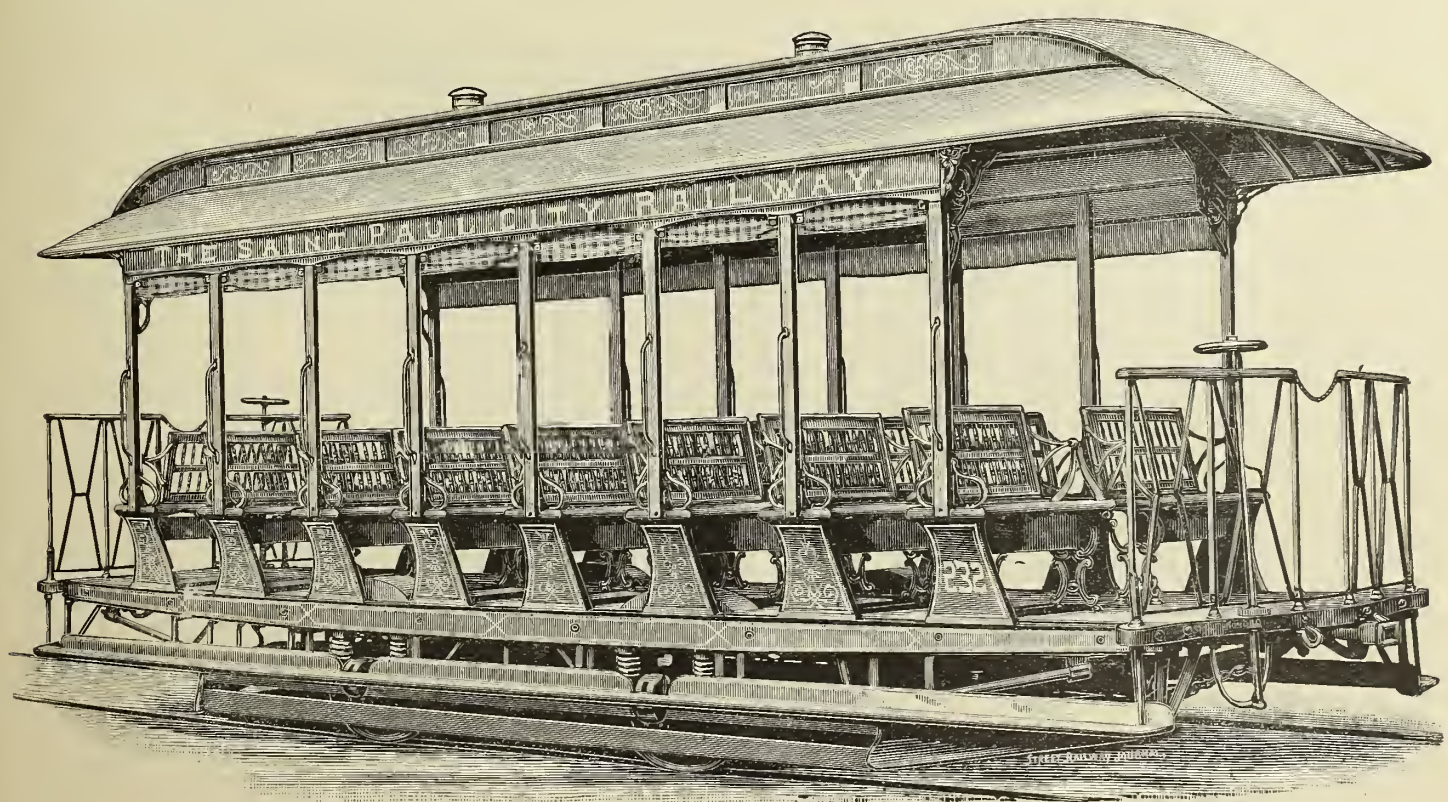
CORRESPONDENCE SOLICITED.

THE LACLEDE CAR CO. St. Louis, Mo.



BUILDERS OF

Electric Cars, Motor Cars, Horse Cars and Special Trucks



ORDERS QUICKLY AND CAREFULLY FILLED.

WE LEAD

We call attention to the fact that in our

STREET CAR DEP'T

150 CARS

Can be Constructed at once, with an Average Output of SIX CARS PER DAY.

PULLMAN'S

Our manufacture is adapted to any motive power, whether it is

Electric, Cable, Horse or Steam

SATISFACTION GUARANTEED.

Address all Correspondence to

CONTRACTING AGENT

PULLMAN BLDG.,

CHICAGO, ILL.

U. S. A.

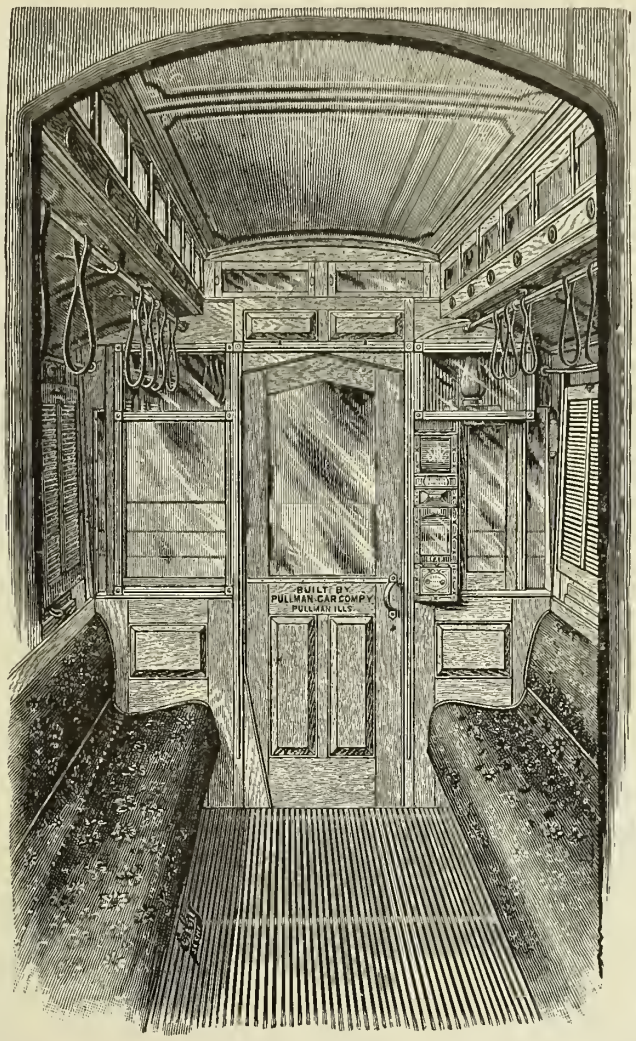
Pullman's Palace Car Co.,

Manufacturers of

RAIL-ROAD

CARS.

Pullman, Illinois.

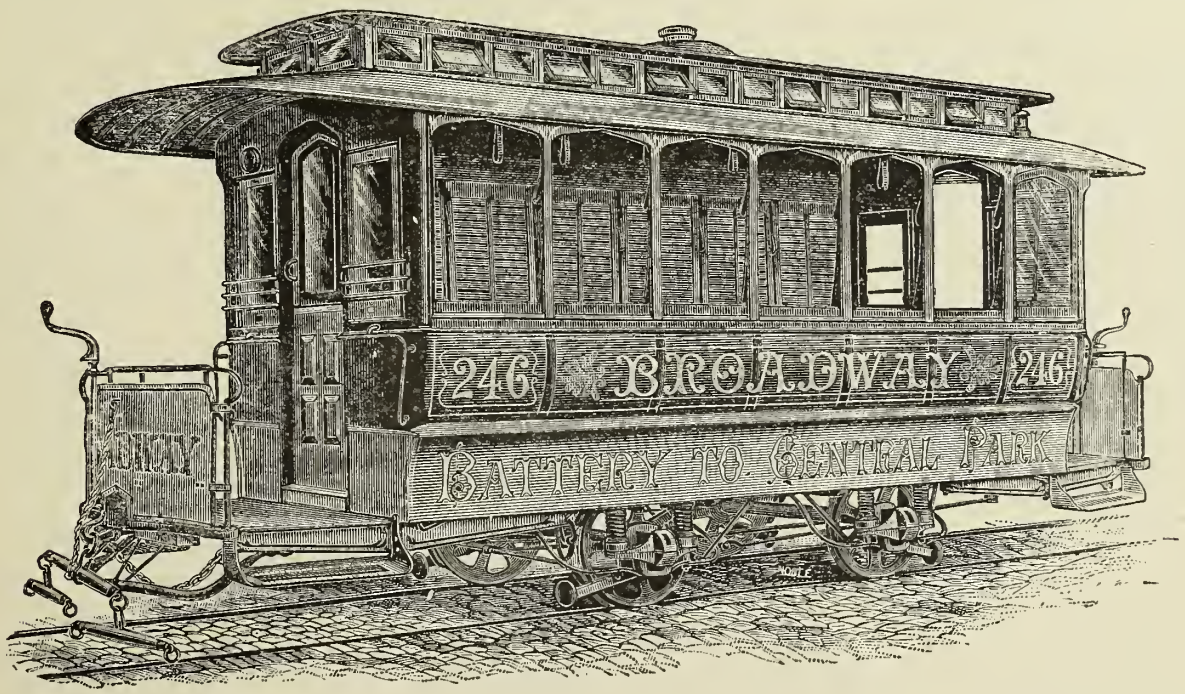


Make a Specialty of

Street, Cable Grip & Electric Motor

CARS.

Detroit, Michigan.

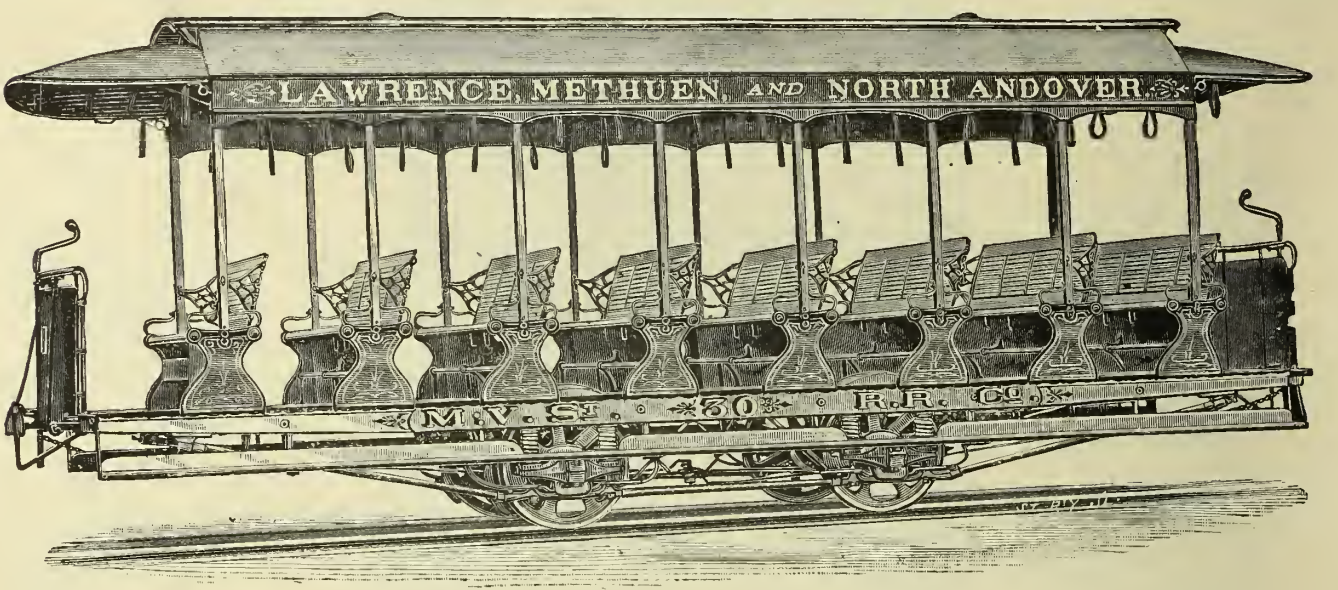


Address all Correspondence

Contracting Agent, Chicago, Ill.

THE ELLIS CAR COMPANY,

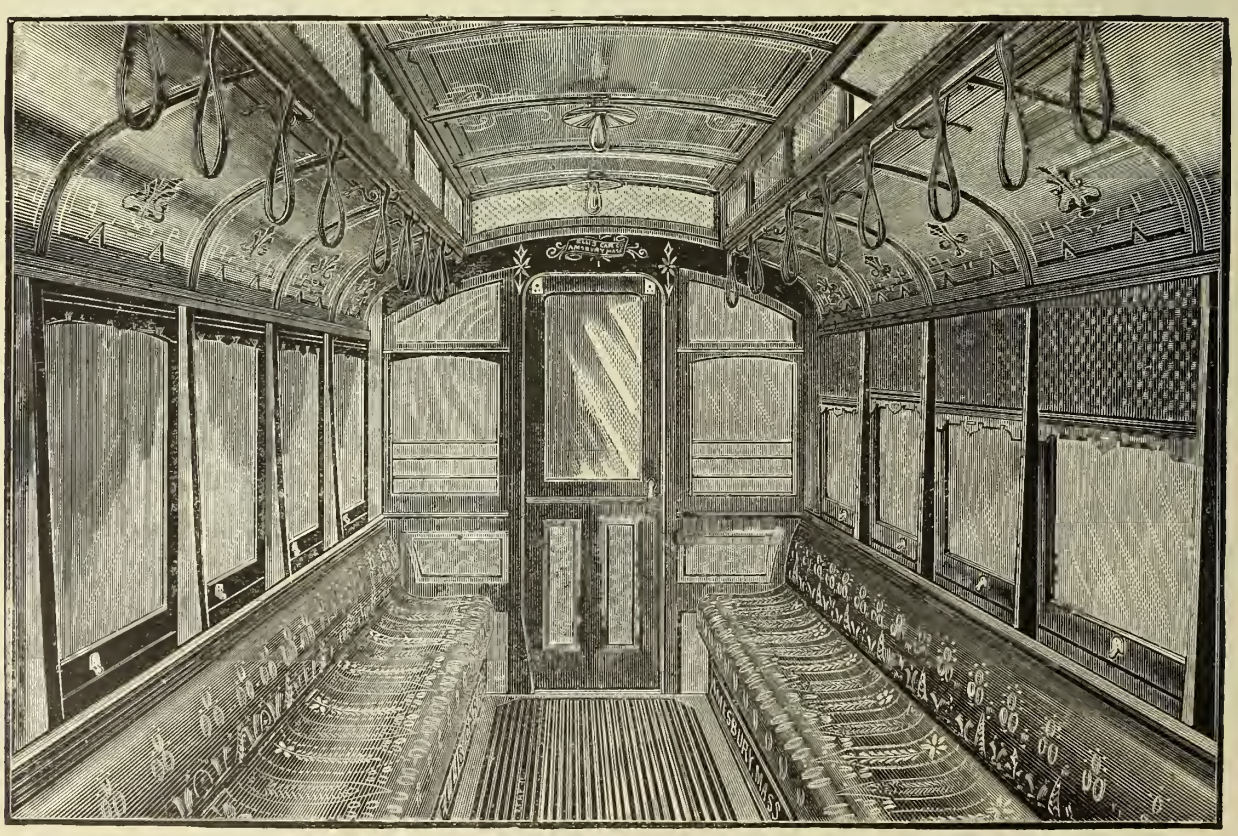
AMESBURY, MASS.



BUILDERS OF

STREET CARS OF ALL STYLES

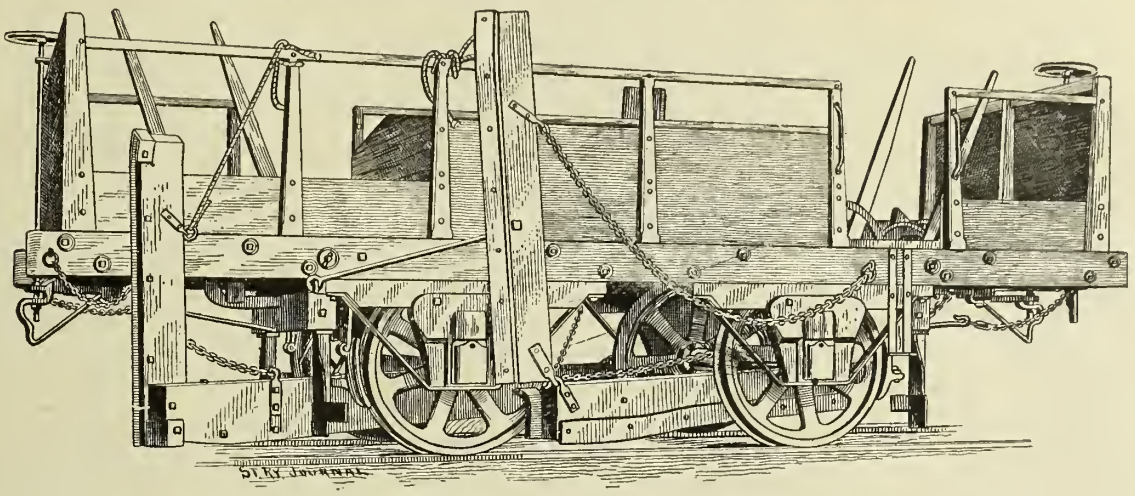
For Electric or Horse Power.



ON ALL OUR OPEN CARS WE USE OUR PATENT BENT POST.

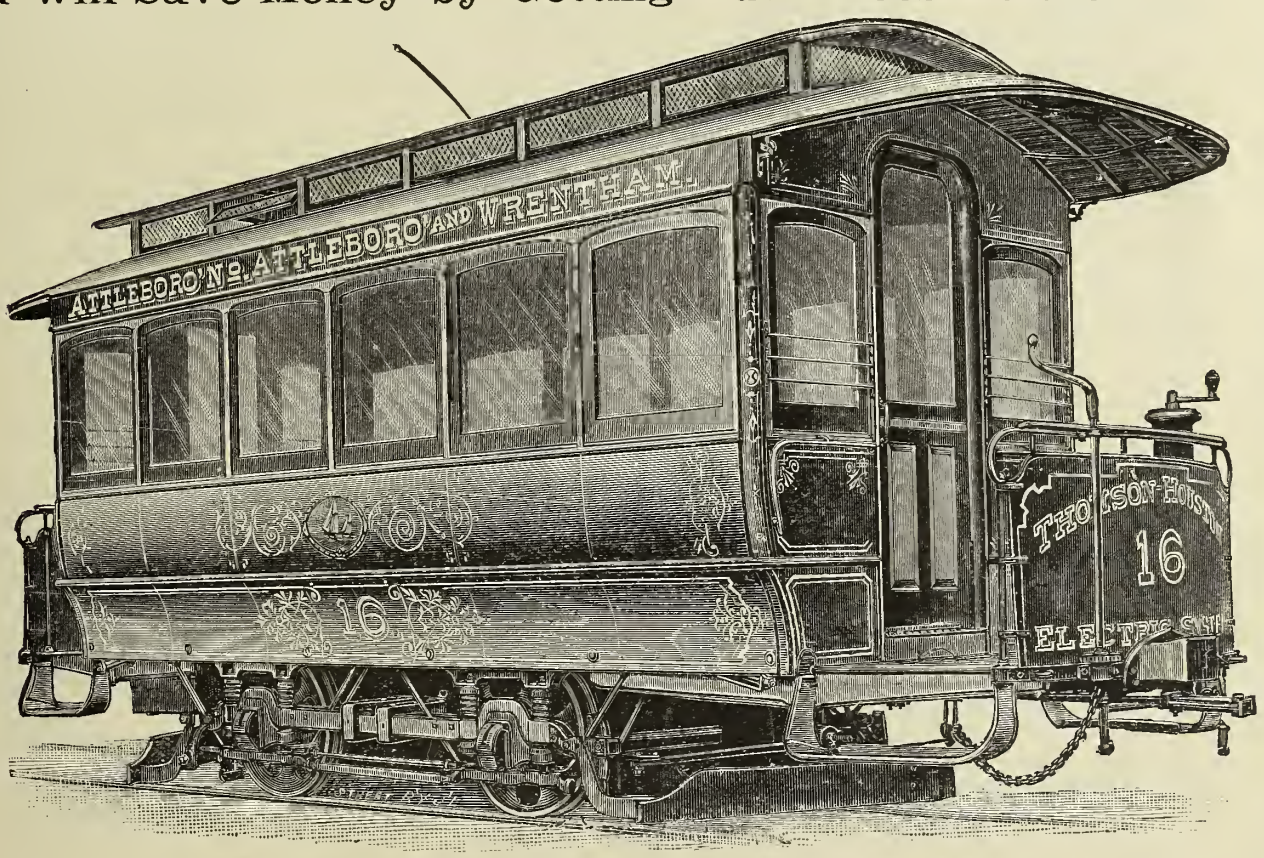
The Ellis Car Company

AMESBURY, MASS.



Best Car in the World for the Money.

You will Save Money by Getting Our Prices Before You Buy.



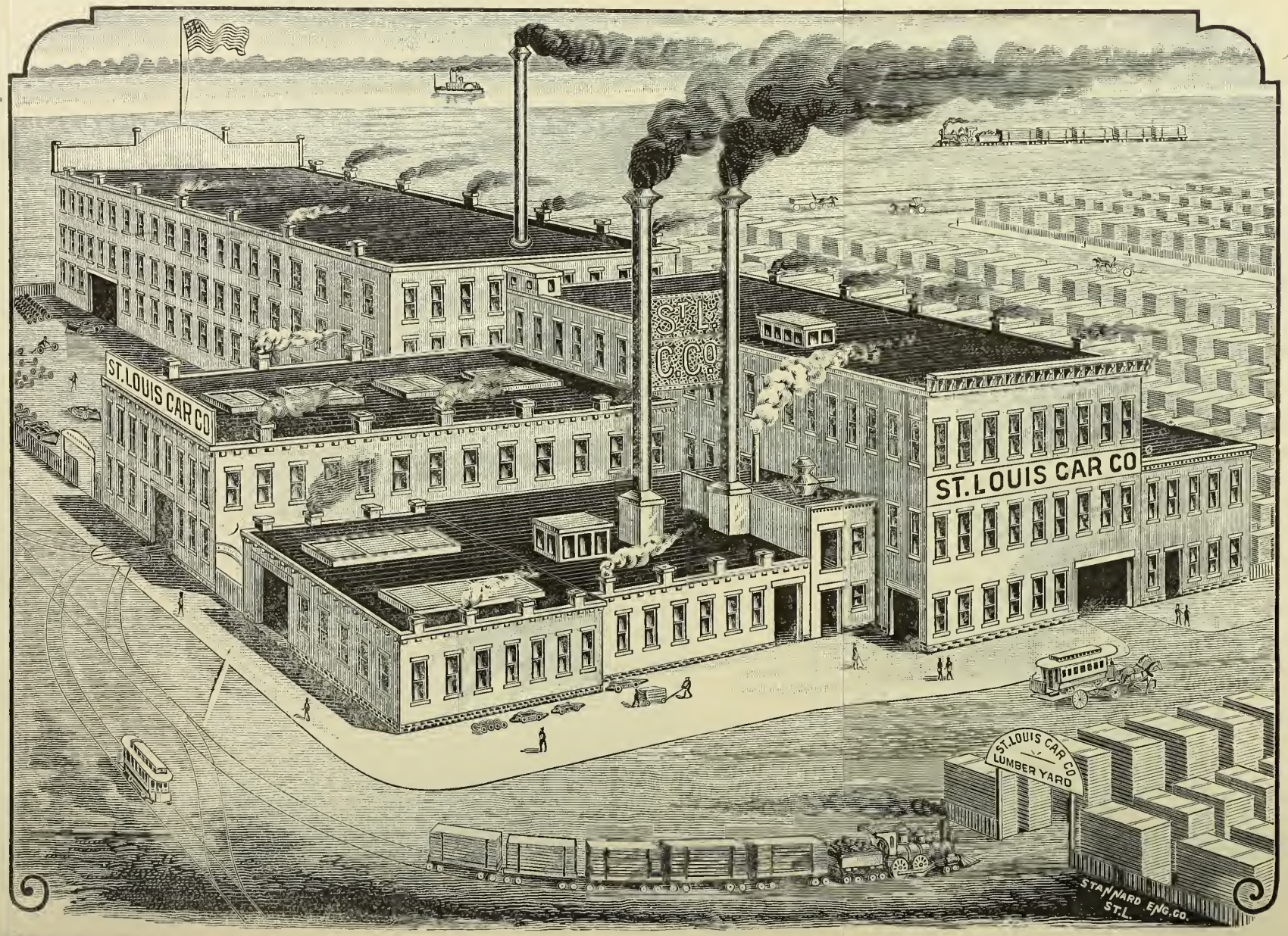
Cars of all kinds for Electric or Horse Power

SEND AND GET OUR PRICES AND PHOTOS.

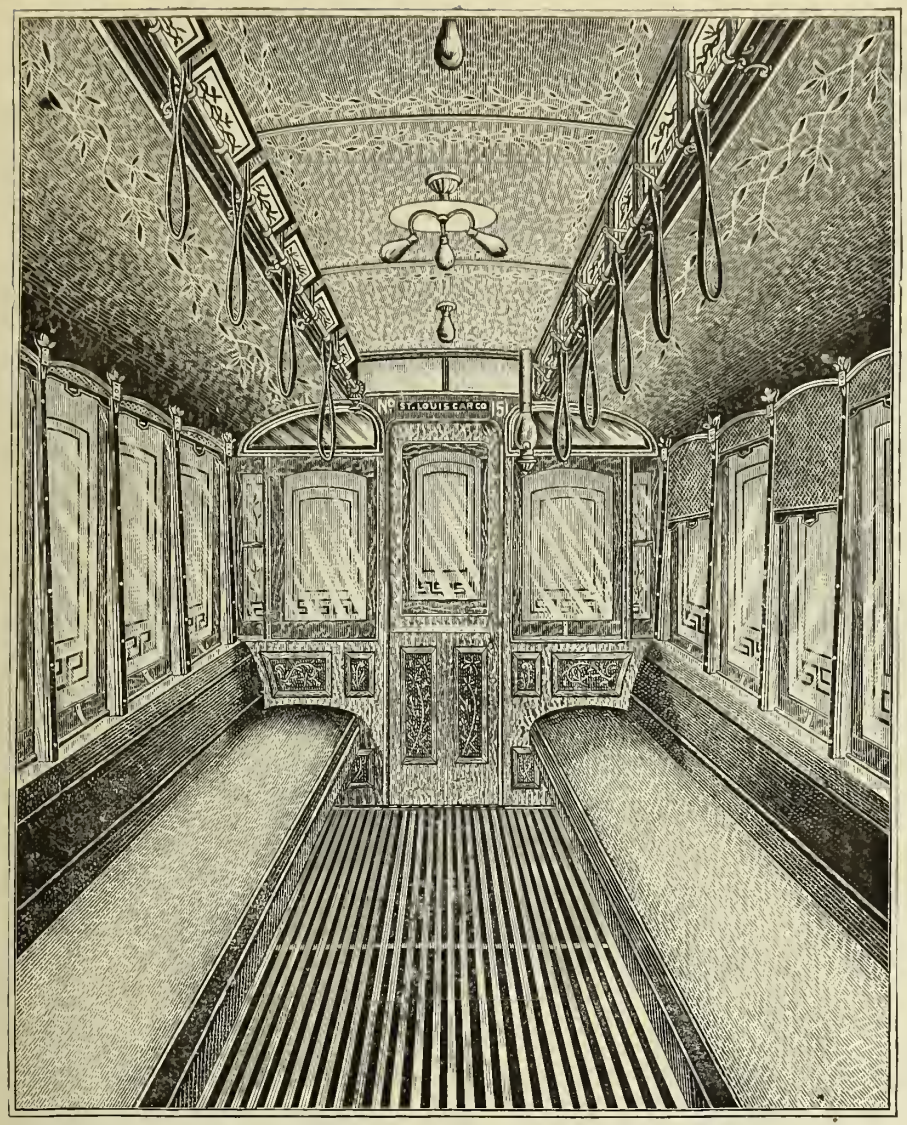
Call on us or write and we will send a representative to talk with you.

Don't Forget the Place, Amesbury, Mass.

The Largest and Most Complete Street Car Factory in the World.



PERSPECTIVE VIEW OF THE NEW WORKS OF THE ST. LOUIS CAR CO.



INTERIOR FINISH OF FANCY ELECTRIC CAR.

ST. LOUIS CAR CO.,

Manufacturers of all kinds of

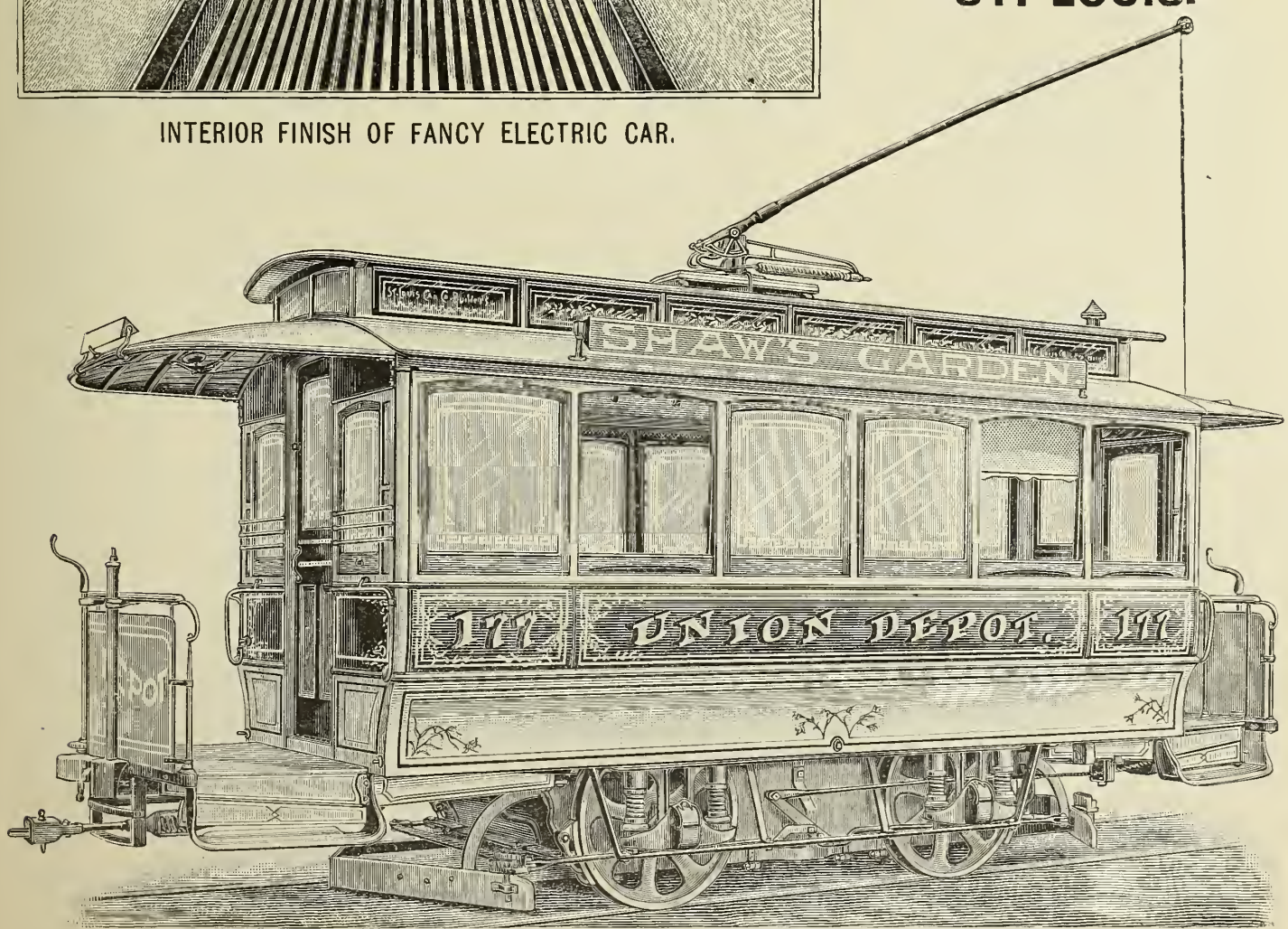
MOTOR CARS, ELECTRIC CARS AND TRUCKS

A SPECIALTY.

OFFICE:

3,023 N. Broadway,

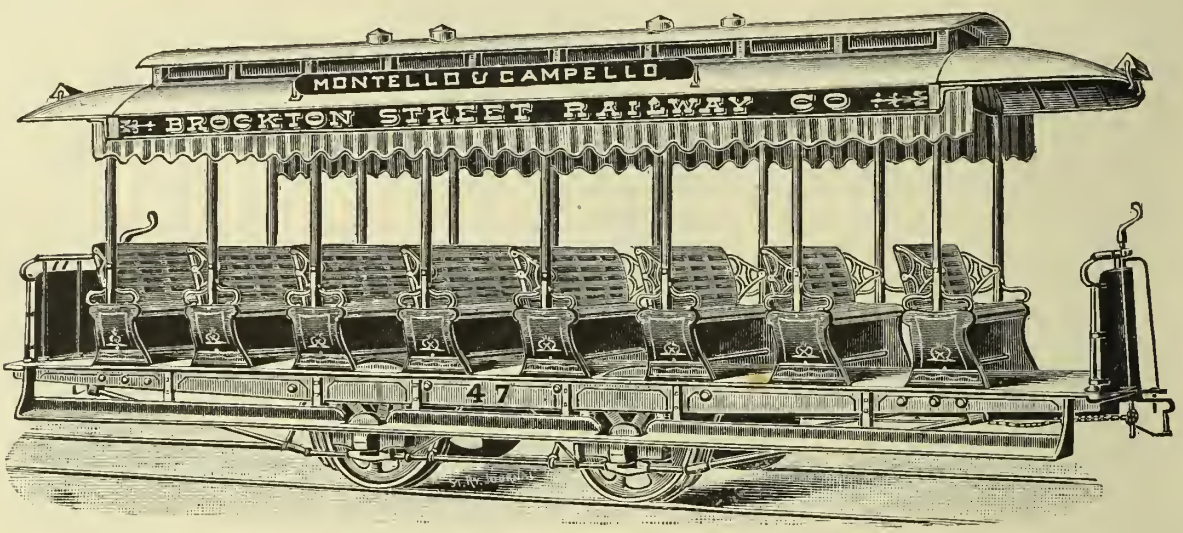
ST. LOUIS.



16 FOOT CLOSED CAR MOUNTED ON PATENT ENCLOSED ELECTRIC TRUCK.

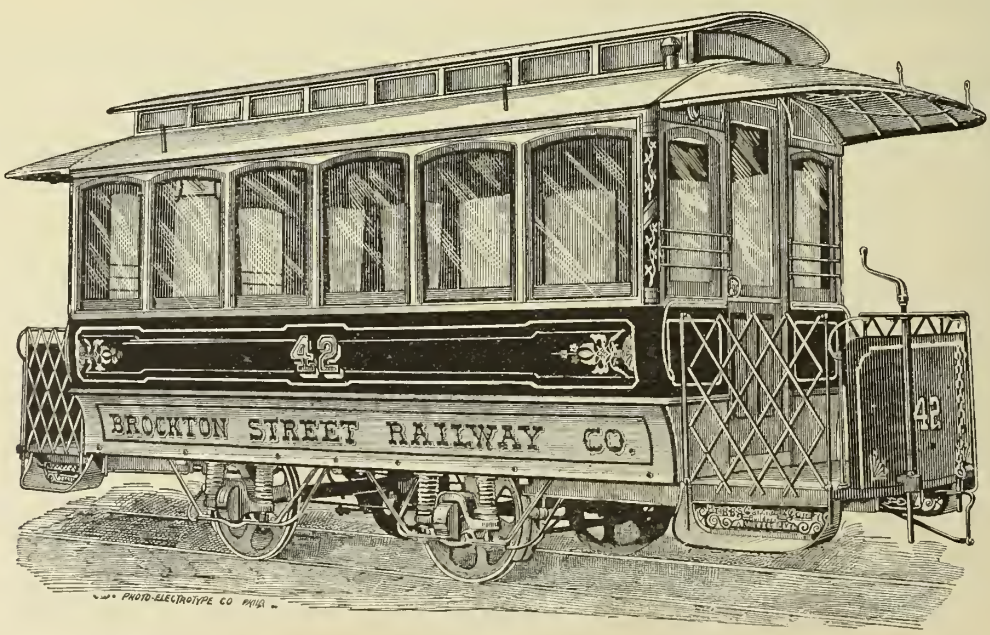
BRIGGS CARRIAGE COMPANY,

AMESBURY, MASS.



BUILDERS OF

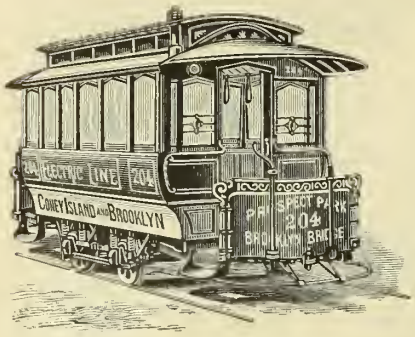
STREET RAILWAY CARS.



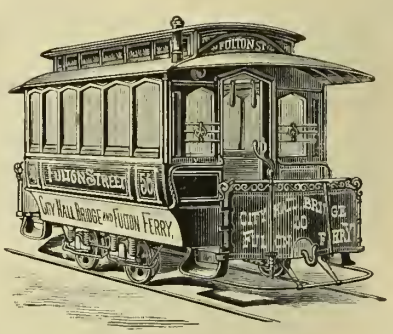
PHOTOS, CUTS AND DESCRIPTION OF CARS FURNISHED ON APPLICATION.
ALL INQUIRIES WILL RECEIVE PROMPT ATTENTION.



SEE PAGES 55, 56, 58, 93, 94, 120.

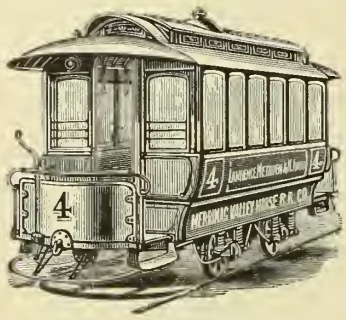


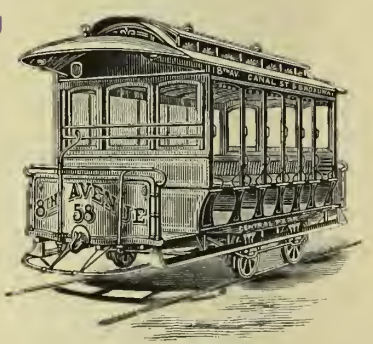




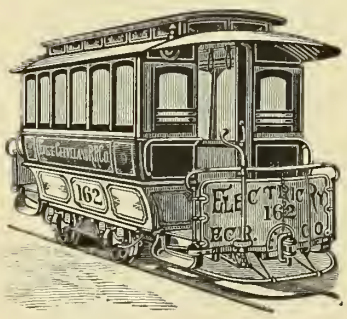
LEWIS & FOWLER
MFG. CO.
BROOKLYN, N. Y.

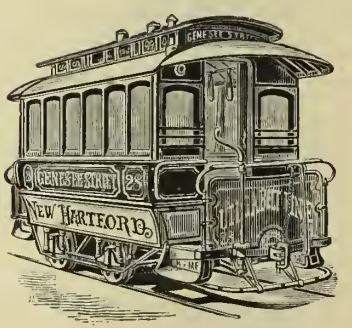
BUILDERS OF





STREET RAILWAY CARS



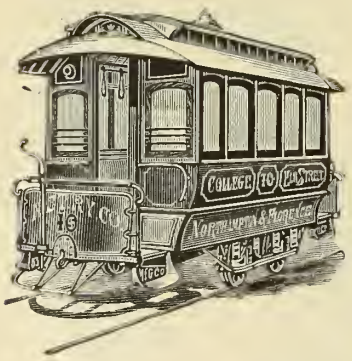


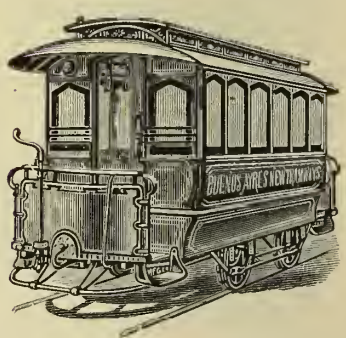
FOR

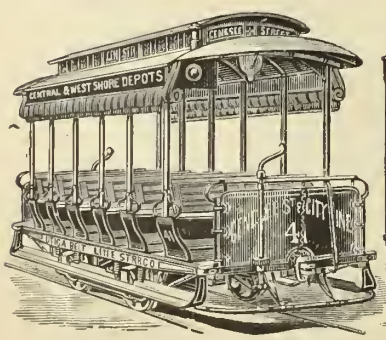
ELECTRIC

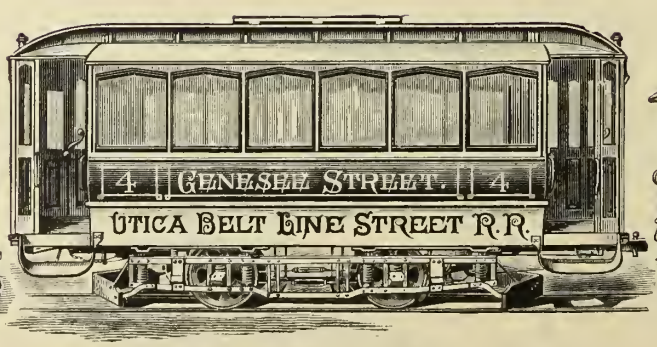
OR OTHER

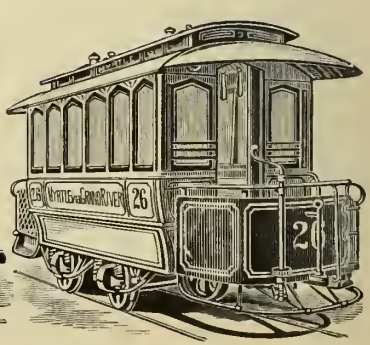
MOTIVE POWER.









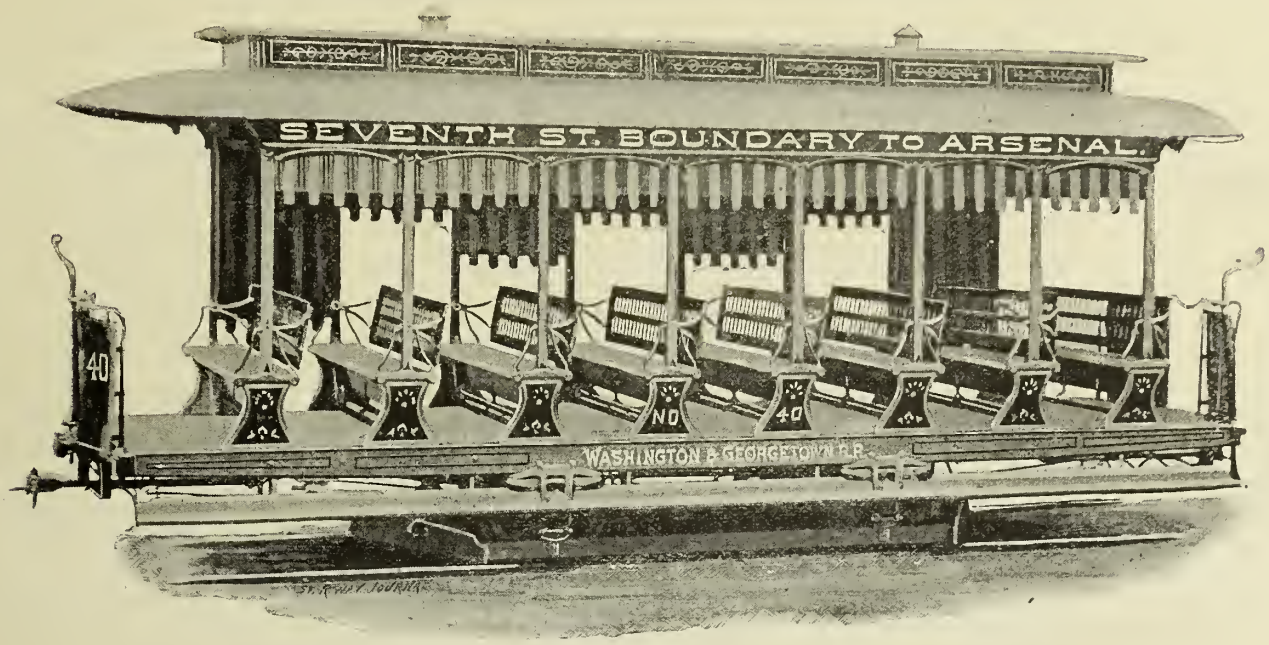


SEE PAGES 55, 56, 58, 93, 94, 119.

—ESTABLISHED 1839.—

J. M. JONES' SONS,

STREET RAILWAY CAR BUILDERS. } WEST TROY, N. Y.



ORDERS FILLED PROMPTLY.



SPECIAL ATTENTION GIVEN TO CARS FOR

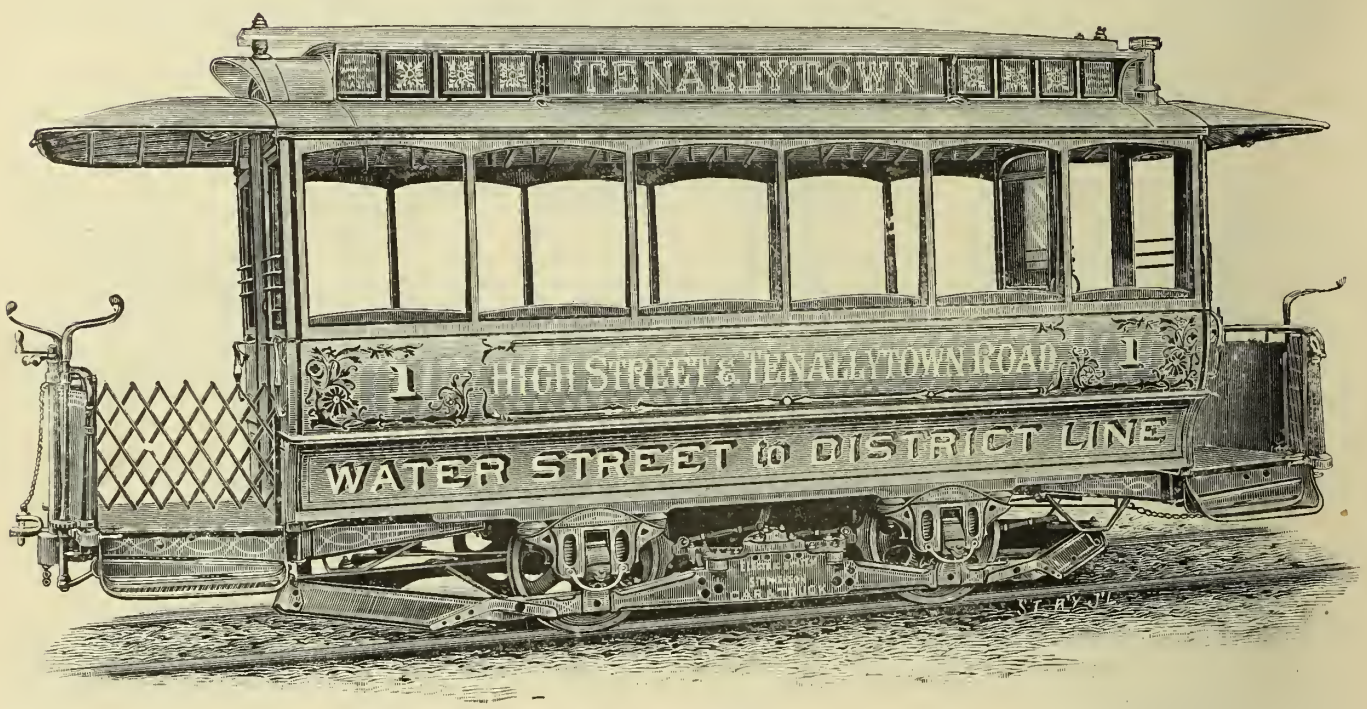
ELECTRIC AND CABLE SERVICE.

PRICES AS LOW AS THE BEST OF MATERIALS AND SKILLED LABOR WILL WARRANT.

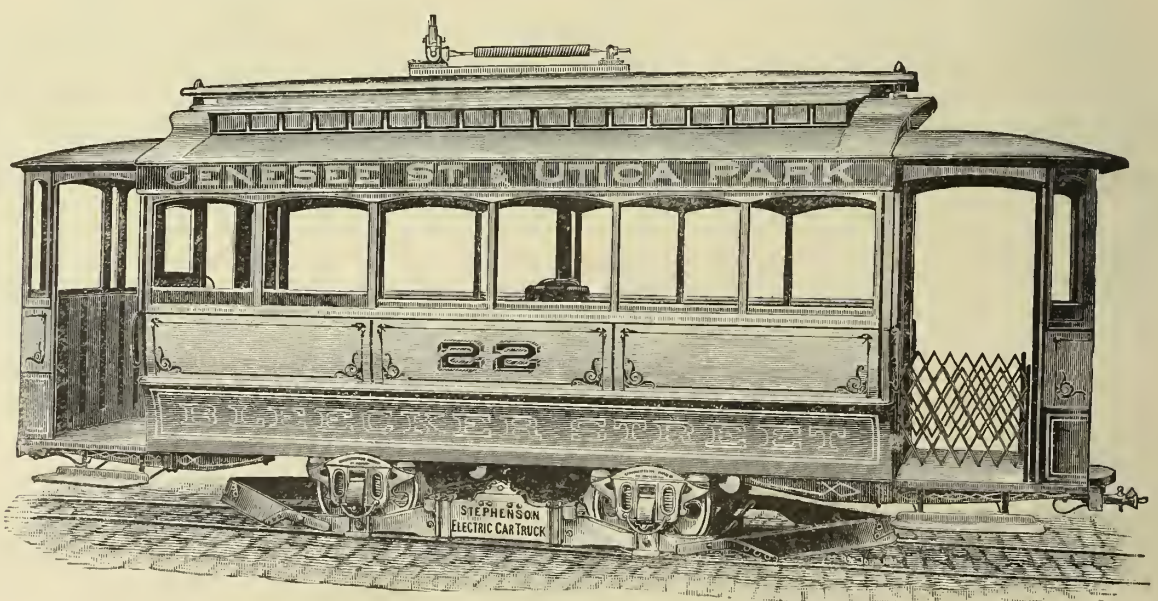
REPAIR · SUPPLIES · AT · COST.

JOHN STEPHENSON COMPANY, LIMITED

NEW YORK.



STREET CARS



ELECTRIC. ✳ CABLE. ✳ HORSE.

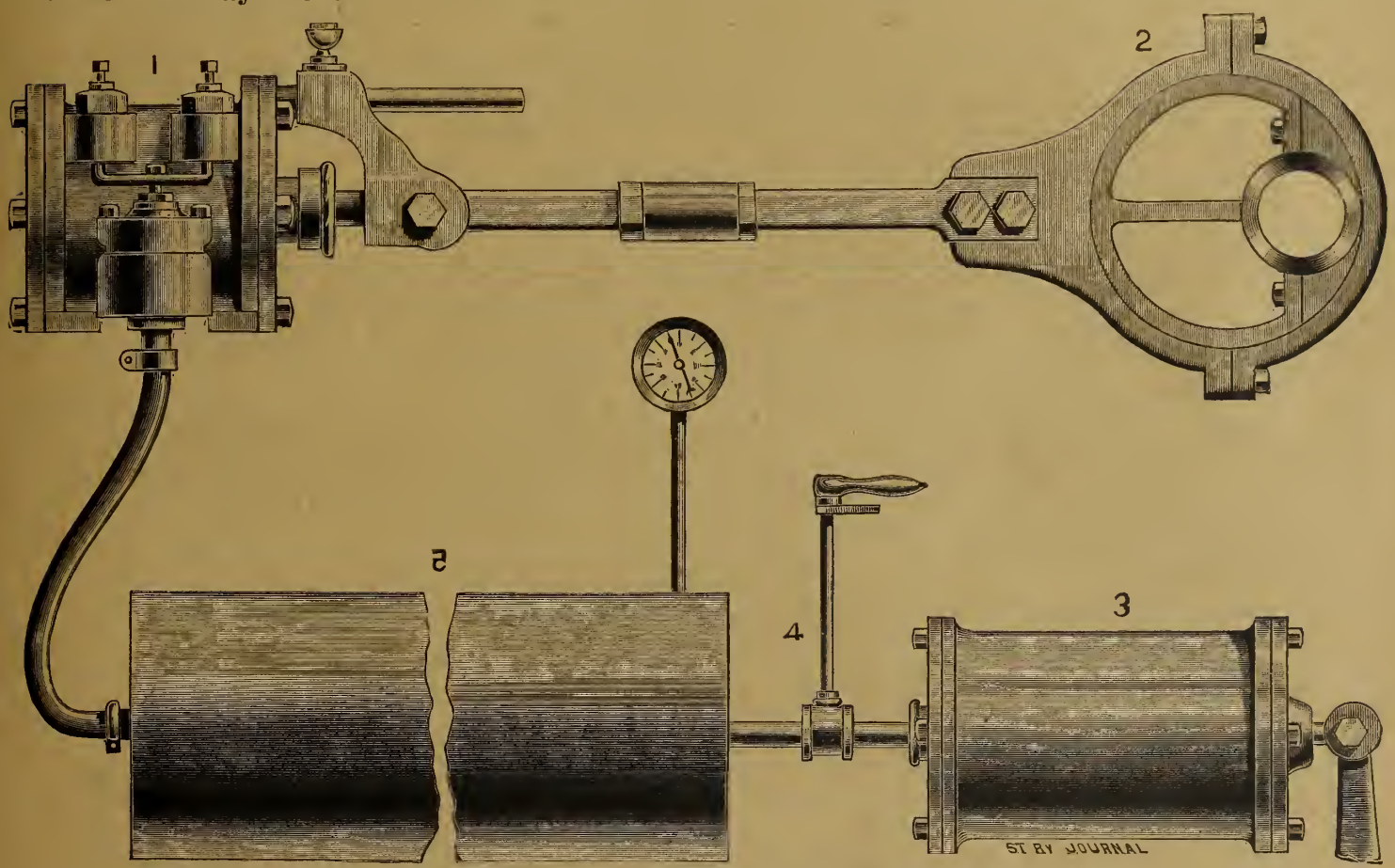
GENETT AIR BRAKE.

The only reliable and economical brake adapted for all kinds of TROLLEY and CABLE Cars, with and without trailers. Trailers broken up from motor car. Cars instantly stopped or slowed down as required, regardless of speed. A boon for motormen. Efficient service and economy secured.

ACCIDENTS REDUCED TO A MINIMUM.

INSTANTANEOUS, POWERFUL AND RELIABLE. SIMPLE IN CONSTRUCTION, EASILY UNDERSTOOD AND OPERATED.

NO POSSIBILITY OF ACCIDENT OR DELAY through failure of apparatus. Its action is entirely uniform. Braking power is under perfect control, and can be applied with any degree of force desired. ESPECIALLY ADAPTED TO HEAVY GRADES. Thoroughly tested by actual use, and pronounced a success by leading street railway men.



WE GUARANTEE THE GENETT AIR BRAKE AND EVERY CLAIM WE MAKE FOR IT.

It is manufactured under our own supervision. Every part thoroughly tested.

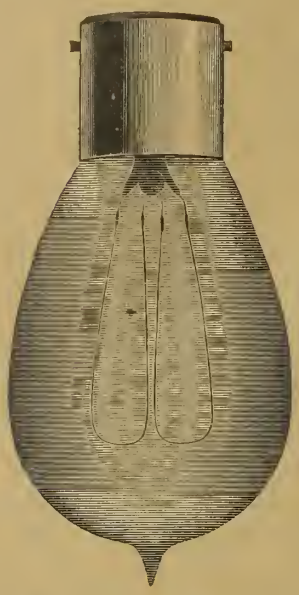
NOW IN ACTUAL OPERATION:

125th St., New York City (Cable), Buffalo, Paterson and Denver (Trolley).

ALL ORDERS PROMPTLY ATTENDED TO.

GENETT AIR BRAKE CO.

New York Office, 150 Broadway. Office & Factory, 11-23 S. Jefferson St., Chicago.



PERKINS LAMPS.

SPECIAL

DOUBLE CARBON LAMPS

FOR

STREET RAILWAYS.



DO NOT BLACKEN.
PURE WHITE LIGHT.
Satisfaction Guaranteed.



MOST EFFICIENT
FOR ALL SYSTEMS.
BEST in the MARKET.

THE PERKINS ELECTRIC LAMP CO.,



116 Bedford Street, Boston, Mass.



—OFFICES—

54 Franklin St,, Chicago, Ill.
28 Court St., Cincinnati, O.
141 E. Seneca St., Buffalo, N. Y.

806 Walnut St., Philadelphia, Pa.
830 Liberty Ave., Pittsburgh, Pa.
314 Pearl St., Hartford, Conn.

657 Park Place, Elmira, N. Y.
14 Butler Block, Syracuse, N. Y.
97 Nassau St., New York City.

DIRECTORY OF

STREET RAILWAYS

IN THE UNITED STATES AND CANADA.

Compiled from Data furnished the editors of "The Street Railway Journal," by the officers of the various roads.

Officials of Street Railways are earnestly requested to observe whether their roads are properly represented in this directory, and if not to send us the facts to make every item correct. For use in the January issue, directory matter must reach us by December 13.

ABBREVIATIONS.—**m, miles; g, gauge; lb r, pounds rail to the yard; c-b r, center-bearing rail; s-b r, side-bearing rail; c, cars; m. c. motor cars; t. c. trail cars; g. c. grip cars; h, horses; mu, mules.**

Officers' addresses are the same postoffice as the company unless otherwise specified.

The figures of mileage mean entire length of single track, counting one mile of double track as two of single, and counting switches as additional length.

Elec. after name of a road means that the road is operated wholly or partly by electric power. Capital means capital issued unless otherwise expressly stated.

A

ABERDEEN, WASH.—Wheless Underground Electric Co. 4 m c. Edison system. 10 2

ADRIAN, MICH.—Adrian City Electric Belt Ry Co. Elec. 2.8 m, 4-8½ g, 38 lb. T r, 4 c. of which 3 are m. c. and 1 t. c. Detroit system. Pres. J. H. Blain V. Pres. W. A. Jackson, Sec. W. W. Rhodes, Treas M. E. Chittenden. Office, 25 S. Main st. Capital $50,000. Bonds, $36,500. 5 2

AKRON, O.—Akron St. R. R. Co. 12 m elec. 4-8½ g, 52 lb girder r, 35 c, of which 25 are m. c. and 10 are t. c. Edison system. Pres. J. F. Seiberling, V. Pres I. M. Miller, Sec. & Treas. F. A. Seiberling, Supt J. E. Metlin. Capital, $300,000 10 2

ALAMEDA, CAL.—Alameda, Oakland & Piedmont R. R. Co. 5 m, 3 g, 16, 20 & 35 lb T & flat r, 5 closed and 8 open c, 25 h. Pres. & Gen. Man. Theo. Meetz, V. Pres. J. R. Spring, Sec. Rudolph Mohr. Capital, $100,000. j 2 2

ALBANY, GA.—Arteslan City R. R. Co. 3¼ m, 4-8½ g, 30 lb T r, 2 c, 4 mu. Sec. & Treas W. E. Mitchell, Gen. Man. J. M. Tift. Capital, $20,000 authorized, $100,000, 5 2

ALBANY, N. Y.—Watervliet Turnpike & R. R. Co. 15 m elec, 4-8½ g, 35 lb T & 47 flat r, 26 c, of which 20 are m. c. and 6 t. c. T-H and Short systems. Pres. Wm. B. Van Rensselaer, V. Pres. John J. Acker, Sec. & Treas. Cantine Tremper, Gen. Man. & Supt. G. Emmett. Offices 1165 Broadway. Capital, $240,000. Leased to Albany Ry. Co.

Albany & E. Greenbush Horse Ry. Co. 1.7 m, 4-6 g, 6 c, of which 4 are box and 2 open, 20 h. Pres. A B. Banks, Sec. & Supt. J. W. Gascoigne. Office, 473 Broadway. Capital, $50,000. 3 1

The Albany Ry. Co. 16 m elec, 4-8½ g, 60-65 lb girder r, 42 m. c. T-H system. Pres. Rob't C. Pruyn, V. Pres. Anthony N. Brady, Sec. James McCredie, Treas. & Gen. Man. John W. McNamara, Supt. J. J. O'Connor. Capital, $750,000. Bonds, $500,000. Office, Albany Co. Bank building. 9 1

ALBANY, ORE.—Albany St. Ry. Co. Steam. 3 m, 3-6 g, 25, 35 lb T r, 4 motor c, 3 h Pres. L. Flinn V. Pres. S. E. Young, Sec. C. G. Burkhart, Treas. E. F. Sox, Supt. & Gen. Man. W. Goltra. Capital, $12,000; authorized $16,000. 11 2

ALEXANDRIA, VA.—Washington, Alexandria & Mt. Vernon Electric Ry. Co. Elec. 9 m, 4-8½ g 50, 70 lb girder and T r, 6 m c. T-H system. Pres D. C. Leech, V. Pres. J. S. Swartz, Sec. & Treas. L. W Spear. Capital, $500,000. 9 2

ALHAMBRA, CAL.—Alhambra & Pasadena St. Ry. Co. 3½ m, 3-6 g, 16 lb. T r, 3 c, 4 h. 4 mu. Pres. A. C. Weeks, V. Pres. G. B. Adams, Sec. T. E. Stuart, Man. F. Williams. Capital, $12,000. 2 2

ALLEGHENY, PA.—Nunnery Hill Incline Plane Ry. Co. 1,100 ft. 5 g, 48 lb. T r, 2 c, using wire rope and drum. Pres. & Treas. Oliver P. Scalfe. Sec A. Kennedy, Supt. C. D. Heist. Capital, $60,000. Office cor. Fairmount & Federal sts. 8 2

Troy Hill Inclined Plane & Bridge Co. 370 ft. 6 g, 60 lb T r, 2 c. Pres. Jas. D. Callery, Sec. C. S. Wight Treas. Wm. V. Callery, Gen. Man. J. J. Saint. Capital, $200,000. Office, 448 Liberty Ave. 9 2

ALLENTOWN, PA.—Allentown & Bethlehem Rapid Transit Co. Elec. 17 m, 4-8½ g. 45, 48, 70 lb T & girder r, 57 c, of which 28 are m. c. and 29 t. c. T-H system. Pres. G. H. Campbell, Sec & Treas. A. A Glasier, Supt. A. H. Hayward. Capital, $700,000 Office, Car House, Madison St. near Gordon. 11 2

ALLIANCE, O.—Alliance St. Ry. Co. Elec. 2½ m 4-8 g, 42 lb tram r, 4 open m c. T-H & Short systems Pres. & Treas. W. W. Hazzard, Sec. & Gen. Man W. H. Whitacre. Capital stock $75,000; authorized $100,000. Cleveland office, 489 The Arcade. 5 2

ALTON, ILL.—Alton Improvement Association. 3½ m steam, 4-8½ g, 30 & 40 lb steel T r, 2 Baldwin m. c. Pres. Chas. W. Milnor, Sec. & Treas. H. R Phinney. Office, 305 W. 2d St. Capital $25,000. 9 2

Alton & Upper Alton Horse R. R. & Carrying Co 3 m, 4-8½ g, 40, 66 lb steel T & flat r, 7 c, of which 5 are box and 2 open, 24 h. Pres. C. W. Milnor, Sec Treas. & Supt. H. R. Phinney. Capital, $42,200; authorized, $100,000. Office, 305 W. 2d st. 11 2

ALTOONA, PA.—City Pass. Ry. Co. of Altoona Pa. Elec. 6 m, 5-3 g, 48½ lb. girder r, 28 c, of which 14 are m. c. and 14 t. c. T-H system. Pres John P. Levan, Sec. & Treas. L. B. Reifsneider, Supt W. P. Hewitt. Capital $180,000; Bonds $50,000. Office Chestnut av. below First st. 8 2

City & Park Railroad Co. Elec. 7¼ m, 4-8½ g. 60-65 lb channel and T r, 18 c, of which 9 are m. c. and 9 t. c. Edison sytem, Pres. S. C. Baker, V. Pres J. Loudon. Sec. & Treas. D. G. Thompson. Capital authorized, $150,000. 8 1

AMERICUS, GA.—Americus St. Ry. Co. Elec 5 m, 4-8½ g, 35 lb T r, 6 m c. T-H system. Lessee C M. Fouche.

AMES, IA.—Ames & College Ry. Co. 2½ m. Steam 4-8½ g, 30 lb. T r, 2 c, 1 steam motor. Pres. J. L. Stevens, V. Pres. D. S. Fairchild, Sec. M. K. Smith Treas. B. J. Sheldon. Capital $25,000. 9 2

AMSTERDAM, N. Y.—Amsterdam St. Ry. Co Elec. 4 m. 4-8½ g, 48½ lb. girder r., 13 c, of which 6 are m. c. and 7 t. c, 5 h. Edison system. Pres. J H. McClement, V. Pres. F. J. Sprague, Sec. & Treas T. D. Mosscrop, Gen. Man. J. R. Snell, Counsel J. S Wise. Capital, $250,000. Bonds, $150,000, Office of Pres. and V. Pres. 42 and 44 Broad St., N. Y. City Office of Supt. 102 E. Main St., Amsterdam. 8 2

ANACONDA, MONT.—Electric Ry., Light & Power Co. 5.2 m, 4-8½, g, 35 & 50 lb. T r, 4 motors, 10 c, of which 4 are m. c. and 6 t. c. T-H system. Pres. M. Daly, Sec., Treas. and Gen. Man. D. F. Hallahan. 3 2

ANACORTES, WASH.—Fidalgo City & Anacortes Railway Co. Elec. 13 m, 4-8½ g, 35 lb. T r 4 m. c. T-H system. Pres. J. Pierce, V. Pres. H. C. Colver, Sec. J. S. Potter, Treas. W. A. Potter, Gen. Man. C. B. Holman, Supt. E. Dutcher. Capital $250,000; bonds $150,000. 3 2

ANACOSTIA, D. C.—Anacostia & Potomac River Ry. Co. 15.3 m, 4-8½ g, 62 lb. girder r, 46 c, 185 h Pres. & Supt. H. A. Griswold, Sec. & Tres. J. B Pitcher. Office, Anacostia, D. C. 9 2

ANDERSON, IND.—Anderson Electric St. Ry Co. 7 m, 4-8½ g, 40, 50, 60 lb T r, 16 c, of which 10 are m c and 6 t c. Westinghouse, Edison & T-H systems Pres., Treas. & Gen. Man. C. L. Henry, V. Pres. J. F Wild, Sec. S. M. Cox, Supt. L. Cox. Capital, $150,000 authorized, $200,000. Bonds, $100,000. Office, 41 Meridian st. 9 2

ANN ARBOR, MICH.—The Ann Arbor St. Ry Co. Elec. 5½ m, 4-8½ g, 45 lb Johnson girder r, 7 c of which 6 are m. c. and 1 t. c. Edison system. Pres. H. P. Glover, Sec. & Gen. Man. H. T. Morton, Treas. C. E. Hiscock Supt. of line, C S. Fall. Capital, $100,000; authorized, $100,000. Bonds, $60,000. 9 2

Ann Arbor & Ypsilanti St. Ry. Co. Dummy. 9 m 4-8½ g, 40 lb T r, 11 c, of which 5 are pass. c & 6 gravel c; 2 steam motors. Pres. & Gen. Man. J. E Beal, V. Pres. H. P. Glover, Sec. J. T. Jacobs, Treas D. L. Quirk, Supt. T. Neat. Capital, $100,000. 9 2

ANNISTON, ALA.—Anniston City St. Ry. Co. 6 m, 35 lb T r, 9 box c, 35 h. Pres. J. W. Bigsby, Sec., Treas. and Gen. Man. O. E. Edwards. 9 1

Oxford Lake Line Ry. Co. Elec 8 m, 4-8½ g, 40 lb T r. 10 c, of which 6 are m c & 4 t c. T-H system. Pres. H. W. Sexton V. Pres. L. Jemison, Sec., Treas., Gen. Man. & Supt. F. Wheyland. Capital, $52,000; authorized, $175,000. Office 915 Wilmer St. 11 2

ANOKA, MINN.—Anoka St. Ry. Co. 3 m, 4-8½ g, 26 lb T r, 3 c, 13 h. Pres. R. Mahany, Sec. J. Mahany Treas. R. Mahany, Jr., Gen. Man. W. W. Mahany Capital, $15,000. 9 2

APPLETON, WIS.—Appleton Electric St. Ry. 3.5 m. 4-8½ g, 33, 60 lb tram and girder r, 9 c, of which 5 are m. c. and 4 t. c. Edison system. Pres. & Treas. A. Le Smith, V. Pres. J. H. Van Northwick, Sec. C. A. Beveridge, Supt. F. C. King. Office College Ave. 3 2

Marinette St. Ry. Co. 3¼ m, 4-8½ g, 32 lb tram r 6 box c, 34 h. Pres. & Gen. Man. H. C. Higgins, V Pres. E. Scofield, Sec. & Treas. T. Higgins. Capital $50,000. Office 1511 Main st. 4 1

ASBURY PARK, N. J.—Seashore Elec. Ry. Co. 12 m, 4-8½ g, 45 lb flat & girder r, 23 m. c. T-H & Wightman systems. Pres. & Treas. J. S. Shaffer, Supt. A. S. Hickey. Capital, $200,000; authorized, $500,000. President's Office, 115 Broadway New York. 5 2

ASHEVILLE, N. C.—Asheville St. Ry. Co. Elec 6½ m, 4-8½ g, 30 & 40 lb c. b. & T r, 14 c of which 12 are m. c. and 2 t. c. Edison system. Pres. & Gen Man. J. G. Martin, V. Pres. W. T. Pennlman, Sec. & Treas. B. M. Jones. Supt. W. T. Gray. Capital $100,000; authorized $250.000. Bonds, $100,000. 3 2

West Asheville & Sulphur Springs Ry. Co. 4½ m, 3 m. c. T-H system. 5 2

ASHLAND, KY.—Ashland & Catlettsburg St Ry. Co. 6 m, 4-8½ g, 45 & 50 lb Johnson girder & T r, 7 c, of which 4 are m. c. and 3 are t. c. Pres. & Man. W. L. Ringo, Sec. & Treas. John Russell, Jr Capital, $20,000, authorized, $200,000. No bonds. 9 2

ASHLAND, PA.—Schuylkill Traction Co. (Leases Mahanoy, Shenandoah, Girardville & Ashland St. Ry.) Elec. 22 m, 4-8½ g, 40, 50, 60 lb T r, 30 c, of which 20 are m c & 10 t c. T-H & Westinghouse systems. Pres. J. F. Bailey, V. Pres. J. H. Cofrode, Sec. & Treas. C. E. Winters, Gen. Man. V. H. Yarnall Office, 265 Centre st. 10 2

ASHLAND, WIS.—Ashland St. Ry. Co. 2½ m 4-8½ g, 35 lb s b r, 6, 4-wheel box c, 36 h. Pres. & Gen Man. G. H. Hopper, V. Pres. S. S. Fefield, Sec. & Treas. G. F. Merrill, Supt. Geo. W. Marshall. Capital, $75,000. 6 2

ASHTABULA, O.—Ashtabula City Ry. Co.—4 m 4-8½ g, 40 lb T r, 9 c, 60 h. Propr. J. N. Stewart Sec. & Treas. S. C. Stewart, Man. H. H. Stewart. Officers and office at Cleveland, O. 5 2

Ashtabula Rapid Transit Co. Elec. 4½ m, 4-8½ g. 47 & 70 lb Johnson girder r, 9 c, of which 5 are m. c. and 4 t. c. T-H & Short systems. Pres. F. B. Wagner, V. Pres. R. A. Brown, Sec. & Supt. T. Fricker, Treas E. W. Savage. Capital $150,000. 8 2

ASPEN, COLO.—Aspen City Ry. Co. 2 m, 4-8½ g, 16 lb T r, 2 open c, 3 h, 2 mu. Pres. H. A. Tabor, Sec. M. K. Page, Gen. Man. T. J. Flynn. 5 2

ASTORIA, ORE.—Astoria St. Ry. Co. 3 m, 3-6 g, 30 lb T r, 8 c, of which 4 are m c and 4 t c. Pres. J. W. Conn, V. Pres. W. A. Sherman, Sec. & Supt. F. W. Newell, Treas. F. R. Stokes. Capital, $15,000; authorized, $200,000. 7 2

ATCHISON, KAN.—Atchison St. Ry. Co. 10 m, 4-8½ g, 20-50 lb tram & T r, 21 c, 60 h. Pres. W. L. Challis, Sec. W. L. Bailey, Supt. G. T. Ada. Capital $150,000. 11 2

ATHENS, GA.—Athens Ry. Co. Elec. 6 m, 4-8½ g 40 lb T 4 m, c. Detroit system. Pres. E. G. Harris Sec. Treas. & Gen. Man, J. T. Voss, Supt. E. W. Voss Capital $10.000. 11 2

ATHENS, TENN.—Athens Mineral Land & Imp't Co. 2½ m, 20 lb r, T 2 c, 4 mu. Sold to R. D. Vandyke and associates, of Rome, Ga. 6 0

ATLANTA, GA.—Atlanta Consolidated St. Ry. Co Lines operated. Peachtree st. and North Atlanta, Peachtree st. and Ponce de Leon. Marietta st.—Decatur st., Whitehall st. and West End, Capitol Ave. —North Ave., Wheat st. and Ponce de Leon. Broad st., West End, West View Cemetery and Fulton County St. R. R. 43 m, 4-8½ g, 45, 52 & 63 lb girder & T r, 54 m c. T-H system. Pres. J. Hurt, V. Pres. E Griffin, Sec. & Treas. A. A. Glasier, Asst. Sec. & Treas. & Pur. Agt. H. I. Bettis, Gen. Supt. M. R McAdoo. Capital, 2,000,000. Bonds, $1,750,000. 9 2

Atlanta & Chattahoochee River Ry Co. Elec 15 m 10 m c. Short System. 2 2

Atlanta Traction Co. Elec. 8 m, 9 m. c. Edison system. 8 2

Atlanta, West End & McPherson Barracks St. Ry. Co. 13 m c. Edison system. 7 2

ATLANTIC CITY, N. J.—Atlantic City Electric Ry. (Operated by Pennsylvania R. R. Co.) 7 m, 4-9 g, 65 lb T & girder r, 42 c, of which 30 are m c and 12 t c. Edison system. Supt. G. K. McAlister. 8 2

ATTLEBORO, MASS.—Attleboro, N. Attleboro & Wrentham St. Ry. Elec. 6½ m 4-8½ g, 40 lb. T r 17 c, of which 9 are m. c. and 8 are t. c. T-H system. Pres. P. Nerney, Treas. C. T. Guild, Supt M. A. Carter. Capital, $60,000, bonds $50,000. 8 2

AUBURN, N. Y.—Auburn City Ry. Co. Elec. 5¼ m, 4-8½ g, 45-47 lb girder & T r, 12 c, of which 9 are m c and 3 t. c. T-H system. Pres. C. E. Eddy, V. Pres. G. Underwood, Sec. & Supt. A. H. Underwood, Treas. J. E. Storke. Capital $50,000, authorized $150,000. Bonds $200,000. 9 2

AUGUSTA, GA.—Augusta & Summerville R.R. Co 10 m, 5 g, 30 lb T r, 25 c, 102 h. Sold to Augusta Ry. Co. 4 1

Augusta Ry. Co. Elec. 25 m, 4-8½ g, 35 lb T & 54 lb girder and T r, 48 c, of which 35 are m. c. and 13 t. c. Edison and T-H systems. Pres. D. B. Dyer, V. Pres. S. M. Jarvis. Sec. R. M. Spivey, Treas. R. R. Conklin, Supt. C. S. Clark. Capital, $300,000. Bonds, $400,000. Office Jarvis-Conklin building. 9 2

AUGUSTA, ME.—Augusta, Hallowell & Gardiner R. R. Co. Elec. 8 m, 4-8½ g, 40 & 55 lb. T & Johnson r 13 c, of which 9 are m. c. and 4 t. c. T-H., Edison & Detroit systems. Pres. & Treas. G. E. Macomber, Sec. H. G. Staples. Capital, $120,000; authorized, $150,000. Bonds, $150,000. Office, Hallowell, Me. 11 2

AURORA, ILL.—Aurora St. Ry. Co. Elec. 17 m 4-8½ g, 67 lb. T and 57 lb girder r, 21 c, of which 16 are m c and 5 t c. T-H and Detroit systems. Pres. & Treas. R. B. Dodson, V. Pres. H. C. Tinker, Sec. A. T Simendinger, Gen. Man. D. A. Belden. Capital, $300,000. Bonds, $300,000. 11 2

AUSTIN, TEX.—Austin Rapid Transit Ry. Co. Elec. 15 m, 4-8½ g, 40 lb girder & T r, 20 c, of which 12 are m. c. and 8 t. c. T-H system. Pres. F. H. Watriss V. Pres. I. H. Evans. Sec. & Supt. J. K. Urle. Capital $200,000. 9 2

B

BABYLON, N. Y.—Babylon Street Ry. Co. 1.53 a, 4-9 g, 60 lb T r, 4 c, of which 3 are box and 1 is open, 3 h. Pres. W. F. Norton, Sec. Jos. F. Sammis Treas. John R. Reid, Supt. David S. S. Sammis Capital $25,000. 11 2

BAKER CITY, ORE.—Baker City St. Ry. & Motor Co., 2½ m, 3-5½ g, 20 lb. T r, 2 4-wheel box c. 6 h Pres., Gen. Man. & Supt. C. L. Palmer, Sec. M. D Abbott, Treas. L. W. Place. Capital, $50,000. 6 2

BALTIMORE, MD.—Baltimore & Curtis Bay St. R. R. Co. Elec. 4½ m, 5 m c, Edison system. 7 2

Baltimore, Catonsville & Ellicott's Mills Pass Ry Co. 6 m, 5-4½ g, 35 lb T r, 10 c, 40 h. Pres. Nelson Perin, Sec. W. W. Orndorff, Treas. E. J. D. Cross. Office, Pratt st. & Frederick ave. a 90

Baltimore City Pass. Ry. Co. 46¾ m, 5-4½ g, 47 lb tram r, 172 c, of which 162 are 4-wheel box and 4 are 4-wheel open, 1,250 h. Pres. & Supt. Oden Bowie Sec. S. L. Bridge, Treas. A. B. Clark, Supt. car shops J. M. Blundell, Supt. tracks, Boyer Parks. Office cor. Calvert & Baltimore sts. Capital $1,000,000. Bonds, $2,000,000. 9 2

Baltimore Traction Co. Elec. (Includes N. Baltimore Pass. Ry. and Baltimore & Powhatan Ry.) 63 m, of which 29 are borse & 10 cable, 5-4½ g, 42, 45, 47 and 78 lbs s b, flat & girder r, 150 c, of which 115 are h c & 35 g c, 522 h, 4 m c, Short system. Pres. T. E. Hambleton, V. Pres. J. S. Hagerty, Sec. N. H. Johnson. Treas. F. S. Hambleton, Gen. Man. Wm. A. House, Jr. Office, Druid Hill Ave. Extension, Clifton. 9 2

Baltimore Union Pass. Ry. Co. 45 m, 5-4½ g, 25, 45 65 lb T & girder r, 117 c, 710 mu. Pres. & Gen. Man N. Perin, Sec. Leon Fender, Treas. E. J. D. Cross, Capital, $750,000. Office cor. Huntington ave. & Oak St. 1 2

Central Ry. Co. Elec. 13 m, 5-4½ g, 80 lb tram r, 40 c, of which 20 are m c and 20 t c. T-H system. Pres G. Blaklstone, V. Pres. Peter Thompson, Sec. N James, Treas. N. H. Bell. Capital, $250,000. Office 503 E, Preston st. 11 2

Highlandtown & Point Breeze Ry. Co. 6 m, 5-4½ g, 45 lb tram & T r, 25 c, of which 20 are 4 wheel box & 6 4-wheel open, 100 h. Pres. Francis Hazlehurst, Sec. J. L. Weitzel, Supt. Jas. Smith. Capital $180,000. Office 712 Eastern Ave., Highlandtown. b 4 1

Lake Roland Elevated Ry. Co. Elec. 19 m 5-4½ g, 40 62, 70 lb. T, Duplex & girder r 32 m c, Edison system Pres. S. M. Jarvis, V. Pres. & Treas. R. R. Conklin Sec. E. H. Bouton, Gen. Man. L. N. Frederick. Capital, $987,500. Authorized $1,000,000. Office, 22 N. Charles St. 11 2

BANGOR, ME.—Bangor St. Ry. (Owned and operated by Public Works Co.) Elec. 8 m, 4-8 g, 35 lb tram & T r; 30 c, of which 21 are m c and 9 t c. T-H system. Pres. F. M. Laughton, Sec. Frank H. Clergue, Treas. M. H. Wardwell, Supt. Ry. Dept. J. G. Carroll, Chief Eng. J. G. Kimball. Capital, $200,000. 8 2

BATTLE CREEK, MICH.—Battle Creek Electric Ry. Co. 8¼ m, 4-8½ g, 42 lb r; 18 c, of which 8 are m c and 10 t c. Short system. Pres. J. L. Boderidge, V. Pres. C. Miller, Sec. & Gen. Man. F. J. Willson, Treas. C. H. Harbert. Capital $100,000. Bonds $110,000. Office, 15 & 17 Annex Building. 9 2

BAY CITY, MICH.—Union St. Ry. Co. 15 m 4-8½ g, 47 lb r, 27 c, 95 h. Pres. & Gen. Man. W. H Tousey, V. Pres. S. O. Fisher, Sec. J. Turner, Treas H. H. Norrington, Supt. Byron Alley. Capital $100,000. Bonds, $60,000. Office, 503 Phœnix Block. 11 2

BAY RIDGE, MD.—Arundel on the Bay R. R. (Operated by Chesapeake & Columbia Investment Co.) Steam. 2 m, 4-8½ g, 30 lb T r, 4 c, 1 engine. Pres. T. W. Smith, V. Pres. W. P. C. Hazen, Sec. T. D. Kelleher, Treas. N. H. Shea, Gen. Man. D. D. Stone, Supt. L. Cavanaugh. Capital, $100,000. Office, I St and Indiana Ave. Washington, D. C. 8 2

BEATRICE, NEB.—Beatrice Rapid Transit & Power Co. Elec. 6 m, 4-8½ g, 38, 52 lb girder & T r, 8 c, of which 4 are m c and 4 t c. Short system Pres. N. N. Brumback, V. Pres. C. L. Schell, Sec. L. E. Spencer, Treas. S. K. Davis, Supt. G. M. Johnston. Capital $250,000. Office Cor Court & 8th Sts. 11 2

BEAUMONT, TEX.—Beaumont St. Ry. Co. 2½ m, 4-8½ g, 30 lb T r, 2 c, 8 mu. Pres. G. W. Carroll V, Pres. W. R. Caswell, Sec., Treas. & Gen. Man. J H. Blanchford. Capital, $15,000; authorized $100,000 6 2

BEAVER FALLS, PA.—Beaver Valley Traction Co. (Includes Central Electric St. R R. Co.) Elec. 7.3 m, 5-2 g, 45-56 lb. girder & T r, 11 c, of which 10 are m c and 1 t c. T-H system. Pres. J. M. Buchanan, V. Pres. A. M. Jolly, Sec. A. R. Leyda, Treas. S. P. Stone, Supt. W. N. Whitacre. Capital $300,000. Bonds $150,000. 8 2

BELDING, MICH.—Belding St. Ry. & Imp. Co., Elec. 7 m. 4 8½ g, 40 lb r. Pres. B. Stone, V. Pres. W G. Merkle, Sec. R. S. Hale, T. F. Ireland. Capital $25,000. 7 2

BELLAIRE, O.—Bellaire St. R.R. Co. 2½ m, 4-8½ g, 20 lb r, 5 c, 20 h. Pres. & Gen. Man. J. Felix, Treas. J. C. Beard 9 2

BELLEVILLE, ILL.—Citizens' Horse Ry. Co 4½ m, 4-8½ g, 16 lb T r, 9 4-wheel box c, 3 h. & 18 mu Sold to G. W. Atterbury & Co. Receiver J. T. Rider Office, 105 N. High st. Capital, $25,000. 7 2

BELLEVILLE, ONT., CAN.—Belleville St. Ry. Co. 2 m, 3-6 g, 28 lb. tram r, 5 c, of which 4 are 4 wheel box and 1 is 4 wheel open, 12 h. Pres. D. Lockwood, Sec., Treas. & Man. S. A. Lockwood Capital, $30,000. 9 1

BENSON, NEB.—Benson & Halcyon Heights Ry. Co. Elec. 2 m, 4-8½ g, 20 lb T r, 2 m c. Westinghouse system. Pres. W. H. Crary, Supt. E. H. Cone 9 2

BEREA, O.—Cleveland & Berea St. Ry. Co. 4½ m 4-8½ g, 40 lb tram & T r, 2 4-wheel box c, 3 h. Pres C. W. D. Miller, V. Pres. O. S. Pomeroy, Sec. & Treas A. H. Pomeroy, Supt. A. W. Bishop. Capital, $60,000 authorized, $150,000. Bonds, $15,000. 3 2

BERKLEY, VA.—The Berkley St. Ry. Co. 2 m, 4-8½ g, 20 & 42 lb c. b., & T. r, 2 4-wheel box c, 8 h. 7 mu. Pres. T. H. Synon, Sec., Treas. & Gen. Man. W Tillotson. Capital, $8,000; authorized $75,000. 5 2

BESSEMER, ALA.—Bessemer & Birmingham R. R. Co. 13½ m, 4-8½ g, 40 lb T. r, 15 c. of which 10 are 8 wheel box & 5 8-wheel open, 4 frgt. c, 5 steam motors. Pres. T. T. Hillman, V. Pres. & Gen. Man. R. Jemison, Sec. J. A. Stratton, Supt. J. B. McClary Capital $250,000. Owned by Birmingham Ry. & Elec. Co. 4 1

BEVERLY, MASS.—Beverly & Danvers St. Ry Co. Elec. 4 m, 4-8½ g, 40 lb T r, 5 motor c. Union Electric Car Co. batteries. Pres. John I. Baker. 1 1

BIDDEFORD, ME.—Biddeford & Saco R. R. Elec 6 m, 4-8½ g, 35 lb T r, 16 c, of which 4 are 4-wheel box 6 m c and 6 t c. T-H system. Pres. E. H. Banks, Sec. & Treas. Chas. H. Prescott, Supt. G. C. Towle, Capital, $40,000. Bonds, $90,000. Office, 154 Main st. 8 2

BINGHAMTON, N. Y.—Binghamton & Port Dickinson R. R. Co. 10 m, 4-8½ g, 35 lb T & flat r, 13 c, of which 8 are box and 5 open, 25 h. Pres. J. Evans V. Pres. G. T. Rogers, Sec. J. B. Rogers, Treas. C. J Knapp. Leased to N. L. Osborne to Jan. 1, 1893 Office Strong Block. Capital, $28,000. 5 2

Binghamton R. R. Co. Elec. 22 m, of which 12 are horse and 10 elec, 4-8¼ g, 48 & 71 lb girder and T r, 49 c of which 17 are h c, 17 m c and 15 t c, 41 h. Edison and T-H systems. Pres. G. T. Rogers, V. Pres. J. Evans, Sec. C. O Root, Treas. J. B. Rogers, Gen. Man. & Supt. J. P. E. Clark. Capital $260 000; authorized $500,000. Bonds $200,000. Office, Trust Co. Bldg. 9 2

Court St. & East End R. R. 3.38 m, 4-8½ g, 35 & 45 lb flat & T r, 9 c, of which 5 are box and 4 open, 26 h Pres. Chas. M. Stone, V. Pres., Sec. & Treas. Wm G. Phelps, Supt. Miles Leonard. Office, Phelps Bank Bldg. Capital stock, $35,000. 8 2

Main, Court & Chenango St. R.R. 7½ m, 4-8½ g, 20-35 lb flat & T r, 13 c, of which 8 are box and 5 open 26 h, 4 mu. Supt. & Lessee, N. L. Osborn. Pres. H Westcott, Sec. G. M. Harris. Capital, $30,000. 3 1

West Side St. Ry. Co. 1½ m, 4-8½ g, 35 lb. T r 2 4-wheel box c. Pres. C. M. Stone, Sec. & Treas. W G. Phelps. Office, Phelps Block. Capital, $25,000. Leased to Court st. & East End R. R. 7 1

BIRMINGHAM, ALA.—Birmingham Ry. & Electric Co. 58 m, of which 43 are steam, and 15 elec 4 8½ g, 40-58 lb T & Johnson girder r, 104 c, of which 32 are h. c, 36 steam, 24 m. c. and 12 t. c, 50 h. Pres T. T. Hillman, V. Pres. & Gen. Man. R. Jemison, Sec & Treas. Jas. A. Stratton, Supt. J. B. McClary. Capital $1,900,000; Authorized $3,000,000; Bonds $927,000 Office, 303 20th St. 9 2

Birmingham & Forest City Dummy St. R. R.. 4 m, 4-8½ g, 38 lb. r., 2 dummies, 2 coaches. Pres. & Man. E. Eastman. 9

Birmingham & Milner Springs St. Ry. Co. 1¼ m 4-8½ g, 35 lb tram r. Sold to Birmingham & Forest City Dummy line. 9

Highland Ave. & Belt R. R. Co. 29 m, 4-8½ g, 40 lb T r and 14 pass. c, 9 engines. Pres. F. M. Billings Sec. C. R. McCullough, Treas. & Gen. Man. J Loudon, Supt. L. W. McCants. Capital $1,000,000 Office, 9 N. 20th St. 9 2

BIRMINGHAM, CONN.—Derby Street Ry. Co Elec. 4 m, 4-8½ g, 45 lb girder and flat r; 11 c, of which 6 are m c and 5 t c. T-H system. Pres. H Holton Wood, V. Pres. C. as. F. Bliss. Sec. Geo. O Schneller, Treas. Chas. E. Clark. Supt. B. W. Porter Capital stock $50,000; authorized $200,000, Bonds $5,000 8 2

BLOOMFIELD, N. J.—Newark & Bloomfield R. R. (See Newark, N. J.)

BLOOMINGTON, ILL.—The Bloomington City Ry. Co. Elec. 11 m, 4-8½, 30 and 47 lb tram & T r, 25 c, of which 15 are m. c. and 10 t. c. United Elec. Traction & Short systems. Pres. John J. Patterson, Sec Treas. & Man. W. H. Patterson. Capital $600,000. 9 2

BLOUNTSVILLE, ALA.—Blountsville & Bangor Dummy Line Co. 12½ m. Pres. A. E. Fields, V. Pres. Dr. W. M. Cole, Sec. J. L. Montgomery, Treas. Dr. W. M Fennell, Gen. Man. C. Turner, Supt. J. A. B. Lovett. 9 2

BOISE CITY, IDAHO.—Boise City Rapid Transit Co. Elec. 2.75 m, 2 m c. Edison system. 7 2

BOONE, IA.—Boone St. Ry. Co. 3½ m, 3 g, 30 lb T r, 5 c, 20 h. Pres. L. W. Reynolds, V. Pres. C. J A. Ericson, Sec. S. T. Stanfield, Treas. C. E. Rice Supt. J. F. Reynolds. Capital $45,000. Bonds, $15,000. 6 2

BOSTON, MASS.—Boston & Chelsea R. R. Co. (Leased to West End St. Ry. Co. operated by Lynn & Boston Ry. Co.) 4.154 m, 4-8½ g, 48-56 lb girder r Pres., Treas. & Clerk, John H. Studley, Jr. Office Lynn & Boston Ry. Co., 81 Milk st. Capital $121,000 6 2

Boston & Revere Electric St. Ry. Co. 4-30 m, 4-8½ g, 56 lb T r, 16 c, of which 6 are 4-wheel open m.c. and 10 are 4-wheel open t.c. T-H system. Pres. & Man. Washington G. Benedict, Sec. & Treas. Ellery I. Garfield. Capital $50,000. 11 2

Malden & Melrose R. R. Co. (Operated by West End St. Ry. Co.) 8 m, 4-8½ g, 35 & 52 lb Street r Pres. Chas. E. Powers, Sec. J. H. McFarland. Capital $200,000. Office, 27 Tremont Row. 9 1

Somerville Horse R. R. Co. (Operated by the West End St. Ry. Co.) 5.4 m, 4-8½ g, 56 lb r Boston pattern. Pres. Joslah Q. Bennett, Somerville, Treas & Clerk, J. H. Studley, Jr. Office, 81 Milk st. Capital, $153,000. 6 2

West End St. Ry. Co., 260 m (includes Boston & Chelsea, Malden & Melrose, Somerville) of which 140 are horse and 120 are elec., 4-8½ g, 50 to 72 lb. tram and T flat steel and Richards r, 2745 c, of which 150 are 8 and 6-wheel box, 950 are 4-wheel box, 75 are 8 and 6-wheel open, 1083 are 4-wheel open, 487 m. c 8000 h. T-H system. Pres. H. M. Whitney, V. Pres P. Cummings, 2d V. Pres. C. S. Sergeant, Treas. J. H Goodspeed, Auditor, H. L. Wilson, Pur. Agt. Henry F. Woods, Chief Eng. Elec. Dept. F. S. Pearson Consult'g Vet. Surgeon Dr. Chas. F. Lyman. Capital $10,500,000. Office, 81 Milk St. 6 2

Winnisimmet R. R. Co. Elec. 2.015 m, 4-8½ g, 70 lb girder r, T-H system. Pres T. P. Proctor, Boston, Mass., Treas. & Clerk, E. Francis Oliver, Boston. Capital, $50,000; authorized, $75,000. Office 13 Tremont Row. Leased to Lynn & Boston Co 1 7 1

BOULDER, COLO.—Boulder St. Ry, Co. 1½ m, 3 c. Pres. C. E. Leibold, V. Pres., Treas. & Gen. Man. J. A. Root, Sec. C. B. Horsford. 10 1

BOWLING GREEN, KY.—Park City Ry. Co. Pres. J. E. DuBose.

BRADFORD, PA.—Bradford & Kendall Ry. Co 1½ m, 4-8½ g, 35 lb T & flat r, 2 c, 5 h. Pres. & Gen Man. W. S. Wales, Sec. & Supt. M. F. King, Treas G. S. Wales. Capital, $12,000. 9 2

BRADDOCK, PA.—Braddock & Turtle Creek St Ry. Co. Elec. 3.7 m, 5-2½ g, 40, 48½ lb T & Johnson girder r, 6 m c, Westinghouse & T-H systems Pres. J. D. Callery, Sec. J. C. Reilly, Treas. J. W Taylor. Capital $62,000. Bonds $50,000. 7 2

Braddock Electric Ry. Co. 3¾ m, 5-2½ g, 48½ lb Johnson girder r, 5 m. c. Short system. Pres. A. L Sailor, V. Pres. J. P. McKelvey, Sec., Treas. & Man. C. F. Ellis. Capital, $80,000; authorized, $100,000. Bonds, $40,000. Office, Bell Ave. 8 2

BRANTFORD, CAN.—Brantford St. Ry. Co. 5 m, 3-6 g, 25 lb r, 7 4-wheel box c, 22 h. Pres. D. A. Flack, V. Pres. R. A. Pringle, Sec., Treas. & Man Chas. H. Flack. Capital $40,000. h 3 1

BRIDGEPORT, CONN.—Bridgeport Horse R. R Co. 8 m, 4-8½ g, 42 45 lb c b & T r, 29 4-wheel box c, 200 h. Pres. C. A. Hotchkiss, Sec. Thos. B Lasbar, Treas. F. Hurd, Supt. B. F. Lashar. Capital $140,000; authorized $300,000. Bonds $50,000. Office 333 E Washington Ave. 8 2

The East End Ry. Co. 6 m, 4-8½ g, 35 & 40 lb c b & T r, 27 c, of which 11 are 2-h. and 12 1-h, 150 h. Pres F. D. Baker, Sec., Treas. & Gen. Man. G. O. Lincs Capital $42,550; Authorized 100,000; Bonds $12,000 7 2

BRISTOL, TENN.—Bristol St. Car Co. 1¾ m, 4-8½ g, 30 lb. T r, 4 4-wheel box c, 12 h. Pres. J. M Barker, Sec. & Treas. A. D. Reynolds. Capital $50,000. Owned by Bristol Belt Line Ry. Co. 9 1

Bristol Belt Line Ry. Co. Elec. 7 m, 4-8½ g, 35 lb T r, 5 c, of which 3 are m c and 2 t c. Short & Edison system. Pres. J. L. Stadelman, Sec. & Gen. Man W. A. Stadelman, Treas. A. W. Morris. Capital $250,000. Bonds, $75,000. 11 2

BROCKTON, MASS.—Brockton St. Ry. Co. Elec 18½ m, of which 4½ are horse and 14 elec, 4-8½ g, 35 40 & 45 lb flat and T r; 50 c, of which 34 are h c and 16 m c, 221 h. T-H system. Pres. G. H. Campbell Treas. A. A. Glasier, Gen. Man. H. B. Rogers. Capital $200,000. Bonds $300,000. Office, 203 Main st. 9 2

East Side R. R. Co. Elec. 4½ m, 4-8½ g, 40 lb T & Johnson r; 11 c, of which 6 are m c and 5 t c T-H & Edison systems. Pres. A. C. Thompson, Treas. A. A Glasier, Supt. H. B. Rogers. Capital $45,000. Office 203 Main st. 9 2

BROOKLYN, N. Y.—Atlantic Avenue R. R. (Includes South Brooklyn Central) Co. of Brooklyn. Elec. 23 m, 4-8½ g, 50-60 lb c b and flat r, 383 c, 1,562 h. Westinghouse system. Pres. & Gen. Man. Wm. Richardson, Sec. W. J. Richardson, Treas. N. H. Frost. Capital, $1,143,750; authorized $2,000,000. Bonds, $2,144,000. Office, cor Atlantic & Third aves. 8 2

Broadway R. R. Co. of Brooklyn. 23.042 m, 4-8½ g 60 lb double groove r, 203 c, 700 h. Pres. Edwin Beers. Sec. & Treas. Robert Sealy, Supt. H. Myerholz Capital, $525,000. Bonds, $350,000. Office, 21 Broadway, E. D. 9 2

Brooklyn City R. R. Co. Elec, 184 m, of which 156 are horse, 8 steam and 20 elec, 4-8½ g. 50, 60 & 65 lb s b, c-b & girder r (all steel), 1,603 c, of which 1,507 are horse, 76 elec. m c, 20 are t c. 29 steam motors, 5,587 h. Pres. D. F. Lewis, V. Pres. E. D. White, Sec. & Treas. H. M. Thompson, Asst. Sec. & Treas. Thos. P. Swin, Supt. J. C. Cameron. Capital authorized and issued $6,000,000. Bonds, $3,925,000. Offices cor. Montague & Clinton Sts. 9 2

Brooklyn City & Newtown R. R. Co. 21½ m, 4-8½ g, 45-60 lb c b and s b r, 218 c, 642 h. Pres. John N Partridge, V. Pres. L. Fitzgerald, Sec. & Treas. Duncan, B. Cannon, Supt. John L. Helns. Capital, $1,000,000; authorized $2,000,000. Bonds, $1,000,000. Office cor. DeKalb & Central aves. 8 2

Broadway Ferry & Metropolitan Ave. R. R. Co. 11 m, 4-8½ g, 47-52 lb c. b. and tram r, 55 c, 124 h. Pres G. W. Maslin, Sec. E. M. Robinson, Asst. Treas. D W. Binns, Supt. F. Hartshorn. Office of Pres. & Supt. Metropolitan ave., E. Williamsburgh. Capital, $100.000. b 9 1

Brooklyn Heights R. R. Co. Cable. 1.1 m, 4-8½ g 60 lb girder r, 8 c. Pres. D. F. Lewis, V. Pres. J. E Searles, Jr., Sec. E. Johnson, Treas. G.S. Studwell. Supt. A. Rogers. Capital, $200,000. Bonds, $250,000 Office, 40 State st. 4 2

Coney Island & Bklyn R.R. Co. Elec. 22 m, of which 16 are horse & 6 elec., 45 & 60 lb r, 4-8½ g, 115 c, of which 40 are box, 61 open and 14 m. c., 300 h, T-H Short and Edison systems. Pres. H. W. Slocum, Sec. & Treas. E. F. Drayton Supt. D. W. Sullivan. Office cor. Smith & Huntington sts. Capital, $500,000. 4 2

Franklin Ave. R. R. Branch of Brooklyn City & Newtown R. R. Co. 9 m, 4-8½ g, 50 lb c b r, 72 c, of which 40 are 4-wheel box and 32 are 4-wheel open, 224 h. 4 2

Jamaica & Brooklyn R. R. Co. (See Jamaica, N. Y)

Prospect Park & Flatbush R. R. Co. 3 m, 4-8½ g, 34 lb r, 4 box c, 10 h. Pres. H. W. Slocum, Sec. & Treas H. W. Slocum, Jr., Supt. D. W. Sullivan. Office, 45 Broadway. Capital $50,000. 4 2

Van Brunt St. & Erie Basin R.R. Co. 2½ m, 4-8½ g, 45 lb s b r, 19 c, 41 h. Pres. Michael Murphy, Sec. & Treas. Wyllys Terry, Supt. T. J. Carey. Capital authorized and issued, $150,000. Bonds, $25,000. Offices, 264 Van Brunt st. 9 2

BROWNSTOWN, IND.—Brownstown & Ewing St. R. R. Co. ½ m, 5-4 g, 1 c, 3 h. Pres. W. Frysinger V. Pres. W. R. Boiles, Sec. W. L. Bryatt, Treas. B. H Burrell, Supt. F. Falk. 8 0

BRUNSWICK, GA.—Brunswick St. R. R. Co. 9 m, 4-8½ g, 48½ lb T and girder r, 15 c, 70 mu, 1½ m on St. Simon's Island, with 2 steamboats connecting lines Receiver, W. H. Berrie. Office, Newcastle st Capital $200,000. 9 2

BUENA VISTA, VA.—The Buena Vista St. Ry Co. Elec. 4 or 5 m. Pres. A. C. Gordon, Sec. & Treas. F. D. Coe. Capital, $100,000. 12 0

BUFFALO, ILL.—See Mechanicsburg, Ill.

BUFFALO, N. Y.—Buffalo Railway Co. Elec. 86 m, of which 47 are horse and 21 elec., 4-8½ g, 50-62 lb girder and c b r, 285 c, of which 220 are h c and 65 are m c, 1,116 h. T-H & Edison systems. Pres. Henry M. Watson, V. Pres. & Gen. Man. H. H. Littel, Sec Joseph S. Baecher, Supt. Edw. Edwards. Capital $5,370,500; authorized, $6,000,000. Bonds, $5,000,000 Office, 346 Main st., Buffalo. 8 2

Buffalo, Bellevue & Lancaster Ry. Co. 4 m c. T-H system. 7 2

Buffalo & Tonawanda Electric Ry. Co. 6 m, 4-8½ g, 45 lb T & girdor r, 8 c, of which 3 are m c and 5 t c T-H & Edison systems. Pres. E. H. Butler, V. Pres M. Nellany, Sec. & Treas. C. M. Howard, Supt. W. J Voorhees. Capital, $125,000; authorized $250,000. 9 2

Buffalo, North Main St. & Tonawanda R. R. Co. Elec. 5¾ m, 4-8½ g, 65-90 T r, 6 c, of which 3 are m c and 3 t c. Pres. L. F. W. Arend, V. Pres. A. T Fancher, Sec. E. Rutherford, Treas. C. C. Mead Capital $60,000. Office 44 Niagara st. 9 2

BURLINGTON, IA.—Burlington Electric Ry. Co. 11 m, 4-8½ g, 40 lb T r, 45 c, of which 20 are h c, 15 m c and 7 t c. Westinghouse system. Pres. W F. Putnam, V. Pres., Treas. & Supt. F. G. Jones, Sec G. McInnes. Capital, $650,000. Bonds, $300,000. 7 1

BURLINGTON, VT.—Winooski & Burlington St. Ry. Co. 4½ m, 4-8½ g, 25 lb T r, 10 c, 24 h. Pres Ellas Lyman, V Pres. Louis H. Turk, Sec. B. H. Eagan Treas. W. F. Hendee, Asst. Supt. J. Lepp. Capital $50,000; authorized, $100,000. Bonds, $15,000. Office 186 College st. 9 2

BUTTE, MONT.—Butte Consolidated Ry. Co. 30 m, of which 6 are cable, 5 steam and 19 elec, 4-8½ g 40 and 50 lb T r, 24 c, of which 5 are steam, 4 g c, 10 m c and 5 t c. Edison system. Capital, $500,000 Bonds, $500,000. Pres. W. Bennett, Sec. & Gen. Man E. E. Congdon, Treas. W. A. Clark, Office, Main & Park sts. 9 2

Metropolitan Electric Ry. Co. 5½ m. 5m c. Edison system. 10 2

C

CAIRO, ILL.—The Delta Electric Co. 4 m, 4-8½ g 45 lb T r, 6 c. Pres. W. Kluge, V. Pres. J. J. Rendleman, Sec. & Gen. Man. H. Schulze, Treas, H. Hasenjaeger. Capital $150,000. Office 807 Washington st 9 2

CALERA, ALA.—So. Calera Land & Imp't Co. 2 m, 4-8 ½ g, 40 lb steel r, 1 dummy engine. Capital, $150,000. Office, Calera. b

CAMDEN, N. J.—Camden & Atlantic R. R. Co Elec. 6½ m, 4-9 g, 60 lb. r, 18 motor & 19 trail c Pres. G. B. Roberts, V. Pres. Wm. J. Sewell, Sec. J R. McClure, Treas. W. Taylor, Supt. A. O. Dayton Office 233 S. 4th st., Phila. 7 1

Camden Horse R. R. Co. Elec. 16 m, of which 4½ are elec. & 11½ horse, 5 g., 47, 52, 63½ lb s-b and Johnson girder r, 56 c, of which 42 are h. c. 8 m. c and 6 t. c. 146 h. United Electric Traction Co. System. Pres. Wm. S. Scull, V. Pres. B. C. Reeve, Sec Morris W. Hall, Treas. G. G. Browning, Supt. S. J. Fenner. Capital, $250,000. Bonds, $250,000. Office, 307 Market st. 6 2

CANANDAIGUA, N. Y.—Canandaigua St. R. R Co. 2¾ m, 4-8½ g, 36 lb Johnson girder r, 6 c, of which 4 are box and 2 are open, 12 h. 12 mu. Pres. A. S. Cooley, V. Pres. I. B. Smith, Sec. Chas. F. Milliken, Treas. & Supt. Chas. C. Sackett. Capital, $30,000. Bonds $20,000. 9 1

CANTON, O.—Canton St. Ry. Co. Elec, 6¾ m 4 g, 40 & 50 girder & T r, 38 c, of which 24 are m. c and 14 t. c. Edison system. Pres. & Treas. W. A Lynch, V Pres. R. A. Miller, Sec. A. J. Underhill, Supt. T. R. Catlin. Capital $300,000. Office, 275 W. Tuscarawas st. 9 2

Lakeside St. R. R. Co. Elec. 2½ m, 4 g, 40 lb T r, 12 c, of which 6 are m. c. and 6 t. c. Summer line. Officers, same as above. 9 2

CAPE MAY, N. J.—Cape May & Schellenger's Landing R. R. Co. 3 m, 5-2 g, 45 lb r, 4 1-h 4 2-h c, 50 h. Pres. L. H. Cone, Sec., Treas. & Gen. Man. J. H. Edmunds. 7 1

Cape May & Sewell's Point Electric Ry. Co. 7 2

CARBONDALE, PA.—Carbondale Traction Co Elec. 7 m, 5-2 g, 45, 52 lb T & girder r, 6 m c. T-H system. Pres. J. W. Aitken, V. Pres. A. H. Chadbourne, Sec., Treas. & Gen. Man. M. F. Thompson Supt. F. Blizzard. Capital $150,000. Bonds $150,000. 11 2

CARTHAGE, MO.—Carthage Horse Ry. Co. 4½ m, 3-6 g, 16-30 lb T r, 5c, of which 4 are box and 1 open, 2h, 18 mu. Pres. J. Guinney, Sec. J. W. Halliburton, Gen. Man. & Supt. E. A. Sexton. Capital $30,000. Bonds $10,000. Office, 19 S. Grant st. 11 2

CEDAR RAPIDS, IA.—Cedar Rapids & Marion Ry. Elec. 14 m, 4-8½ g, 35, 45, 60 lb T & girder r, 27 c, of which 8 are h c, 13 m c and 6 t c, 6 h. T-H system. Pres. P. E. Hall, V. Pres. W. D. Douglas, Sec. J. S. Ely, Treas. C. H. Clark, Supt. F. L. Diserens. 6 2

CENTERVILLE, IA.—Centerville St. Ry. 1.6 m 3-8 g, 20 lb. T r, 2 4-wheel box c, 12 mu. Pres. J. R Wooden, Sec. & Treas. C. R. Wooden. Capital $12,000; authorized, $25,000. 6 2

CENTRALIA, ILL.—Centralia & Central City St. Ry. Co. 3 m, 4-8½ g, 25 lb T r, 6 c, 15 mu. Pres. S. N. Pierce, Sec. G. P. Duncan, Treas. A. Duncan. Capital, $10,000. 1 2

CHAMPAIGN, ILL.—Urbana & Champaign St Ry. Co. Elec. 5½ m, of which 1 is horse & 4½ elec. 4-8½ g, 40 lb T r, 10 c. of which 5 are m. c. and 5 t. c Westinghouse system. Pres. Frank G. Jaques, Sec Treas. & Gen. Man. W. B. McKinley, Supt. J. Ahern Capital $150,000. Bonds $50,000. 1 2

Champaign Rapid Transit Co. Elec. 3 m, 4-8½g 50 lb. T r, 3 m. c. Westinghouse system. Pres. E. L Doyal, Sec. J. M. Clarke. Capital, $50.000. 3 2

CHARLESTON, S. C.—Charleston City Ry. Co. 13 m, 4-8½ g, 38 & 42 lb c. b. r, 39 c, of which 28 are box, & 11 open 144 h. Pres. Jno. S. Riggs, Sec. & Treas. Frank F. Whilden, Supt. John Mohlenhoff. Office, 4 Broad st. 11 2

Enterprise R. R. Co. 13½ m, 5 g, 30 & 40 lb c b & T r 35 c, 90 h, 12 mu. Pres. and Gen. Man. T. W. Passallaigue, Sec. & Treas. P. J. Balagcur. Capital, $200,000; authorized, $250,000. Bonds $50,000. Office East Bay near Battery. 7 2

Middle Street Sullivan Island Ry. Co. 2¼ m, 4-8½ g, 20 & 30 lb T r, 7 c, 14 mu. Pres. B. Callaghan, Sec & Treas. Frank F. Whilden, Supt. B. Buckley Capital $15,000. Office 4 Broad st. d 3 2

CHARLESTON, W. VA.—Charleston St. Ry. Co 4 m, 4-8½ g, 35 lb. s. b. r, 6 open c, 7 h, 12 mu. Sec E. W. Bridge, Treas. & Gen. Man. J. D. Campbell Supt. W. B. Carder. Capital, $50,000. Bonds, $10,000 Office, 215 Kanawha st. 3 2

CHARLOTTE, N. C.—Charlotte St. Ry. Co. Elec 4¾ m, 4-8½ g, 40-45 lb T & girder r, 11 c, of which 2 are h c, 6 m c and 3 t c. Edison system. Pres. E. D Latta, V. Pres. F. B. McDowell, Supt. S. G. Strickland, Auditor, F. A. Savin. Capital, $60,000. Bonds $100,000 11 2

CHARLOTTE, N. Y.—Grand View Beach R. R Co. Elec. 8 m, 4-8½ g, 40 lb T r, 15 c, of which 7 are m c, 7 t c and 1 freight c. Detroit system. Pres. H H. Craig, V. Pres. M. L. Doyle, Sec. & Treas. J. M Kelly, Supt. E. A. Roworth. Capital $100,000. Bonds $200,000. 9 2

CHARLOTTESVILLE, VA.—Charlottesville & University St. Ry. Co. 1¾ m, 4-8½ g, 16 lb T r, 4 4-wheel box c, 3 h, 12 mu. Pres., Gen. Man. & Pur Agt. R. P. Valentine, Sec. Geo. Perkins, Supt. H. D. Porter. Capital, $10,000; authorized, $100,000. 9 2

CHATTANOOGA, TENN.—Chattanooga & North Side St. Ry. Co. Elec. 6 m, 4-8½ g, 56 lb. girder & T r 6 box m. c. T-H system. Pres. S. R. Read, V. Pres. W. E. Baskette, Sec. and Treas. D. W. H. Hart Gen. Man. S. R. Read, Supt. D. R. Rankin. Capital, $50,000. Bonds $60,000. 9 2

Chattanooga Coal, Iron, Land & Ry. Co. 3 m. 3 m c. Edison system. 7 2

Chattanooga Electric Ry. Co. 40 m, 4-8½ g, 40, 63 lb T & girder r, 36 c, of which 32 are m c and 4 t c T-H, Detroit & Edison systems. Pres., Sec. & Treas S. W. Divine, V. Pres. E. Watkins, Gen. Man. P. K Roots, Supt. C. P. Young. Capital, $1,500,000; authorized, $1,500,000. Bonds, $1,200,000. 11 2

Chattanooga Union Ry. Co. dummy line, 44 m 4-8½ g, 56 lb. r, 56 c. Pres. C. E. James, V. Pres. C S. Adams, Sec. W. E. Baskette, Treas. F. Harris Supt. H. Bouron. 6 0

CHESTER, PA.—Chester St. Ry. Co. (Leased to Union Ry. Co.) 7½ m, 5-2¼ g, 47 lb r, 18 c, 80 h. Pres. S. A. Dyer, V. Pres. R. Peters, Jr., Sec. J. G. Dyer, Treas. J. F. Black, Supt. John McFayden. Capital $100,000, fully paid up. Office, 1,300 Edgmont av. 6 2

Union Ry. Co. Elec. 18½ m, 5-2¼ g, 65 lb. girder r, 32 m c. Short system. Pres. R. Peters, Jr, V. Pres. S A. Dyer, Sec. & Treas. J. G. Dyer, Supt. J. MacFayden. Capital, $40,000; authorized, $100,000. 11 2

CHEYENNE, WYO. — Cheyenne St. R. R. Co. 5 m, 3-6 g, 22 lb T r, 11 c, 20 h. Pres. F. E. Warren V. Pres. N. R. Davis, Sec. J. C. Baird, Gen. Man. & Supt. T. A. Kent. 11 2

CHICAGO, ILL.—Chicago City Ry. Co. 147 m 4572 ft., of which 34 m 1506 ft. are cable, and 113 m 3,066 ft. are horse, 4-8½ g, 56 to 78 lb girder r, 1,472 c, of which 1150 are h c and 322 g c, 2,549 h. Pres Geo. H. Wheeler, 1st V. Pres. J. C. King, 2d V. Pres E. M. Phelps, Sec. F. R. Greene, Treas. T. C. Pennington, Track Master C. E. Hall, Supt. M. K. Bowen Office, 2,020 State St. 9 2

Calumet Electric St. Ry. Co. Elec. 20 m, 4-8½ g, 78 lb girder r, 40 c, of which 18 are m c and 22 t c. T-H & Detroit systems. Pres. W. V. Jacobs, V. Pres. J. C Evans, Sec. & Treas. A. J. Whipple, Gen. Man. J. M. Stewart, Supt. E. E. Miller. Capital, $100,000; authorized $500,000. Office 605 Tacoma Building. 7 2

Chicago Pass. Ry. Co. 27 m, 4-8½ g, 52 & 60 lb r, 113 c, 480 h Pres. & Gen. Man. J. B. Parsons, Sec. & Treas. Geo. L. Webb. Leased to West Chicago St R. R. Co. Office, 89 W. Washington St. 7 2

Cicero & Proviso St. Ry. Elec. 22 m, 4-8½ g, 60 lb Johnson girder r, 53 c, of which 24 are m c and 29 t c. Edison system. Pres. D. J Kennedy, V. Pres. T. A. Snow, Sec. F. E. Ballard, Treas. D. J. Kennedy, Gen. Man. G. A. Butters, Supt. P. H. Quaid. Capital stock, $1,000,000. Bonds, $600,000. Office, 601 Tacoma Building. 9 2

North Chicago St. R. R. Co. 83 m, of which 66 are horse and 17 are cable, 4-8½ g, 66½ lb girder r, 496 c, of which 116 are g c and 380 horse and t c, 1,485 h Pres. Chas. T. Yerkes, 1st V. Pres. W. F. Furbeck, 2d V. Pres. & Supt. J. M. Roach, Sec. & Treas. Wm. D Meeker, Gen Man. Fred L. Threedy. Capital, $5,000,000. Office, 444 N. Clark st. 7 1

South Chicago City Ry. Co. Elec. 24 m, 4-8½ g, 75 lb girder r, 40 c, of which 25 are m c and 15 t c Edison and Westinghouse systems. Pres. D. F Cameron, V. Pres. V. S. Kennedy, Sec. & Treas. O S. Gaither, Gen. Man. J. R. Chapman. Capital, $100,000. Office, 220 1st Nat. Bank building, Chicago 11 2

West Chicago St. R. R. Co. (includes Chicago Pass. Ry.) 145 m, of which 127 are horse and 18 cable, 4-8½ g, 43-90 lb flat & girder r, 1,450 c, of which 1,095 are horse and 355 g c, 4,300 h. Pres. Chas. T. Yerkes, V. Pres. & Gen. Man. John B. Parsons-Sec., Treas. & Asst. Gen. Man. R. C. Crawford, Supt. C. F. Nagel, Supt. of Cable Dept. T. C. Nash. Capital, $10,000,000. Office of Pres. & Supt. 86 W. Washington st. 11 2

CHILLICOTHE, ILL.— People's Street Ry. Co 1¾ m, 4-8½ g, 20 lb T r, 4 c, 10 mu. Pres. and Gen. Man. W. F. Ryon, Sec. & Treas. R. H. Truitt, Capital, $8,000. 3 2

CHILLICOTHE, O.—Chillicothe Electric Ry. & Lighting Co. 5 m, 4-8½ g, 50 lb girder r, 16 c, of which 8 are m c and 8 t c. T-H system. Pres. M. Cahill, Sec. & Gen. Man. G. F. Woolston, Jr., Treas. William Poland, Supt. A. H. Reutinger. Capital $100,000. Bonds, $100,000. (Changing to electricity.) 7 2

CINCINNATI, O.—Cincinnati Inclined Plane Ry Co. Elec. 16 m. 1920 ft. of which are cable and 16 m elec, 5-2½ g, 56, 58½, 63 lb. girder r, 38 c, of which 36 are m. c. and 2 incline cable. Edison system. Pres & Gen. Man. H. H. Littell. V. Pres. St. John Boyle Treas. E. Bultman. Capital, $675,000 ; authorized $1,000,000. Bonds, $150,000. 9 2

Cincinnati St. Ry. Co. Elec , cable and horse. 139½ m, 8 m cable, 37 electric, 5-2 g, 42-52 lb tram and Johnson r, 300 c of which 91 are m c, 36 grip, 72 trail. T-H system. 1,200 to 1,500 h. Pres. & Gen. Man. John Kilgour, Treas. R. A. Dunlap, Sec. & Auditor Jas. A. Collins, Gen. Supt. Jno. Harris, Pur. Agt. A. G. Starr Office, 2d floor Apollo bldg. 6 2

Mt. Adams & Eden Park Inclined Ry. Elec. 25 m of which 8 are cable and 17 elec, 5-2½ g, 52 lb r 152 c, of which 32 are g c, 42 m c and 78 t c. T-H system. Pres. John Kilgour, Sec. & Treas. James A Collins, Pur. Agt. & Auditor, A. G. Starr, Supt. John C. Weaver. Office, 5th & Walnut, sts. 9 2

Mt. Auburn Cable Ry. Co. 8½ m, cable, 5-2 g, 56 lb girder r, 42 c, of which 21 are g c. & 21 tc. Pres Henry Martin, V. Pres. R. Wurlitzer, Sec. and Treas A. Hill Supt. G. Levins. Capital $300,000; authorized $600,000; bonds $370,000. Office Highland ave. & Saunders st. 9 2

Pendleton, Mt. Lookout & E. Walnut Hill Ry. Co Elec. and Dummy. 1⅔ m, 5½ g, 40 lb T r, 6 c., of which 2 are dummy, 2 m. c. and 2 t. c. Pres. C. H Kilgour, Sec. A. H. Meier. Capital authorized $150, 000. Office Station C. 9 2

Price Hill Inclined Planes, 2 planes, each 800 ft 5-6 g, 60 & 85 lb T r, 2 c on each plane. Pres. M. W Oliver, Gen. Man. Rees E. McDuffie, Sec. & Treas Geo. T. McDuffie. Capital, $400,000. Office, Price Hill 6 2

So. Covington & Cincinnati. (See Covington, Ky.)

CITY ISLAND, N. Y.—Pelham Park R. R. Co 3½ m, 3-6 g, 30-57 lb T and s b r, 8 c, of which 6 are 4-wheel box and 2 4-wheel open, 15 h. Pres. W. R. Lamberton V. Pres. H. D. Cary, Sec. & Treas. E. N Anable, Supt. F. Underhill, Capital $50,000. Office, City Island, N. Y. 9 2

CLARKSVILLE, TENN.—Clarksville St. Ry Co. 4.2 m, 4-8 g, 18 lb T r, 6 c, 32 mu. Pres. W. M Daniel, Sec., W T. Dortch, Supt. J. Black. Capital $16,500. Bonds, $11,000. Office, Farmers & Merchants' Nat. Bank. 2 2

CLEVELAND, O.—Brooklyn St. R. R. Co. Elec 30 m, 4-8½ g, 78 lb Johnson girder r, 128 c, of which 53 are m c and 75 t c. T-H & Short systems. Pres Tom. L. Johnson, V. Pres. A. L. Johnson, Sec. & Treas. H. J. Davies, Supt. S. Harris. Capital, $600,000 Bonds, $600,000. Office, 1,301 Pearl st. 6 2

Broadway & Newburgh St. R. R. Co. Elec. 26 m 4-8½ g 82 lb Johnson girder r, 96 c of which 57 are 4-wheel box & 39 4 wheel open & 37 m c. Edison & Short systems. Pres. H. E. Andrews, V. Pres. & Supt. J. J. Stanley, Sec. & Treas. E. Fowler. Capital $1,000,000. Office, 1,373 Broadway. 9 2

Cleveland City Cable Ry. Co. Superior st., Payne & Lexington Ave., and St. Clair st. lines. 32¼ m of which 13 are horse & 19 cable, 78 lb girder r, 124 c of which 64 are box & 60 open & 47 g c, 250 h. Pres Frank De H. Robison, 1st V. Pres. & Treas. J. J Shipherd, 2d V. Pres. Geo. H. Holt (New York), Sec W. Parsons, Gen. Man. M. S. Robison. Capital $4,000,000. Bonds $1,884,000. Office, 1094 Superior St 9 2

East Cleveland R. R. Co. Elec. 39.10 m, 4-8½ g 66½ lb girder r, 210 c, of which 90 are m c. and 120 t. c T-H & Edison systems. Pres. A. Everett, V. Pres. C. W Wason, Sec. & Treas. H. A. Everett, Asst. Sec. & Treas. L. E. Bellstein. Supt. E. Duty. Capital, $1,650-000 ; authorized, $2,000,000. Bonds, $1,000,000. Office 1154 Euclid Ave. 6 2

Lake View & East Cleveland St. Ry. Co. Elec. 12.68 m, 4-8½ g, 52 lb girder r, 6 c, of which 4 are 4-wheel box & 2 4-wheel open & 2 m c. Edison system. Pres A. Everett, V. Pres. C. W. Wason. Sec. & Treas. H. A Everett, Supt. E. Duty, Capital $25,000. Office 2,500 Euclid ave. 6 2

South Side St. R. R. Co. Elec. 9 m, 4-8½ g, 78 lb Johnson girder r, 34 c, of which 13 are m c and 21 t c Pres. A. L. Johnson, V. Pres. T. L. Johnson, Sec. & Treas, H. J. Davis, Supt. S. Harris. Capital, $300-000 ; Bonds, $300.000. Office, 1,301 Pearl st. 6 2

Woodland Avenue & West Side St. R. R. Co. Elec 40 m, 4-8½ g, 98 lb girder r, 175 c, of which 115 are m c and 60 t c. Westinghouse system. Pres. M. A. Hanna. V. Pres. C. F. Emery, Sec. J. B. Hanna Treas. H. P. Eells, Gen. Supt. George G. Mulhern Capital, $2,000,000. Office, 303-304 Western Reserve Bldg. 9 2

CLEVELAND, TENN.—Cleveland St Ry. Co. 2 m, 4-9 g, 32 lb. T r, 2 4-wheel box c, 4 mu. Pres. L D. Campbell, Sec. & Treas. L. L. Harle, Supt. J. T Johnston. Capital $4,000. 6 2

CLINTON, IA.—Lyons & Clinton Horse R. R. Co. (See Lyons.)

State Electric Co. 15 m. of which 8 are horse & 7 elec. 4-8½ g, 45-51 lb T and girder r; 14 c, of which 6 are h c, 6 m c and 2 t c; 28 h. T-H system. Pres. E C. Walsh, V. Pres. D. Langan, Sec. C. C. Coan, Treas A. L. Stone, Gen. Man. G. F. Brown, Supt. F. Crapser, Capital $500,000. Bonds $156,000. 2 2

CLINTON, MO.—Clinton St. Ry. Co. 3 m, 4-1 g 7 c, Z T & crescent r, 4 c, 16 mu. Pres. A. P. Frowein, V. Pres. J. T. Buffin, Supt. G. C. Haysler, Sec. & Treas. H. P. Farls. Capital, $12,000. 9 2

COLORADO SPRINGS, COL.—Colorado Springs & Manitou St. Ry. Co. 6¼ m, 3-6 g, 18 lb r, 10 c, 42 h. Pres. T. L. Martin, V. Pres. E. J. Eaton, Sec & Treas. A. L. Lawton, Man. A. Van Vechten, Jr k 3 0

Colorado Springs Rapid Transit Ry. Co. Elec 28 m, 4-8½ g, 30 lb T r, 42 c, of which 25 are m. c and 16 t. c. Edison system. Pres. F. L. Martin, V. Pres E. J. Eaton, Sec. & Treas. A. L. Lawton, Gen. Man. & Auditor, A. A. McGovney, Supt. D. L. Macaffree Capital, $500,000. Bonds, $350,000. 9 2

COLUMBIA, PA.—Columbia & Ironville St. Pass Ry. Co. 7m, 5-2 g, 66 lb. T & girder r, 6 c of which 4 are m. c. and 2 t. c. Westinghouse system. Pres. W B. Given, Sec. F. S. Given, Treas. J. Janson. Capital $75,000; authorized, $100,000. 203 Locust St. 10 2

COLUMBIA, S. C.—Columbia St. Ry. Co. 4½ m 3-8½ g, 30 lb s.b. r, 6 c, 32 h. Pres. J. Q. Marshall, V pres. W. A. Clark, Sec. J. P. Thomas, Jr., Supt. A Wallace. Capital, $50,000. Office, 85 Gervais st. a 7 1

COLUMBIA, TENN.—Columbia St. Ry. Co. 1½ m, 4-9 g, 40 lb Johnson r, 4 4-wheel box c, 7 mu. Pres. J T. Craik, Sec. & Gen. Man. E. C. McDewell, Supt 1. M Sullivan. Capital $50,000, bonds $25 6 2

COLUMBUS, GA.—Columbus R. R. Co. 17 m, of which 5 are horse and 12 steam, 4-8½ & 4-9 g, 25 & 40 lb T r, 27 c, of which 9 are dummy and 18 h. c, 10 h 50 mu Pres. J. F. Flournoy, Sec. & Treas. Cliff B. Grimes, Supt. J. H. Henderson. Capital, $25,000 Bonds $100,000. 1 2

North Highlands R. R. Co. Elec. 3 m, 4-8½ g, 45 lb T r, 6 c, of which 3 are m. c. and 3 t c. T-H system Pres. and Gen. Man. S. A Carter, V. Pres. E. J. Rankin, Sec. and Treas. R. Browne, Supt. F. E. Knapp Capital $31,000; authorized $50,000. 6 2

COLUMBUS, IND.—Crump's St. Ry. 5 m, 4-8½ g, 30 lb T r, 5 c, 2 h, 19 mu. John S. Crump, proprietor; Gen. Man. R. F. Gottschalk, Supt. J.W. Crump Jr. 9 2

COLUMBUS, MISS.—Columbus St. Ry. & Power Co. Dummy. 2 m, 4-½ g, 40 lb T r, 2 c. Pres E. Cahn, Sec. & Gen. Man. C. E. Rodenburg, Treas. R T. Williams. Capital, $25,000. 9 2

COLUMBUS, O.—Columbus Consolidated St. R. R. Co. Elec, 40 m, 5-2 g, 52, 70 lb Johnson girder r, 125 c, of which 85 are m. c. T-H system. Pres A. D. Rodgers, V. Pres. W. W. Franklin, Sec. & Treas R. R. Rickly, Supt. W. Wilcox. Capital, $1,000,000 Bonds, $70,000. Office; 9 S. High St. 9 2

Glenwood & Greenlawn St. Ry. Co. Elec. 5 m, 5-2 g 5-2 g, 45 lb girder & T r, 14 c, of which 8 are m. c. and 6 t. c. Edison and Westinghouse systems. Pres. W W. Franklin, V. Pres. A. D. Rodgers, Sec. & Treas R. R. Rickly, Supt. G. W. Wilcox. Office, No. 9 S High st. 9 2

CONCORD, N. C.—Concord Ry. Co. Steam. 2.65 m, 48½ g, 40 lb T r, 3 c. Pres. W. M. Smith, V. Pres. N. F. York, Sec. J. B. Shul, Treas. D. B. Caltrane, Capital $15,000; authorized $100,000. 6 2

CONCORD, N. H.—Concord St, Ry. Co. Elec 9 m. 3 g, 35, 45 & 50 lb T r; 15 c, of which 8 are m. c and 7 t. c. T-H. system. Pres. J. H. Albin, Treas. E. C. Hoague, Sec. N. E. Martin, Man. & Supt. G. W Pierce. Capital $100,000; authorized $100,000. Office Main st. 9 2

CONEY ISLAND, N. Y.—Sea View R. R. Co Elevated. 2¼ m, 4-8½ g, 50 lb T r, 7 c, 7 steam motors Pres. F. A. Schroeder, Sec. Geo. Varrelman, Treas I. M. Bon, Gen. Man. & Supt. Wm. Finley. Capital $191,000, authorized $250,000. Office Flatbush, N. Y. 9 2

CONNELLSVILLE, PA.—Connellsville, New Haven & Leisenring St. Ry. Co. Elec. 4¼m. 5 2½g 52 lb. girder r 4 m. c. Edison system. Pres J. D Frisbee, Sec. J. K. Ewing, Jr., Treas. E. T. Norton Supt. A. C. Kendall. Capital, $50,000; authorized $100,000. 6 2

CORPUS CHRISTI, TEX.—Corpus Christi Improvement Co. Dummy. 6½ m, 4-8½ g, 30 lb T r 4 c, 2 steam motors. Pres. E. H. Ropes, V. Pres J. M. Ropes, Sec. W. B. Newkirk, Treas. & Supt H. Keller. Capital, $100,000. 9 2

Gussett St. Ry. 4 m, 4-8½ g. 25-30 lb T r, 6 c, 16 mu. Proprietor, N. Gussett. Capital $25,000, 9 1

CORSICANA, TEX.—Corsicana St. Ry. Co. 4¼ m, 4-8½ g, 16 lb T r, 6 c, 28 mu. Pres. & Gen. Man B. G. McKie, V. Pres. J. E. Whiteside, Sec. & Treas W. J. McKie. Capital, $50,000. 7 1

CORTLAND, N.Y.—Cortland & Homer Horse R R Co. 4.1 m, 4-8½ g, 25-30 lb flat & T r, 8 c, of which 4 are box and 4 open, 25 h. Pres. C. H. Garrison, V. Pres. S. E. Welch, Sec. & Treas. L. D. Garrison, Supt B. B. Terry. Capital, $40,000. Office, 19 Main St. 9 2

CORVALLIS, ORE.—The Corvallis St. Ry. Co 2 m, 3-6 g, 20 lb. T steel r, 2 box c, 5 h. Pres & Gen Man. M. W. Wilkins, Sec. M. G. Wilkins, Treas. M. O. Wilkins. Capital $42,000. Bonds, $10,000. 9 2

COTTAGE CITY, MASS.—Cottage City St. Ry Co. 4 m, 4-8½ g, 35 lb T r, 8 c. Pres. W. C. Van Derlip, Sec. Gen. Man. & Supt. W. A. Boland, Treas. H J. Greene. Capital, $15,000; authorized, $25,000 Office of Gen. Man. 610 Exchange Bldg, Boston. 9 2

COTTONWOOD FALLS, KAN.—Consolidated St. Ry. Co. 2 m, 3-6 g, 36 T lb steel T r, 2 4-wheel box c, 2 h. 6 mu. Pres. W. Adare, V. Pres. W. G Morgan, Sec. E. W. Tanner. Treas. J. M. Little, Supt W. L. Holsinger. Capital $10,000. 9 2

COUNCIL GROVE, KAN.—Council Grove St. Ry Co. 1½ m, 3-6 g, 20 lb T r, 2 c, 4 mu. Pres. W. H White, Sec. & Treas. H. W. Gildermeister, Treas. & Gen. Man. A. J. Marks, Morris Co. Capital, $6,000. 7 1

COVINGTON, GA.—Covington & Oxford St. R. R Co. 7 m, 4-8½ g, 25 lb. T r, 6 c, 9 mu. Pres. I. W. Brown Sec. & Treas. J. G Lester, Gen. Man. & Supt. R. O Usher. Capital, $16,000, authorized $20,000. 9 2

COVINGTON, KY.—Cincinnati, Newport & Covington St. Ry. Co. 34 m, of which 25 are horse and 9 elec 5-2½ g, 72 lb girder r, 70 c, of which 44 are h. c. and 26 m. c, 170 h, 105 mu. Short & T-H systems. Pres. J J. Sh pherd, V. Pres. G. H. Kimball, Sec. G. M. Abbott, Treas. H. P. Ellis, Supt. T. M. Jenkins. Capital $500,000; Bonds $500,000. Office, 402 Scott st. 9 2

CUMBERLAND, MD.—Cumberland Electric Ry Co. 6 m, 4-8½ g, 54 lb girder r; 13 c, of which 8 are m c and 5 t c. Edison system. Pres. G. D. Landwehr, V. Pres. G. L. Wellington, Sec. & Treas. J. H Holzshu, Supt. W. Milnor Roberts, Jr. Capital $50,000; authorized $100,000. Bonds $70,000. Office North Centre St 11 2

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DALLAS, TEX.—Dallas Consolidated Traction Ry. Co. Elec. 38 m, of which 30 are horse and 8 elec, 4-8½ g, 30 to 40 Johnson & T r, 88 c, of which 73 are horse and 15 m c, 3 h. 241 mu. T-H & Edison systems. Pres. & Gen. Man. Royal A. Ferris, V. Pres. A. Davis, Sec. & Acting Treas. J. L. Sale, Supt J. F. Payne. Capital, $1,000,000. Bonds, $1,000,000. Office, 135 Main St. 6 2

Dallas & Oak Cliff Ry. Co. Steam. 11 m, 4-8½ g, 35 & 65 lb T r, 25 c. Pres. & Man. T. L. Marsalis, V. Pres J. T. Elliott, Sec. & Treas. E. L. Snodgrass. Capital $460,000. Room 5 Knepply Bldg. a 8 0

Dallas Rapid Transit Ry. Co. Elec. 13 m, 4-8½ g, 35 & 45 lb steel T r, 14 m. c. Edison system. Pres. J. D Trammell, V. Pres. L Reese, Sec. J. S. Summerfield Supt. Geo. D. Hartson. Capital $200,000. Office, 416 North Texas Bank B'ld'g. 9 2

North Dallas Circuit Ry. Co. Elec. 4 m, 4-8½ g 40 lb T r, 5 m c. T-H system. Pres. J. C. Schneider V. Pres & Gen. Man. Royal A. Ferris, Acting Sec. J. L. Sale, Treas. N. A. McMillin. Capital, $100.000. Bonds, $100,000. 6 2

The Dallas Cable Ry. Co. 6 1-7 m, 3-6 g, 45 lb T r 24 c, of which 12 are g. c. Pres. A. W. Childress, Sec C. E. Keller, Treas. J. S. Armstong. Capital, $400-000 authorized, $600,000. Office, Elm & Griffith Sts 9 2

DANBURY, CONN.—Danbury & Bethel Horse Ry. Co. 6½ m, 4-8½ g, 25 lb T, s. and c. b. r, 20 c, of which 13 are 4-wheel box and 7 4-wheel open, 130 h Pres. S. C. Holly, V. Pres. S. H. Wagner, Sec. & Treas J. B. McGeorge, Gen. Supt. G. H. Klinzing. Office 23 South st. Capital, $100,000. 9 2

DANVILLE, ILL.—Danville Gas, Elec. Light & St. Ry. Co. 7 m, 4-8½ g, 50, 60 lb T r, 12 m c, T-H system. Pres. & Gen. Man. F. W. Penwell, V. Pres. A C. Daniel, Sec. & Treas. W. P. Cannon. Capital $250,000. 3 2

DANVILLE, VA.—Danville St. Car Co. Elec 2 m, 4-8½ g, 38 lb steel T r, 5 m. c. T-H system. One 10 H. P. motor on each car. Pres. T. B. Fitzgerald V. Pres. L. C. Berkeley, Sec. & Treas. H. L. Lanier Supt. & Man. N. W. Berkeley, Jr. Capital, $50,000 authorized $120,000. Office, 320 Craighead st. 9 2

DAVENPORT, IA.—Davenport Central Ry. Co. 7½ m elec., 4-8½ g, 50 lb Johnson girder r, 16 c, of which 13 are m. c. and 3 t. c. Edison system. Pres & Gen. Man. W. L. Allen, V. Pres J. P. Van Patten Sec. O. S. McNeil, Treas. J. B. Fidler, Supt. J Heinzleman. Office "Masonic Temple." Capital $150,000. k 3 1

Bridge, Second St. & Northwest Davenport Ry. Co. 1½ m, 4-8½ g, 38 lb, Johnson steel r, 6 c, 37 h Pres. C. B. Holmes, Sec. E. A. Holmes, Supt. H Schnitger. e 8 0

Davenport & Rock Island Ry. Co. (See Moline, Ill.)

Davenport City Ry. Co. 4 m, 4-8½ g, 40 lb r, 17 c, 42 h. Pres. C. B. Holmes, Sec. E. A. Holmes, Supt. H. Schnitger. General Offices, 2020 State st.; Chicago; Supt's office, 116 W. Third st., Davenport. e 8 0

Davenport Elec. Ry. Light & Power Co. 8 m, 4-8½ g. 50 lb Johnson girder r, 18 c, of which 13 are 4-wheel box m c & 5 4-wheel open. Edison system. Pres W L. Allen, V Pres. J. P. Van Patten, Sec. & Treas. T O. Swiney, Supt. J. Hentzleman. Capital $300,000 9 2

The Fort Scott Rapid Transit Ry. Co. Elec. 8 m of which 5 are elec. 4 g, 35 T r, 6 motors & 14 trail c 38 h & mu. Pres. E. W. Brady, V. Pres. W. M. Smith Sec. A. B. Brady, Treas. A. L. Hughes. Capital $ 00,000. Office, Davenport 11 0

DAYTON, KY.—Cincinnati, Newport & Covington St. Ry. Co., Dayton Division (See Covington, Ky.)

DAYTON, O.—Dayton St. R. R. Co. 8½ m, 4-8½ g, 44, 70 lb girder r, 28 c, 98 h, 50 mu. Pres. C. J Ferneding, V. Pres. G. W. Rogers, Sec. Wm. H Simms, Treas. 4th Nat. Bank, Supt. A. W. Anderson Capital $300,0000. Office, W. 3d st. 6 2

Dayton & Soldiers' Home Electric R. R. Co. Extension of west end of Fifth st. R. R. 4 m, 4-8½ g, 45 lb Johnson r, 4 c, of which 2 are m c & 2 t c. Edison system. Pres. D. B. Corwin, V. Pres. A. A. Thomas Sec. & Treas. J. C. Pierce, Supt. T. E. Howell. Capital, $100.000. 3 2

Fifth St. R. R. Co. 10 m, 4-8½ g, 48 & 52 lb tram & girder r, 30 c, 115 h. Pres. D. B. Corwin, V. Pres Sec. & Treas. J. C. Peirce, Supt. & Pur. Agt. T. E Howell. Capital $400,000. Office, West End. 1 2

Oakwood St. Ry. Co. 8 m, 4-8½ g, 60, 72 lb girder r, 17 box c, 80 h. Pres. Charles B. Clegg, V. Pres. A L. Stout, Sec. L. Lorenz Treas. 4th Nat. Bank, Gen Man. H. P. Clegg, Supt. William Jones. Capital $300,000. Office, cor. Brown & Fairground av. 6 2

Wayne & Fifth St. R. R. Co. 6½ m, 4-8½ g, 38, 65 70 lb Johnson r, 13 c, 75 h. Pres. Geo. W. Shaw, V. Pres. & Gen. Man. Ezra Bimm, Sec. & Treas. Eugene Wuichet, Supt. N. Routzahn. Capital $100,000. Office 29 Wayne av. 6 2

White Line St. R. R. Co. Elec. 11½ m. 4-8½ g 42 lb steel girder r, 27 c, of which 19 are m c and 8 t c T-H system. Pres. J. A. McMahon, V. Pres. A. G Clark, Sec. J. E. Lowes, Treas. M. A. Nipgen, Supt & Pur. Agt. W. Beach. Capital, $200,000. 9 2

DEADWOOD, SO. DAK.—Deadwood St. Ry Co. 2 m. 3 g, 30 lb flat r, 3 c, 4 h. Pres. J. Swift V. Pres. W. H. Swift, Sec., Treas. & Gen. Man. A. W Coe. Capital authorized, $20,000 9 2

DECATUR, ALA.—Decatur St. Ry. Co. 5m, 4-8 g 20 lb. T r, 5 c, 32 h. Pres. W. W. Hodges, V. Pres. A. C. Hartshorn, Sec. & Gen. Man. A. Bibb.

DECATUR, ILL.—City Electric Ry Co. 12 m elec., 4-8½ g, 30-50 lb girder r, 28 c, of which 18 are m c and 10 t c. T-H and Westinghouse systems. Pres. D. S. Shellabarger, Sec.& Treas. W. L. Shellabarger, Gen. Man. W. L. Ferguson. Capital $300,000. Bonds $175,000. 9 2

Decatur Electric Ry. Co. 4 m elec., 4-8½ g. 40 lb Johnson girder and T r, 9 m. c., of which 4 are open and 5 box. Detroit system. Pres. J. R. Mills, Sec. W H. Star, Gen. Man. J. W. Alexander. Capital, $100,000. Plant purchased by City Electric Ry Co. 12 1

DEERFIELD, N. Y.—Deerfield & Utica R. R. Co 2 m, 4-8½ g, 42 lb s b r, 3 box c, 8 h. Pres. & Gen Man. Frederick G. Weaver, Deerfield; Sec. & Treas A. T. Goodwin, Utica. Capital $12,000. 6 2

DELAWARE, O.—Delaware Electric St. Ry. Co. 4½ m, 4-8½ g, 45 lb girder r, 5 m c. Westinghouse system. Pres. J. K. Newcomer, V. Pres. J. D. Van Deman, Sec. W. A. Hall. Treas. V. T. Hills, Gen. Man. J M. Crawford. Capital, $60,000. 8 2

DEFIANCE, O.—The Defiance Light & Power Co. Elec. 3½ m, 56 lb girder r, 4 c, of which 3 are m c and 1 t c. Westinghouse system. Pres. W. B. McKinley V. Pres. E. O. Harris, Sec., Treas. & Gen. Man. S. L Nelson, Supt. H. J. Smith. Capital stock, $100,000. Bonds $100.000. 9 2

DENISON, TEX.—Denison St. Ry. Co. 5½ m 4 g, 20 lb T r, 11 c, 42 mu. Pres. & Gen. Man. B. J Derby, V. Pres. B. C. Murray, Sec. C. F. Pease, Treas S. Star. Owned and operated by the Denison Land & Improvement Co. 9 1

Denison Rapid Transit Ry. Co. 6½ m, 4-8½ g, 35 lb T r, 6 c, 2 dummies. Pres. & Man. B. J. Derby Sec. C. F. Rose, Treas. S. Star. Owned and operated by the Denison Land & Improvement Co. 4 1

Denison Street & Belt Line Ry. Co. 13 m, of which 5½ are horse and 7½ steam, 4-8½ g, 16, 35 lb. T r, 17 c of which 11 are h. c. and 6 steam, 2 engines, 42 mu. Pres. F. C. Churchill, V. Pres. A. H. Coffin, Sec. A Zintgraf, Treas. E. H. Hanna, Gen. Man. B. J. Derby Capital $150,000. Bonds, $75,600. 9 2

DENNISON, O.—The United Electric Co. 1¾ m 4-8½ g, 45 girder r. Capital $100,000. T-H system. 9 2

DENVER, COL.—Colfax Electric Ry. Co 10¼ m 3 6 g, 30 lb T r, 32 c, of which 12 are m. c. and 20 t. c Edison system. Pres. D. Fletcher, V. Pres. Sec. & Gen. Man. S. M. Perry, Treas. T. S. Hayden, Supt. G. Campbell. Capital, $150,000. Office, 1738 Curtis st. 9 2

Denver Tramway Co. (Includes Denver Cable Denver & Berkeley Park, So. Denver Cable, University Park and Metropolitan.) Elec. and cable. 82 m of which 15 are cable, and 67 elec, 3-6 g, 45 lb T r, 275 c, of which 112 are m. c, 102 g. c. and 61 t. c. T-H, Short & Edison systems. Pres. Rodney Curtis, V. Pres. Jno. J. Riethman, Sec. Wm. G. Evans, Gen. Supt. C. K. Durbin. Capital, $1,000,000. Gen. Offices Broadway and Colfax and Railroad Bldg. 6 2

Denver City Cable Rwy. Co., 35 m, of which 19 are horse & 26 cable, 3-6 g, 20-60 lb. T r, 175 c, of which 20 are h. c., 55 g. c, and 100 t c, 100 h. Pres. Geo. H. Holt, Sec. & Treas. G. A. Schrieter, Gen. Man. G. E. Randolph, Supt. V. Spangberg. Capital $4,000,000. Office 11 Wall st., New York. 1 2

Park Hill Motor Co. 1 2

So. Denver Cable Co. Consolidated with Denver Tramway Co. 1 1

University Park Ry. & Electric Co. Consolidated with Denver Tramway Co. 1 1

West End St, Ry. Co. Elec. 10¼ m, 4-8½ g, 50 lb r, 14 m c. 3 engines. Edison system. Pres. J. Wilbour, Sec. E. M. Dexter. Treas. R. G. Manton. Gen. Man. D. F. Longstreet, Supt. & Pur. Agt. S. R. Wright. Capital, $500,000. Office Prospect Ave. 7 2

DEPTFORD, TENN.—Deptford & South Pittsburg St. Ry. Co. Dummy. 2½ m, 4-8½ g, 40 lb T r 3 c. Pres. L. W. Barringer, V. Pres. J. G. Kelly, Sec Treas. & Gen. Man. J. Bright. Capital, $10,000. Office, Deptford. 9 2

DES MOINES, IA.—Des Moines St. R. R. Co. Elec. 35 m, 4-8½ g, 45, 50, 62 lb girder & T r, 48 c, of which 41 are m. c. and s t, c. T-H system. Pres. J. S. Polk, V. Pres. B. F. Kaufman, Sec. & Gen. Man Geo. B. Hippee, Supt. S. Cassady. Capital $1,600,000 authorized, $2,600,000. Bonds, $900,000. 6 2

Des Moines Suburban Ry. Co. Elec. Operated by Des Moines St. R. R. Co.

DETROIT, MICH.—Fort Wayne & Belle Isle Ry Co. Elec. 22 m, 4-8½ g, 45 & 58 s b girder & grooved r, 86 c, of which 29 are m. c. and 57 t. c. Pres. E. N. Butler, V. Pres. S. Schloss, Sec. N. W. Goodwin, Treas. E. S. Nelneman, Supt. G. S. Hazard. Capital $250,000. Office, Room 12 Kanter Bldg. 9 2

Detroit Citizens' St. Ry. Co. (Includes Grand River St. Ry. and Hamtramck & Grosse Point Ry.) Elec. 65.65 m, 4-8½ g, 45, 66, 78 lb tram and girder r, 309 c, of which 302 are h c, 12 m c and 5 t c, 2,019 h. Detroit system. Pres. D. M. Ferry, V. Pres. W. C. Colburn, Sec. J. R. Stirling, Treas. G. H. Russel, Supt. J. H. Fry. Office 12 Woodward Ave. 9 2

Detroit Electric Ry. Co. 1.1 m, 4-8¼ g, 45 lb tram r 8 c, 14 h. leased to Detroit St. Ry. Co. 4 1

Detroit, Rouge River & Dearborn St. Ry. Co. Elec 1½ m, 1 4-wheel box m c. Edison system. Pres. A. E Peppers, V. Pres. J. R. McLaughlin, Sec. F. C. Irvine Supt. L. E. Wise. Capital, $100,000. 7 1

Highland Park Ry. Co. Elec. 4 m, 4-8½ g, 30 & 42 lb T r, 8 c, of which 4 are 4-wheel box & 4 4-wheel open, & 4 m. c. Detroit system. Pres. & Treas. Frank E. Snow, Sec. F. Woodruff, Supt. H Lewis Capital, $50,000. Office, 904 Hammond Building. 9 2

DOVER, N. H.—Union St. Ry. Co. Elec. 14 m 4-8½ g, 40 lb T r, 19 c, of which 10 are m c and 9 t c T-H system. Pres. H. Haley, V. Pres. & Treas. H. W Burgett, Sec. R. H. Burwell, Supt. J. Houston Capital $150,000. Leased by Consolidated Light & Power Co. 6 2

DUBLIN, TEX.—Dublin St. R. R. Co. 5 m, (1½ in operation), 4 g, 20 lb T r, 3 c, 20 mu. Pres. H. A Smith, V. Pres. R. H. McCain, Sec. & Gen. Man. J. E. Chapman, Treas. A. A. Chapman. Capital stock $25,000. 6 2

DU BOIS, PA.—Du Bois Traction Passenger Ry. Co. Elec. 2¼ m, 4-8½ g, 50 lb. girder r, 3 m. c. Edison system. Pres. M. D. Wayman, V. Pres. A. C Bailey, Sec. Gen. Man. & Supt. C. E. Bostwick, Treas G. E. Grier. Capital, $50,000; authorized, $85,000. 3 2

DU QUOIN, ILL.—Du Quoin St. R. R. Co. 3 m 4-8½ g, 57 lb. T r, 3 c, 4 h. Pres. P. D. Mifflin, V. Pres D. Onslott, Sec. L. Skinner, Treas. P. V. Pope. Capital, $5,375. 6 2

DUBUQUE, IA.—Dubuque St. R. R. Elec. 15 m 4-8½ g. 52 lb girder r, 47 c, of which 22 are h. c. 15 m. c. and 10 t. c., 70 h. Edison and Detroit Elec. Works systems. Pres. & Gen. Man. J. A. Rhomberg, Sec. C. H. Meyer, Treas. & Supt. J. H. Rhomberg. 9 2

Electric Ry. Light & Power Co. 10 m, 4-8½ g, 50 lb. Johnson girder r, 16 c, of which 12 are m. c. and 4 t. c. Edison system. Pres. R. W. Stewart, V. Pres. T. O. Swiney, Sec. & Treas. A. F. Cutter, Supt. W. T. Griffith, Receiver, H. Poole. Capital, $500,000 6 2

Key City Electric St. Ry. Co. 2¾ m, 4-8½ g, 52 lb girder r, 6 c., of which 4 are box and 2 open, 4 m. c Edison system. Pres. L. H. Biglow, V. Pres. L. G Hurd, Sec. & Supt. J. Angell, Treas. G. G. Perry Capital, $75,000. Office, foot of 8th st. In hands of J. K. Deming, receiver. 1 2

DULUTH, MINN.—Duluth St. Ry. Co. Elec 20.69 m, of which 1.13 are cable and 19.56 elec, 4-8½ g 45, 60 lb Johnson girder, r, 50 c, of which 46 are m. c. and 4 t. c, 9 h. T-H and Short systems. Pres. L. Mendenhall, V. Pres. G. G. Hartley, Sec. & Treas. T. W. Hoopes, Gen. Man. & Supt. Fred. S. Wardwell. Capital $300,000; authorizc $1,000,000. Bonds $88,000. Office, 16 3d av, West Duluth. 6 2

Lakeside Ry. Co. Elec. 4 m, 4-8½ g, 45 lb T r, Pres. D. G. Cash, Sec, Treas. & Man. W. C. Sargent Capital, $100,000. Operated by Duluth St. Ry. Co 8 2

Minnesota Point St. Ry. 3¾ m, 3-6 g, 28 lb T r, 8 c 16 h. Pres, Gen. Man. & Supt. J. J. Hibbard, V. Pres R. P. Edison, Sec. W Warner, Treas. B. Silberstein Capital $60,000; authorized $100,000 9 2

Motor Line Improvement Co. Elec. 5½ m, 4-8½ g 35 lb T r, 2 m c. T-H system. Pres. G. G. Hartley, V. Pres. J. D. Stryker, Sec. T. W. Hoopes, Treas. A. R. Macfarlane, Gen. Mans. Mendenhall & Hoopes. Capital, $150,000. Bonds, $200,000. 6 2

DURANGO, COLO.—Durango Ry. & Realty Co., Elec. 2 m, 3 g, 30 lb T r. 2 c. Pres. C. M. Williams, V Pres. & Supt. T. C. Graden, Sec. W. S. Pickerill Treas. Prewitt & Arnold. Capital, $25,000; authorized, $50,000. 9 2

DURHAM, N. C.—Durham St. Ry. Co. 2 m, 4-8½ g, 16 lb T r, 4 box c, 4 mu. Pres. J. S. Carr, V. Pres A. B. Anderson, Sec. R. H. Wright. 1 2

E

EAST LIVERPOOL, O.—East Liverpool & Wellsville R. R. Co. Elec. 8 m, 4-8½ g, 56 lb T and 81 lb girder r, 22 m. c. Short system. Pres. A. L. Johnson, Sec. & Treas. S. H. Short, Supt. J. E. Willis. 9 2

EAST ST. LOUIS, ILL.—Denverside Rapid Transit & Improvement Co. 2¾ m, 4-10 g, 36 lb T r, 4 c, 9 mu. Pres. G. W. Ballantine, V. Pres. J. Scherrer, Sec. L. Ballantine, Treas. J. T. McCasland, Gen. Mans. Porter & Watson. Capital $250,000. 6 2

EAST WAREHAM, MASS.—East Wareham Onset Bay & Point Independence St. Ry. Co. 2,617 m 4-8½ g, 25 & 35 lb. T r, 11 c, 16 h. Pres. T. B. Griffith Sec. B. F. Gibbs, Treas. & Supt. J. B. Eldridge. Capital, $20,000. j 8 1

EASTON, PA.—Easton Transit Co. Elec. 5 m, 5-2½ g, 42 lb T & flat r, 16 4-wheel box c, 52 h. Pres W. A. Wilbur, Sec. & Treas. A. D. Childsey. Capital $120,000; authorized $125,000. Office 348 Northampton st. 9 2

Pennsylvania Motor Co. 2¾ m, elec. 5-2½ g, 36-56 lb flat & T r, 8 m c. Wightman system. Pres. H. E. Hand, Sec., Treas. & Gen. Man. D. W. Nevin, Supt. L. Richter. Capital, $120,000. Bonds, $60,000 9 2

EAU CLAIRE, WIS.—Eau Claire St. Ry. Lt. & Power Co. 8 m, elec, 4-8½ g, 35, 42 & 45 lb c & s b r 13 c, of which 8 are m c and 5 t c. Edison and Detroit Elec. Works systems. Pres. W. Lewis, V. Pres & Gen. Man A. F. Gerald, Treas. W. G. Maxcy, Gen Man. S. J. Hutchinson. Capital, $100,000. 9

EL PASO DE ROBLES, CAL.—El Paso de Robles St. Ry. 5 m, 3 g, 16 lb T r, 2 box c, 6 h Proprietor, George R. Adams. Cost, $10,000. Office Adams Block, cor Spring & 12th sts. 3 2

EL PASO, TEX.—El Paso & Paso Del Norte St Ry. & Bridge Co. 6½ m, 4-8½ g, 30 lb. T r, 14 c, 30 mu Pres. J. Magoffin, V. Pres. J. P. Dieter, Sec. & Treas H. B. Stephens, Supt. F. P. Blunt. a 9 1

El Paso St. Ry. Co. 4 m, 4-8½ g, 30 lb T r, 6 c, 5 mu Pres. J. Magoffin, V. Pres. J. P. Dieter, Treas. H. B Stephens, Supt. F. P. Blunt. 9 1

ELGIN, ILL.—Elgin City Ry. Elec. 13 m, 4-8½ g 40 & 45 lb T & girder r, 22 c, of which 13 are m c and 9 t c. Edison system. Pres. W. Grotc, V. Pres. J. B Lane, Sec. & Treas. A. B. Church, Gen. Man. C Wuestenfeld. Capital, $250,000. 3 2

ELIZABETH, N. J.—Elizabeth & Newark Horse R. R. Co. Consolidated with Newark Pass. Ry. Co 7 0

Elizabeth St. Ry. Co. 3½ m, 4-8½ g, 38 & 52 lb Johnson girder r. 13 box c, 47 h. Pres. F. L. Heidritter, Sec. & Treas. E. C. Woodruff. Supt. J. C. Husbands. Capital $50,000. Office, East Jersey and Front sts. 9 2

ELKHART, IND.—Elkhart Electric & Ry. Co. Elec. 7 m, 4-8½ g, 35 lb T & tram r, 11 c, of which 7 are m c & 4 t c. Detroit system. Pres. L. Warfield, V. Pres. J. McNaughton, Sec. J. W. Ellis, Treas. T. Muir, Supt. C. T. Goodrich. Capital, $99,000; authorized, $100,000. Bonds, $65,000. 9 2

ELMIRA, N. Y.—Elmira & Horseheads Ry. Co. Elec. 14 m, of which 1 is horse, 6 are steam and 7 elec. 4-8½ g, 38, 52, 78 lb. T & girder r, 55 c, of which 32 are h. c. 13 m. c. and 10 t. c, 44 h. Edison, T-H and Westinghouse systems. Pres. D. C. Robinson, Sec. G. M. Robinson, Treas. & Gen. Man. C. H. Baldwin. Capital, $400,000. Bonds $400,000. 3 2

West Side R. R. Co. Elec. 4-8½ g, 70 lb girder r, 12 m c, T-H system. Pres. C. H. Tompkins, Sec. & Treas. H. H. Hallock, Gen. Man. & Supt. W. W. Cole 9 2

EMPORIA, KAN.—Emporia City Ry. Co. 3½ m, 3-6 g, 20 lb r, 8 c, 24 h. Pres. Van R. Holmes, Treas. A. F. Crowe, Sec. & Man. J. D. Holden. K

ENSLEY, ALA.—Ensley Ry. Co. (Consolidated with Birmingham Ry. & Elec. Co.)

ERIE, PA.—Erie City Passenger Ry. Elec. (Operated by Erie Elec. Motor Co.)

Erie Elec. Motor Co. 23 m, 4-8½ g, 52 lb Johnson girder r, 87 c, of which 71 are m. c, 6 transfer c and 10 t. c. Edison system. Pres. J. S. Casement, V Pres. J. C. Brady, Sec. & Treas. J. L. Sternberg, Gen Man. J. F. Pfetch. Capital, $700,000. Bonds, $350 000. Office 202 State st. 11 2

ESSEX, MASS.—(See Salem, Mass.)

EUREKA, CAL.—Eureka St. R.R. Co. 4 m, 4-8½ g, 14 & 36 lb T & flat r, 6 box c, 9 h, 11 mu. Pres. J Soash, Sec. & Treas. B. B. Deming, Supt. R. M Fernald. Capital, $60,000 9 2

EUREKA SPRINGS, ARK.—Eureka Springs Elec. Lt. & St. Ry. Co. 2½ m, 4-8½ g, 35 lb T r, 5 h c 12 mu. Pres. J. D. Jordan, V. Pres. M. R. Baker, Sec & Supt. R. H. James, Treas. T. N. Claflin. Capital $15,000; authorized. $20,000. 3 2

EVANSVILLE, IND.—Evansville St. Ry. Co Elec. 19 m, 4-8½ g, 60 lb T & girder r, 60 c, of which 30 are m c and 30 t c. Westinghouse system. Pres J. J. Shipherd, V. Pres. G. H. Stockwell, Sec. H. D Moran, Treas. S. Krutz, Supt. T. J, Gist. Capital $300,000. Office, 101 Main St. 3 2

F

FAIRHAVEN, WASH.—Fairhaven & New Whatcom Ry. Co. Elec. 12 m, 4-8½ g, 40 lb T r. 16 c. of which 12 are m c and 4 t c. T-H system. Pres J. E. Baker, V. Pres. E. Cosgrove, Sec J. A. Kerr Treas. J. A. Cook, Gen. Man. M. C. Thum, Supt. A E. Roe. Capital 500,000; authorized $600,000. Bonds 300,000. 6 2

FALL RIVER, MASS.—Globe St. Ry. Co. 18 m 4-8½g, 35 & 47 lb r, 68 c, 300 h. Pres. Frank S. Stevens Treas. R. S. Goff, Supt. John H. Bowker. Capital $300,000. Office. 182 N. Main st. j 3 2

FINDLAY, O.—Findlay St. Ry. Co. Elec. 12½ m, of which 4 are horse and 8½ elec., 4-8½ g, 35 & 60 lb T r, 22 c, of which 7 are h c, 10 m c, and 5 t c, 4 h, 32 mu. Westinghouse system. Pres. G. B. Kerper, Cincinnati, V. Pres. J. N. Kinney, Sec. J. Strader, Treas. C. D. Kinney, Supt. Chas. Smith. Capital $200,000. 6 2

FISHKILL-ON-HUDSON, N. Y.—Citizens' St R. R. Co. Elec. 3½ m, 4-8½ g, 45, 54 lb T & girder r, 10 c, of which 6 are m c and 4 t c. T-H system. Pres J. T. Smith, Sec. S. K. Phillips, Treas. W. H. Souchard, Supt. S. D. Lake. Capital $75,000. 9 2

FITCHBURG, MASS.—Fitchburg & Leominster St. Ry. Co. Elec. 11.129 m, of which 6 689 are horse and 4.44 elec., 4-8½ g, 48 lb T r, 25 c, of which 17 are h c and 8 m c, 66 h. Westinghouse system Pres. H. A. Willis, V-Pres. H. I. Wallace, Sec. C. F Baker, Treas. B. F. Wallis, Supt. W. W. Sargent Capital $135,000; authorized $250,000. Bonds $30,000 11 2

FLUSHING, N. Y.—Flushing & College Point St. Ry. Co. Elec. 4 m, 4-8½ g, 47 lb s. b. r, 8 c, of which 4 are m c and 4 open t c. Pres. Joseph Dykes V. Pres. E. P. Stratton, Sec. D. Master, Treas. J Hepburn, Supt. C. Griswold. Capital $60,000. Office Broadway. 6 2

FOND DU LAC, WIS.—Fond du Lac St. Ry. Co 4½ m, 4-8½ g, 30 lb T & tram r, 8 c, 10 h, 21 mu. Receiver W. G. Curtis. Capital, $100,000. 6 2

FORT MADISON, IA.—Fort Madison St. Ry. Co. 4 m, 4-8½ g, 20 & 40 lb T & tram r, 8 c, 5 h 28 mu. Pres. & Gen. Man. D. A. Morrison, V. Pres. R S. Johnson, Sec. H. Jones, Treas. J. C. Brewster Supt. F. H. Weber. Capital, $100,000. Office, Santa Fe Ave. 9 2

FORT MEADE, FLA.—Fort Meade St. Ry. Co. 2¼ m, 3 g, 25 lb T r, 3 c, 2 mu. Pres. F. N. Varn, V-Pres. A. H. Adams, Sec. F. B. Hadless, Treas. J. G Carter, Gen. Man. Max Reif. Capital $6,000. 6 2

FORT SCOTT, KAN.—Fort Scott Rapid Transit Co. Elec. 6 m, 4 g, 35 lb T r, 14 4-wheel box c, of which 6 are m. c. Edison system. Operated by Davenport & Fort Scott Investment Co. Pres. & Gen Man. E. W. Brady, V. Pres. W. M. Smith, Sec. A. B Brady, Treas. A. L. Hughes, Supt. E. B. Brady. Capital, $150,000, authorized $500,000, bonds $100,000. 9 1

FORT SMITH, ARK.—Fort Smith St. Ry Co. 8½ m, 3-6 g, 38 & 45 lb girder r, 22 c, 2 h, 60 mu. Pres Gen. Man. & Supt. Sam'l McLoud, V. Pres. Benj. T Duval, Sec. & Treas. Geo. T. Sparks. Capital, $150,000. Bonds, $35,000. Office, Cor. Third & A sts. 9 2

FORT WAYNE, IND.—C. L. Centlivre St. Ry. Co 2 m, 4-8½ g, 18 lb. T r, 6 c, of which 2 are 4 wheel box and 4 4-wheel open, 24 h. Pres. L. A. Centlivre V. Pres. & Sec. C. F. Centlivre. Treas. J. B. Reuss, Gen. Man. Le Meyers. Capital, $30,000. d 3 2

Fort Wayne Electric Ry. 18½ m, 4-8½ g, 60 lb T & tram r, 59 c, of which 32 are m c and 27 t c. Short system. J. H. Bass, V. Pres. & Treas. M. S. Robison Sec. Jas. M. Barrett, Supt. L. D. McNutt. 9 2

FORT WORTH, TEX.—North Side St. R. R. Co. Elec. 15 m, 4 g, 20-38 lb T & Johnson r, 30 c of which 15 are m c and 15 t c. T-H. system. Pres W. Hendricks, V. Pres. A. T. Byers, Sec. & Treas G. B. Hendricks, Supt. J. T. Payne. 7 0

Fort Worth & Arlington Heights St. Ry. Co. Elec. 6½ m, 4 g, 35 lb T r, 5m. c. Edison system Pres. H. W. Tallant, V. Pres. A. W. Chamberlin Sec. & Treas. W. C. Winthrop, Supt. J. R. Pratt. Capital, $300,000. 3 2

City Ry. Co. Elec. 16 m, Detroit system. Pres. L. Warfield, V. Pres. & Sec. J. C. Terrell, Jr., Treas. J. C. Harrison, Supt. W. P. Quigg. Capital stock, $400,000. 8 2

Lampasas St. Ry. Co. 3 m, 4-8½ g, 35 lb. T r, 4 c, 16 h. Pres. R. E. Maddox, Sec. & Treas. W. H. Little Gen. Man. E. P. Maddox. Office, Lampasas. d 7 1

Polytechnic St. Ry. Co. 2½ m, 4 g, 20 lb T r, 2 c, 10 mu. Pres. W. D. Hall, V. Pres. R. Vickery, Sec. M. F. Lomer, Treas. G. E. Tandy. 4 2

The Riverside St. Ry. Co., Elec. 2¼ m, 4 g, 30 lb T r, 6 m. c. Detroit system. Pres. E. W. Taylor, V. Pres. E. E. Chase, Sec. W. M. Benny. Capital $200,000. 3 1

FRAMINGHAM, MASS.—Framingham Union St. Ry. Co. 7.35 m, 4-8½ g, 30 & 35 lb. T & s. b. r, 17 c 40 h. Pres. Jas. R. Entwistle. Treas. F. E. Gregory Supt. J. J. Hennessy. Capital $60,000 & $50,000 bonds Office, S. Framingham. 11 2

FRANKFORT, N. Y.—Frankfort & Ilion St. Ry. Co. 2½ m, 5 g, 25 lb T r, 5 c, of which 4 are box and 1 open. 6 h. Pres. A. C. McGowan, V. Pres. P. A Skiff, Sec. W. I. Piper, Treas. W. W. Crosby, Supt J. Myers. Capital, $20,000. Office, Frankfort. 11 2

FREDONIA, N. Y.—Dunkirk & Fredonia R. R. Co. Elec. 3½ m, 4-8½ g, 42-48 lb c. b. and girder r, 9 c, of which 3 are m c and 6 t c. Edison and Westinghouse systems. Pres. W. McKinstry, Sec, Treas & Man. M. M. Fenner. Capital, $57,000; authorized, $75,000. Bonds, $40,000. 9 2

FREEPORT, ILL.—Freeport St. Ry. Co. 4 m, 4-8½ g, 30 lb. s. b. r, 6 4-wheel box c, 24 h. Pres. Jacob Krohn, V. Pres. F. C. Platt, Sec. W. G. Barnes, Treas & Gen Man. John B. Taylor. Capital, $45,000. 1 2

FREMONT, OHIO.—Fremont St. Ry. Co. 1½ m, 4-8½ g, 40 lb flat r, 2 4-wheel box c, 8 h. Pres. F N. Carter, 29 Euclid ave., Cleveland, O., Treas. T. M Irvine, Cleveland, O., Supt. E. J. Carter. Capital $125,000. Office, 307 Croghan st. 8 2

FRESNO, CAL.—Fresno R. R. Co. 4 m, 4-8½ g, 20 lb r. 6 c, 7 h. Pres. Dr. L. Leach, V. Pres. T. E. Hughes, Sec. N. I. Baldwin, Treas. L. Einstein. Capital, $200,000. 7 0

Fresno, Belmont & Yosemite R. R. Co. 2½ m. 4-8½ g, 20 lb steel T r, 6 c, 12 h, 8 mu. Pres. E. C. Winchell V. Pres. C. G. Sayle, Sec. A. M. Drew, Treas. O. J Woodward. Capital, $500,000. 1 3 1

FRYEBURG, ME.—Fryeburg Horse R. R. Co. 3 m, 4 8½ g, 16 lb steel T r, 3 4-wheel box c, 1 h. Pres Freeman Hatch, Clerk, Gen. Man. & Supt. Seth W Fife, Treas. John Locke. Capital $5,075, authorized $10,000. 9 2

FULTON, N. Y.—Fulton & Oswego Falls St. Ry. Co. 6,000 ft, 4-8½ g, Gibbon's metallic stringer and r, 4 c, of which 3 are box and 1 open, 9 h. Pres Joseph Walker, Jr., V. Pres. N. N. Stranahan, Sec. & Treas. Charles Lyman, Supt. H. Hulett. Capital, $15,000. Office, 15 Broad st., New York. 1 3 1

G

GADSDEN, ALA.— Gadsden & Attalla Union Ry. Co. Dummy. 13½ m, of which 2 are horse and 11½ steam, 4-8½ g, 40 lb T r, 16 c, of which 2 are h c and 14 steam c, 2 h, 10 mu. Pres. J. M. Elliott, Jr., V. Pres. C. A. Lyerly, Sec., Supt. & Treas. M. L. Foster. Capital, $200,000. Office 123 N. 4th st, 6 2

GAINESVILLE, FLA.—Gainesville City & Suburban Ry. Co. 1½ m, 4-8½ g, 20 lb T r, 5 c, 40 mu. Pres. Wm. H. Robertson, Treas. Jas. D. Matheson, Supt. & Pur. Agt. R. L. Robb. 3 90

GAINESVILLE, GA.—Gainesville & Hall Co. St. R. R. Co. 5 m, 4-8½ g, 20 lb crescent r, 4 c, of which 2 are pass., 1 freight and 1 open, 1 h, 5 mu. Pres Sec. & Treas. H. H. Dean, V. Pres. A. D. Cummier Capital, $15,000. Leased to G. P. Boone for three years. Office, 10 Spring st. 3 2

GAINESVILLE, TEX.—Gainesville St. Ry. Co. 5 m, 3-6 g, 36 lb T r, 10 c, 21 mu. Pres. W. R. Chester, V. Pres. Geo. L. Hurley, Sec. H. C. Butman, Gen. Man. Geo. L. Hurley, Supt. Chas. N. Smith. Capital $40,000. Office, Fort Worth. a 3 1

GALESBURG, ILL.—Galesburg Electric Motor & Power Co. 6 m, 4-8½ g, 28-30-38-50 lb T & Johnson r, 12 box c, 30 mu. V. Pres. P. M. Johnson, Sec. H F. Arnold, Treas. R. Chappell, Supt. W. Wise. 9 2

GALLIPOLIS, O.—Gallipolis St. Ry. Co. Elec 3 m c, T-H system. 10 2

GALVESTON, TEX.—Galveston City R. R. Co Elec. 38 m, of which 5 are horse and 33 elec. 4-8½ g 40, 52 lb T r, 52 c, of which 40 are m c and 12 t c, 67 mu. T-H and Westinghouse systems. Pres. & Gen Man. Wm. H. Sinclair, Sec. & Treas. H. Kellner, Supt. M. J. Keenan. Capital, $318,673.50; authorized $1,000,000. Bonds, $300,000. Office, I and Center Sts. 9 2

Gulf City St. Ry. & Real Estate Co. Elec. 13 m, of which 10 are horse & 3 elec. 4-8½ g, 25-30 lb T r, 30 c, 50 mu. Pres. J. H. Burnett, Sec. P. S. Wren. Capital $100,000. Office, Ave. I & 21st St. 10 2

South Galveston & Gulf Shore R. R. Co. Elec. 24 m, 4-8½ g, 45 lb. T r. Pres. G. J. Gray, V. Pres. H C. Brown, Sec. H. E. Barden, Treas. L. Minor, Supt N. Dahl. Capital, $300,000. 10 2

GEORGETOWN, KY.- Georgetown St. Ry. Co 1½ m, 4-8½ g, 20 lb T r. 2 c, 6 mu. Pres. S. M. Davis Sec. W. Z. Thomson, Treas. A. H. Sinclair, Gen. Man J. E. Cantrell. Capital $6,000. 6 2

GETTYSBURG, PA.—Gettysburg Battlefield R. R. Elec. 12 m, 4-8½ g, 50 & 70 lb T & girder r, 6 m c. Pres. E. M. Hoffer, Sec. & Treas, G. P. Hoffer. Capital $100,000. 4 2

GIRARDVILLE, PA.—Mahanoy, Shenandoah Girardville & Ashland St. Ry. Co. (Leased to Schuylkill Traction Co.) Elec. 7 m, 6 m c. T-H system. Gen. Man. C. R. Eberle. 7 2

GLENS FALLS, N. Y.—Glens Falls, Sandy Hill & Fort Edward St. R. R. Co. Elec. 8 m, 4-8½ g, 40 lb T r, 12 c, of which 8 are m c and 4 t c. Westinghouse system. Pres. J. M. Coolidge, V. Pres. L Allen, Sec. & Treas. B. B. Fowler, Supt. H. Crabie Capital authorized $120,000. Bonds $100,000. 9 2

GLOUCESTER, MASS.—Gloucester St. Ry. Co. Elec. 8½ m, 4-8½ g, 40-60 lb T & Johnson r, 13 m c T-H and Detroit systems. Pres. W. B. Ferguson, V Pres. J. H. Cunningham, Sec. D. S. Presson, Treas. A. D. Bosson, Supt. A. R. Hallowell. Capital, $180,000. Bonds, $60,000. Office, Gloucester st. 9 2

GRAND ISLAND, NEB.—Grand Island St. Ry. Co. 7 m, 4-6 g, 16 & 20 lb T r, 11 c, 54 h & mu. Pres G. H. Thummel, V. Pres. C. Wasmer, Sec. & Gen. Man O. B. Thompson, Treas. A. H. Baker, Supt. W. C Lamon. Capital, $240,000. 3 2

GRAND JUNCTION, COL. — Grand Junction St. Car Co. 2 m, 3 g, 22 lb. T r. 2 4-wheel box c, 4 h. Pres. G. Wheeler, V. Pres. B. Cannon, Sec. & Treas. T. B. Crawford, Gen. Man. & Supt. B. K. Kennedy. Capital $25,000. h 3 1

GRAND RAPIDS, MICH.—Consolidated St. Ry Co. Elec. 45 m, 4-8½ g, 45, 66 & 78 lb girder r; 180 c, of which 20 are h c, 116 m c and 44 t c. Edison, Short and Detroit systems. Pres. A. J. Bowne, V. Pres. & Gen. Man. J. R. Chapman, Sec. J. M. Hagar, Treas. J. Blair, Asst. Sec. & Asst. Treas. B. S. Hanchett, Supt. D. Campbell, Gen. Elec'n. S. Barnes. Capital, $2,000,000. Bonds, $2,000,000. 7 2

GREAT FALLS, MONT.—Great Falls St. Ry Co. Elec. 10.8 m, 4-8½ g, 45 lb T & girder r, 11 c, of which 7 are m. c. and 4 t. c. T-H system. Pres. A. S. Bigelow, V. Pres. L. Lewesohn, Sec. & Treas. T. Nelson, Supt. W. D. Dickinson. Capital, $200,000. Bonds $120,000. 9 2

GREENBUSH, N. Y.—North & East Greenbush St. Ry. Co. 1.7 m, 4-8½ g, 6 c, 22 h. Pres. & Treas. A Bleecker Banks. Capital $50,000. Office, 473 Broadway, Albany. 3 2

GREEN CASTLE, IND.—Green Castle City St. Ry. Co. 2.60 m, 4-8½ g, 30 lb T r, 3 4-wheel open c, 10 mu. Pres. J. W. Welk, V. Pres. J. S. Dowling, Sec. & Supt. F. G. Gilmore, Treas. H. Meltzer, Gen Man. E. McClean. Capital $32,000; authorized $50,000. Office Crystal Palace cor. Vine and Walnut sts. 10 2

GREENSBURG, PA.—Greensburg & Hempfield Electric St. Ry. 2.4 m elec., 4 8½ g, 35 & 45 lb Johnson & T r, 3 m. c. Westinghouse system. Pres. R. S. Jamison Sec. J. E. Keenan, Treas. W. A. Huff, Gen. Man. F. Y. Clopper, Supt. R. C. Reamer. Capital $60,000, bonds $59,200. Office, Huff Building. 11 2

GREENVILLE, S. C.—St. Ry. Co. of the City of Greenville. 2½ m, 5 g, 16 lb crescent r, 6 c, 3 mu T. C. Gower & Son, proprs. Pres. T. C. Gower, Sec G. G. Wells, Supt. A. G. Gower. Capital $10,000. Office, 104 Washington st. 6 2

GREENVILLE, MISS.—Greenville St. Ry. Co. 6 m, 4-8½ g, 25-30 lb T r, 9 c. 15 mu. Pres. J. M Joyne, Sec. & Treas. J. E. Neggus, Gen. Man. J Gunn, Supt. J. H. Gonterman. Capital, $35,000 authorized, $100,000. 3 2

Suburban St. Ry. of Greenville. 2 m, 4-8½ g, T r 2 c, 4 mu. Pres. & Man. H. Wilczinski, V. Pres. N Wilczinski, Sec. & Treas. L. Wilczinski, Capital $25,000. 3 2

GREENVILLE, TEX.—City Ry. Co. 3 m, 4-8½ g, 20 lb. flat & T r, 3 c, 16 mu. Pres. W. N. Harrison, Sec. M. S. Andrews, Supt. T. E. Boyd. 7 0

GRIFFIN, GA.—Griffin St. Ry. Co. 3 m, 4-8½ g, 35 lb steel r, 5 c. 14 mu. Pres. J. G. Rhea, Sec. & Treas. R. H. Drake, Supt. C. K. Reaves. Capital $20,000, authorized $50,000. 6 2

H

HALIFAX, N. S.—Nova Scotia Power Co. (Lim.) 7 m, 4-8½ g, 45-60 lb T r, 25 c, 100 h. Pres. John White, Sec. & Treas. H. Freeman, Supt. J. Adams. Office, 138 Hollis st. Halifax, N. S. Office of Supt. Richmond. 11 0

HAMILTON, O.—Hamilton & Lindenwald Electric Transit Co. 9 m, 4-8½ g, 45 lb Johnson girder r, 23 c, of which 15 are m. c. and 8 t. c. Edison system. Pres. Thos. Millikin, V. Pres. C. Benninghofen, Sec. & Gen. Man. Ira S. Millikin, Treas. P. Benninghofen Capital, $100,000. Bonds $100,000 6 2

HAMILTON, ONT.—Hamilton St. Ry. Co. Elec 12 m, 4-8½ g. 35 lb flat r, 46 c, 170 h. Pres. B. E. Charlton, V. Pres. ————, Sec. & Gen. Man. T. B Griffith. Capital $205,000. Office 107 King St. West 3 2

HAMPTON, VA.—Hampton & Old Point Ry. Co Elec. 14 m, 4-8½ g, 50-69 lb T & girder r, 20 c, of which 12 are m c, 1 freight and 2 flat c. Edison system. Pres. F. W. Darling, V. Pres. J. McMenamin Sec. & Treas. H. L. Schmelz, Elec'n J. B. Crankshaw Capital, $150,000. 8 2

HANNIBAL, MO.—Hannibal Ry. Co. Elec 2½ m 4-8½ g, 36,40 lb T & c b r, 5 c, of which 3 are m. c. and 2 t. c. T-H system. Pres. & Supt. M. Doyle Sec. & Treas. James O'Hern. Capital $25,000. Office 300 Market st. 6 2

HARRISBURG, PA.—Harrisburg City Passenger Ry. Co. Elec. 5½ m, 5-2½ g. T-H system. Pres. H. A. Kelker, V. Pres. G. R. Fleming, Sec. A. Roberts, Treas. W. L. Gorgas. Capital $125,000. Office, 27 South 2d st. Consolidated with East Harrisburg Pass. Ry. Co. 9 2

Citizens' Passenger Ry. Co. Elec. 4 m c. Westinghouse system. Pres. J. A. Dunkle, Supt. F. H. Alleman.

East Harrisburg Pass. Ry. Co. Elec. 15 m, 5-2½ g 52-78 lb girder r, 52 c, of which 43 are m. c. and 9 t. c. T-H system. Pres. John Q. Denney, V. Pres. T. G. Greenawalt, Sec. & Treas. W. J. Calder, Supt. F. B. Musser. Capital, $350,000; authorized $500,000 Office, S. Cameron st. 6 2

HARTFORD, CONN.—Hartford & Wethersfield Horse R. R. Co. Elec. 30 m, of which 20 are horse and 10 elec, 4-8½ g, 35-60 lb T, & girder r, 106 c, 460 h, 3 m c. Westinghouse & T-H systems. Pres. E. S. Goodrich, Sec. Dan'l R. Howe. Capital, $200,000 Office 346 Main st. 9 2

East Hartford & Glastonbury Horse R. R. Co. Elec 5 m, 4-8½ g, 50 lb T r, 4 m c. Short system. Pres D. R. Howe, V. Pres. I. Broadhead, Sec. G. D. Curtis Treas. E. M. White, Gen. Man. E. S. Goodrich. 11 2

HARVEY, ILL.—Harvey Transit Co. Elec. 3 m c, 4-8½ g, T r, 3 m c. Short system. Pres. J. M Wanzer, V. Pres. A. G. Spalding, Treas. R. Titus Supt. P. B. Lamb. 9 2

HASTINGS, NEB.—Citizens' St. Ry. Co. 5 m, 4-8½ g, 16 & 32 lb T & flat r, 4 box c, 8 h. Pres. Robt. Batty, V Pres. C. L. Stone, Sec. F. J. Benedict, Supt. J. M. Hamsher. Capital, $100,000. 3 1

HAVERHILL, MASS.—Haverhill & Groveland St. Ry. Co. 15 m, 4-8½ g, 30-35-40 lb T & flat r, 39 c of which 20 are 8-wheel box and 19 are 8-wheel open 100 h. Pres. G. H. Campbell, Treas. A. A. Glasier Supt. F. Woodman. Capital $144,000. Office, 3 Water st. 7 2

Haverhill & Amesbury St. Ry. Co. Elec. 32 m, of which 8½ are horse, 5½ steam & 18 elec, 4-8½ g, 35 50, 70 lb T & girder r, 40 c, of which 6 are h c, 10 steam 16 m c and 8 t c. Pres. & Gen. Man. E. P Shaw, Sec. & Treas. J. F. Tilton, Supt. F. Stuck Capital, $150,000; authorized, $250,000. Bonds, $300,000. 9 2

HELENA, ARK.—Citizens' St. Ry. Co. 2½ m, 4-8½ g, 20 & 40 lb T & Johnson r, 7 c, of which 4 are 4-wheel box & 3 truck c, 12 h. Pres. H. S. Hornor, V Pres. A. T. Hargraves, Sec. & Gen Man. J. H. Thompson, Treas. S. H. Hornor. Capital $30,000 6 2

HELENA, MONT.—Helena Electric Ry. Co. 9 m, 4-8½ g, 38-48 lb girder & T r, 17 c, of which 9 are m c. T-H & Westinghouse systems. Pres. C. K. Wells, V. Pres. W. A. Chessman, Sec. & Treas. H. L. Walker Capital. 250,000 9 2

Helena Rapid Transit Co. Elec. 10 m, 4-4½ g, 35 45, 50 lb T & girder r, 9 m c. T-H. system. Pres J. H Lawrence, V. Pres. R. S. Vivian, Sec. G. May, Treas G. B. Child. Capital $500,000. 4 2

Helena Union Ry. Co. 12 m c. T-H system. 7 2

HENDERSON, KY.—Henderson St. Ry. Co. 6½ m, 4-8½ g, 20 lb steel T r, 7 4-wheel box c, 10 h 33 mu. Pres. & Gen. Man. E. G. Sebree, Jr., Sec. & Treas. D. Banks, Jr., Supt. John W. O'Brien. Authorized capital, $100,000. 1 2

HENDERSONVILLE, N. C. — Hendersonville St. Ry. Co. 3 m, 4-8½ g, 30 lb T r, 3 c, of which 1 is 4-wheel box and 2 4-wheel open, 1 h, 2 mu. Owner and Gen. Man. S. V. Pickens. Capital, $6,000. Office, 1 S. End Main st. 9 2

HERKIMER, N. Y.—Herkimer & Mohawk St. Ry. Co. 1½ m, 4-8½ g, 30-40 lb T r, 4 c, of which 3 are 4-wheel box and 1 is 4-wheel open, 6 h. Pres., Treas & Man. H. D. Alexander, V. Pres. H. Deimel, Sec E. L. Prince. Capital, $20,000 Office Mohawk, N. Y. 9 2

HOBOKEN, N. J.—North Hudson County Ry Co. (includes Pavonia Horse R. R.) 40 m, of which 30 are horse, 2½ cable and 7½ steam, 4-8½ g, 56, 67 lb c. b. girder and T r, 180 c, of which 143 are h. c, 17 g. c and 20 steam, 930 h, 6 eng. Pres. S. B. Dod, V. Pres

H. J. Bonn, Sec. T. J. Mallory, Asst. Soc. W. C Doubleday, Treas. J. F. W. Mangels, Supt. Nicholas Goelz. Office, 21 Hudson Place. 6 2

HOLYOKE, MASS.—Holyoke St. Ry. Co. Elec 9 m, 4-8½ g, 56 lb. T r, 32 m c. T-H and Westinghouse systems. Pros. Levi Perkins, V. Pros. J Olmstead, Sec. W. H. Brooks, Treas. & Gen. Man Wm. S. Loomis. Capital $200,000; authorized, $250,000. Office 23 Canal St. 11 2

HOT SPRINGS, ARK.—Hot Springs St. R. R 11 m, 4-8½ g, 35 & 36 lb T r, 24 c, 3 h, 121 mu. Pres. & Treas, S. W. Fordyce, St. Louis, Mo.; Sec. J. B. Fordyce, Hot Springs; Man. & Pur. Agent. C. G. Convers, Hot Springs. Office, 615 Park Ave., Hot Springs. 9 2

Fountain & Suburban R. R. Co. Elec. 4½ m, 4 g 35 lb T r R. Murray, owner & manager, Williamson Block, Valley st., at Malvern Crossing. Capital $20,000. 8 2

HOT SPRINGS, S. DAK.—Hot Springs & Chautauqua R. R. Co. Elec. 1¼ m, 2 m. c. Short system 10 1

HOUSTON, TEX.—Houston City St. Ry. Co. Elec 35 m, of which 18 are horse and 17 elec; 4-8½ g, 20 30, 40 lb T & flat r, 51 c, of which 41 are m c and 10 t c, Edison, Short & T-H systems. Pres E. A. Allen, V. Pres. & Gen. Man. H. F. MacGregor, Sec. & Treas. C. A. McKinney, Supt. F. Mundes, Houston. Capital, $800,000. Office, 510 Travis st. 9 2

Bayou City St. R. R. Co. 17 m, 4-8½ g, 25 lb steel r, 36 c, 147 mu. Controlled and operated by Houston City St. Ry. Co. 6 2

HUDSON, N. Y.—Hudson Elec. Ry. Co. 1¾ m elec, 4-8½ g, 35 lb T r, 4 m. c. T-H system. Pres. H Mc Gonegal, Vice-Pres. A. J. Rowles, Sec. E. J Hodge, Treas. S. D. Lake. Capital stock $50,000. 9 1

HULL, MASS.—Hull St. Ry. Co. 4 m c. T-H system. 7 2

HUNTINGTON, L. I., N. Y.—Huntington R. R Co. 3 m, 4-8½ g, 30 lb T r, 3 c, 9 h. Pres. E. D. Davidson. V. Pres. Temple Prime, Sec. Geo. M. Tileston Treas. D. Conklin, Gen. Man. I. Rogers. Capital $30,000. Bonds, $26,000. 9 2

HUNTINGTON, W. VA.—Consolidated Elec. Light & Ry. Co. 11 m, of which 5 are horse and 6 elec, 4-8½ g, 45 lb girder r, 11 c, of which 6 are h c, 3 m c and 2 t c. Short system. Pres. J. L. Caldwell V. Pres. F. F. McCullough, Sec. & Gen. Man. F. L Doolittle, Treas. C. L. Hafner, Sr., Supt. A. L. Fickle Capital stock $80,000; authorized $250,000. Office, 3d Ave. 10 2

Huntington Belt Line Co. 4 m, 4-8½ g, 40 lb flat r 6 c, 15 h, 11 mu. Pres. C. L. Hafner, Sr.; V. Pres. F. F McCullough, Sec., Treas. & Gen. Man. F. L. Doolittle Supt. of track J. K. Lambert. Capital, $20,000. Office 9th st. 3 2

HUNTSVILLE, ALA.—Huntsville Belt Line & Monte Sano Ry. Co. 12 m steam, 4-8½ g, 60 lb. T r, 20 c. Pres. J. F. O'Shaughnessy, 36 Wall st. New York Capital, $200,000. Bonds, $150,000. Office, Jefferson st. 2 2

HUTCHINSON, KAN.—Hutchinson St. Ry. Co. 10 m, 4-4 g, 20 lb T r, 10 c, 35 h, 15 mu. Pres. Fred A. Forsha, V. Pres. L. A. Biggar, Sec. & Treas. D Richardson, Supt. S. Bigger, Man. Capital $50,000. 3 1

I

INDEPENDENCE, MO.—Kansas City, Independence & Park Dummy Line. (See Kansas City.)

INDIANAPOLIS, IND.—Citizens' St. R. R. Co. Elec. 85 m, of which 55 are horse and 30 elec., 4-8½ g, 38 to 78 lb Johnson girder r, 145 c, of which 95 are h. c, 35 m c. and 15 t c., 940 mu. T-H, Edison, Westinghouse and Short systems. Pres. J. P. Frenzel, V. Pres. S. W. Allerton, Sec. & Treas. A. A. Anderson, Pur. Agt. S. F. Hazelrigg, Asst. Supt. W. T. Lewis. Capital, $1,500,000; authorized, $3,000,000. Bonds $800,000. Room 11 The Fair Block. 6 2

IRONTON, O.—The Ironton & Petersburg St. Ry. Co. 8 m, 4-8½ g, 32 lb r, 13 c, 42 h. Pres. C. H Harman, V. Pres. W. H. Enochs, Sec. & Treas. Wm M. Kerr, Supt. T. T. Johnson. Capital, $100,000 Bonds, $65,000. Office, 32 Nassau St., New York. 9 2

IRONWOOD, MICH.—Twin City Ry. Co. 3.5 m, 3 m. c. T-H system. 6 2

ITHACA, N. Y.—Ithaca St. Ry. Co. Elec. 6 m, 4-8½ g, 30 lb T r, 3 4-wheel box m c, Wightman system. Pres. H. E. Hand, V. Pres. A. Robertson, Sec, & Treas. H. Bergholtz. Capital, $175,000. Bonds $175,000. Office, 16 East State st. 7 2

J

JACKSON, MICH.—Jackson Street Ry. Co. Elec 5½ m, 4-8½ g, 45 lb girder r, 16 c, of which 8 are m. c and 8 t c. Edison system. Pres. H. H. Smith, V. Pres. D. S. Smith, Sec. J. B. Corliss, Treas. & Gen. Man. H H. Smith, Jr., Capital $140,000; authorized $150,000. Office Main Street. 9 2

JACKSON, MISS.—Jackson City R.R. 1½m 4-8½ g, 4 4-wheel box c, 10 h. Pres. P. W. Peoples of Jackson Bank. Capital, $5,000. 3 2

JACKSON, TENN.—Jackson & Suburban St. R. R. Co. 7, m, 4 g, 30 lb tram r, 9 4-wheel box c, 30 mu Pres. & Gen. Man. J. L. Wisdom, V. Pres. J. H. Duke Sec. C. G. Bond, Supt. T. F. Dalby, Treas. 1st Nat. Bank. Capital, $50,000. Office, Royal St. at Five Points. 1 2

JACKSONVILLE, FLA.—Main St. Ry. Co. 1½ m, 5 g, 25 lb T r, 5 4-wheel box c, 18 mu. Pres. S. B Hubbard; V. Pres. J. M. Schumacher, Sec. & Man. H S. Ely, Treas. W. A. Macduff. Capital, $15,000. Office 26 Main st. 9 2

Jacksonville St. R. R. Co. 12 m, 5 g, 25 & 30 lb T & 35 lb c b r, 33 c, 137 mu. Pres. H. S. Haines, Savannah, Ga.; V. Pres. Geo. R. Foster, Jacksonville, Fla.; Treas. J. M. Lco, Savannah; Supt. G. W. Haines, Brunswick, Ga.; Agent & Eng. M. H. Motto, Jacksonville. Office, Commercial st. c 9 0

JACKSONVILLE, ILL.—Jacksonville Ry. Co. Elec., 5 m, 4-8½ g, 25-45 lb r, 21 c, of which 9 are m c, 12 t c, 5 h. T-H. & Detroit systems. Pres. Wm. S Hook, Sec. Marcus Hook, Treas. Fannie Hook, Supt B. F. Sibert. 6 2

JAMAICA, N. Y.—Jamaica & Brooklyn Road Co. 12.8 m elec. 4-8½ g. 50 lb s b & flat r, 23 c of which 18 are m c and 5 t c. Edison system. Pres. S Spencer, New York; Sec. W. S. Townsend, Treas. F E. Worcester. Supt. W. M. Scott. Capital, $197,480 Bonds, $415 000. Office 23 Wall st., New York & Jamaica, L. I. 9 2

JAMESTOWN, N. Y.—Jamestown St. Ry. Co Elec. 15 m, 4-8½ g, 30-52 lb T, tram & girdor; 35 c, of which 22 are m c and 13 t c, 7 h. Short & Westinghouse systems. Pres. A. N. Broadhead, V. Pres. L. B Warner, Sec. W. S. Cameron, Treas. F. E. Gifford. Supt & Pur. Agt. G. E. Maltby. Capital $100 000; authorized $250,000. Bonds $25,000. 9 2

JANESVILLE, WIS.—Janesville St. Ry. Co Elec. 6½ m, 4-8½ g, 35 lb T r, 10 c, of which 5 are m c and 5 t c. Short system. Pres. J. A. Barham, Sec. & Treas. H. G. Williams. Supt. Office, Power House, Academy St. 7 2

JEFFERSONVILLE, IND.—Jeffersonville City Ry. Co. 5 m, 4-8½ g, 20 & 35 lb steel T r, 8 4-wheel box & 3 4-wheel open c, 35 mu. Pres. E. J. Howard V. Pres. G. J. Long, Sec. & Treas. J. C. Zulauf, Supt. E. Frazier. Capital stock, $50,000. Office, 57-59 Spring st. 4 2

JERSEY CITY, N. J.—Jersey City & Bergen R. R. Co. Elec. 37 m, 4-10½ g, 50 & 78 lb c. b. & girder r, 140 c, of which 134 are h c and 6 m c, 801 h, 56 mu. Westinghouse system. Pres. Chas. B. Thurston, V. Pres. E. F. C. Young, Sec. H. C. Ross, Treas. Joseph S. Vanzandt, Supt. Thos. M. Sayre, Engr. E. F. Brooks. Capital, $1,000,000. Bonds, $258,000. Office, No. 1 Exchange Pl. 6 2

JOHNSON CITY, TENN.—Johnson City & Carnegie St. Ry. Co. Elec. 4m, 4-8½ g, 3 m.c T-H. system Pres. E. Day, V. Pres, W. B. Hosmer, Sec. J. K. Smith Treas. & Gen. Man. E. H. Stevens. Capital $50,000 10 2

JOHNSTOWN, N. Y.—Johnstown, Gloversville & Kingsboro Horse R. R. Co. Elec. 4½ m, 4-8½ g, 45 lb T & girder r, 8 c, 22 h. Pres. W. S. Northrop, V. Pres. L. Veghte, Sec. & Supt. L. Caten, Treas. H. W. Potter Gen. Man. F. A. Caten. Capital, $50,000. Bonds, $1,000. 9 2

JOHNSTOWN, PA.—Johnstown Pass. Ry. Co. Elec. 11 m, 4-8½ g, 78 lb girder r, 20 box c. of which 10 are m. c. & 10 t. c. Short system. Pres. Tom. L Johnson, V. Pres. & Man. John B. Hoefgen, Sec B. L. Yeagley, Treas. J. Allen. Capital. $128,000 Office Moxham, Johnstown. a 4 1

JOLIET, ILL.—Joliet St. Ry. Co. Elec. 16 m 4-8½ g, 38, 40, 58 lb. girder & T r; 30 c, of which 16 are m c & 14 t c. T-H system. Pres. & Gen. Man. J A. Henry, V. Pres. & Supt. J W. Folk, Sec. & Treas. J. Hulsizer, Supt. L. G. Bronson. Capital, $150,000 authorized, $300,000. Bonds, $75,000. Office, Chicago & Clinton sts. 9 2

JOPLIN, MO.—Joplin Electric Ry. & Motor Co 4.52 m, 4-8½ g, 56 lb Johnson girder r, 10 4-wheel box c, of which 8 are m.c. and 2 t.c. T-H system. Two 15 H. P. motors to each car. Pres. John N. Boffinger V. Prests. B. F. Hammett, J. C. Stewart; Sec. & Treas. D. R. Powell, Gen. Man. H. L. Newman, Supt C. H. Belden, Atty. D. J. Haff. Capital, $150,000 Office, 115 N. 3d st., St. Louis, Mo. 9 2

K

KALAMAZOO, MICH.—Kalamazoo City & County St. Ry. Co. 12 m. 4 8½ g., 30-45 lbs. tram & girder r, 27 c. of which 15 are box & 12 open, 60 h. Pres. Wayne Griswold, Sec. W. R. Adams, Gen. Man & Supt. F. H. Davis. Capital $100,000. 3 1

KANKAKEE, ILL.—Kankakee Electric Ry. Co. 6 m, 4-8½ g, 40 lb T, girder & T r, 7 c, of which 5 are m. c. and 2 t. c. Westinghouse system. Pres. & Gen. Man. C. H. Cobb, V. Pres. H. K. Wheeler Sec. & Treas. T. W. Adams, Capital $25,000. 9 2

North Kankakee Elec. Lt. & Ry. Co. 4½ m, 4-8½ g, 40, 48½ lb T & girder r, 2 m. c. Detroit System. Pres. B. F. Vran, V. Pres & Gen Man. W. W. Hatch, Sec. E. E. Day, Treas. A. D. Ehrich. Capital $30,000; authorized $60,000. Bonds $35.000. 8 2

North Kankakee St. Ry. Co. Elec. 2 m. c. Detroit system. 8 2

KANSAS CITY, KAN.—Inter-State Consolidated Rapid Transit Railway Co. 15 3-5 m, of which 1 3-5 are cable and 14 steam 4-8½ g, 40-50-62 lb c. b. & T r. 44 c. Pres. J. Wilbour, V. Pres. D. D. Hoag, Sec. W. E. Barnhart, Treas. A. H. Calif, Gen. Man. & Supt. W. Stone. Capital, $1,700,000; bonds $1,700,000. Office, Husted building, cor. 6th st. & Minnesota ave. 3 2

KANSAS CITY, MO.—Kansas City Cable Ry. Co. 20½ m cable, 4-8½ g, 42, 56 & 63 lb flat & Johnson girder r, 190 c, of which 119 are open and 71 g. c Pres. & Gen. Man. Wm. J. Smith, V. Pres. Jas. A Blair, Sec. W. H. Lucas, Asst. Gen. Man. F. C. Peck Capital, $1,575,000. Bonds $1,350,000. Office, 433 E. Ninth st. 9 2

Consolidated City & Chelsea Park Ry. Co. Elec 2 m, 4-8½ g, 40 lb T r, 4 m. c, T-H system. Pres. D D. Hoag, Sec. & Treas. W. E. Barnhart, Gen. Man. & Supt. W. Stone. Capital $100.000. 3 2

Grand Ave. Ry. Co. 12.196 m. of which 1.750 are horse, 8.572 cable & 1.874 steam, 4-8½ g, 58 lb T & Johnson r, 90 c, of which 82 are cable, 6 h. c. & 2 m.c 47 h. Pres. W. H. Holmes, V. Pres. V. B. Buck, Sec D. B. Holmes, Auditor, T. J. Fry, Gen. Man. C. F Holmes, Supt. T. Barratt. Capital, $1,200,000. Office 1500 Grand ave. 6 2

Kansas City Elevated Ry. Co. Elec. 19.6 m 4-8½ g, 40, 50, 62 lb T & Duplex r, 26 c, of which 22 are m c and 4 t c. Pres. J. Wilbour, V. Pres. & Sec D. D. Hoag, Treas. A. H. Calif, Gen. Man. W. Stone 9 2

Kansas City & Independence Rapid Transit Ry. Co. 6.32 m steam, 4-8½ g, 40 lb T r, 18 4-wheel box c, 6 steam motors. Pres. W. H. Holmes, V. Pres. C. L Hutchinson, Sec. D. B. Holmes, Gen. Man. C. F Holmes, Supt. W. P. Buckner, Auditor, T. J. Fry. Capital, $1,000,000. Office 1,500 Grand Ave. 6 2

Kansas City, Masten & Westport R R Co. Bought by the Kansas City & Southern Ry. Co.

Kensington Ry. Co. Steam. 4 m, 4-8½ g, 50 lb T r. Pres. A. P. Smith, V. Pres. C. Bullock, Sec. J. E Brady, Treas. W. A. Bunker. Capital $50,000. Bonds, $50,000. Operated by Interstate Consolidated Rapid Transit Ry. Co. 9 2

Metropolitan St. Ry. Co. 44 m, of which 25 are cable, 11 horse and 8 elec., 4-8½ g, 60 lb c. b. r, 283 c of which 42 are h. c, 76 g. c, 12 m. c. and 153 t. c, 68 h, 118 mu. T-H system. Pres. & Treas. C. F. Morse, V Pres. G. H. Nettleton, Sec. J. A. Harder, Gen. Man & Ch. Eng. R. J McCarty, Supt. L. E. Simmons. Capital, $2,800.000; authorized, $3,600,000. Bonds $2,000,000. Office, 9th & Broadway. 9 2

North East St. Ry. Co. Elec. 7 m, 4-8½ g, 52 lb girder r; 12 m c, of which 10 are 4-wheel box and 2 4-wheel open. T-H system. Pres. W. McDonald Sec. W. C. Scarritt, Treas. J. H. North, Gen. Man. F W. McDonald. Capital $260,000. Bonds $260,000. 3 2

People's Cable Ry. Co. 6.8 m, 4-8½ g, 58½ lb r, 35 c, of which 15 are g. c. and 20 t. c. Auditor & Cashier, W. C. Philips, Supt. F. Philips. Capital $750,000. 3 2

South Side St. Ry. Co., 1½ m, 4-8½ g, 18 lb. strap r, 3 4-wheel box c, 21 h. Pres. A. P. Smith, Sec J A. Harder, Gen. Man. J. McCarty. Capital $20,000 6 2

Vine St. Motor Ry. Co. 3 m, 4 motor c. T-H system Pres. A. J. King, Gen. Man. J. W. Norton. 5 1

West Side R. R. Co. Elec. 8 m, 4-8½ g, 54 lb. Prov girder r, 6 m.c. Detroit Elec. Works system. Pres. W N. Coler, Jr., V. Pres. B. S. Moats, Sec. C. F. Hutchings. Capital, $500,000. 6 2

KEARNEY, NEB.—Kearney Electric Co. 7 m Elec. 4-8½ g, 40 lb T r, 6c, of which 4 are m. c. and t. c. T-H & Edison systems. Pres. Geo. W. Frank V. Pres. Augustus Frank, Sec. & Treas. C. M. Rice Supt. J. F. O'Brian. Capital $250,000. 1 2

KENOSHA, WIS.—Kenosha Electric St. Ry. Co 3 m, 4-8½ g, 52 lb girder r, 6 c. of which 4 are m c and 2 t c. Pres. & Gen. Man. J. W. Munson, V. Pres. N A. Pennoyer, Sec. & Treas. H. B. Robinson. Capital $100 000. 9 2

KEOKUK, IA.—Gate City Electric St. Ry. Co. 6½ m, 4-8½ g, 38-45 lb T & girder r, 14 c, of which 8 are m c and 6 t c. Edison and Westinghouse systems. Pres. S. P. Townsend, Sec. & Treas. G. S. Dana, Supt. H. C. Reiner. Capital authorized, $130,000. Bonds $85,000. 6 2

KEY WEST, FLA.—Key West Street Car Association.

KEYPORT, N. J.—Keyport & Matawan St. Ry Co. 3½ m, 4-8½ g, 38 lb girder s-b r, 6 4-wheel box c 24 h. Pres. T. S. R. Brown, Sec. & Treas. A. M Brown, Supt. W. C. Smith. Capital, $30,000. 11 2

KINGSTON, N. Y.—Kingston City R. R. Co Pres. S. D. Coykendall.

KINGSTON, ONT., CAN.—Kingston St. Ry Co. 8 m, 3 g, 44 lb r, 15 c, 45 h. Pres. & Gen. Man B. W. Folger, V. Pres. M. H. Folger, Sec. F. R. Sargent, Treas. B. W. Folger, Jr., Supt A. Beacance Capital $60,000. Bonds $60,000. 6 2

KNOXVILLE, TENN.—Knoxville St. R. R. Co Elec. 17 m, of which 13 are electric, 4 8½ g, 45 lb girder & T & 25 lb tram r, 26 c, 12 m. c. T-H system Pres. W. G. McAdoo, Jr., V. Pres. F. K. Huger, Sec. & Treas. M. R. McAdoo. Receiver, J. C. Duncan 6 2

Fountain Head Ry. Co. 6 m, 4-8½ g, 45 lb T r, 11 c of which 7 are passenger and 4 freight, 3 dummies Pres. G. Borgfeldt, V. Pres. G. F. Pfeiffer, Treas. J Kahle, Gen. Man. M. O. French, Supt. R. T. Baker Capital $200,000. Office, 91 W. Depot st. 3 2

West End St. Ry. Co. 3 m, 4-8½ g, 24 lb c. b. r, 3 c. 19 mu. Pres. R. M. Rhea Sec., Treas. & Gen. Man T. J. Thomas. Capital $25,000. 3 2

KOKOMO, IND.—Kokomo City St. Ry. Co. Elec 4½ m, 4-8½ g, 35 lb T r, 10 c, of which 7 are m c, and 3 t c. Detroit system. Pres. F. E. Snow, V. Pres W. A. Jackson, Sec. F. Woodruff, Treas. F. Marvin Supt. F. H. Allen. Capital $100,000. 9 2

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LACONIA, N. H.—Laconia & Lake Village Horse R. R. 2.67 m, 3 g, 25 & 34 lb T, girder and flat r, 10 c 25 h. Pres. J. C. Moore, V. Pres. & Gen. Man. Henry Tucker, Treas. Edmund Little, Supt. B. S. Kenniston. Capital $30,000. 4 2

LA CROSSE, WIS.—La Crosse City Ry. Co. 7 m, 4-8½ g, 28-52 lb girder & flat r, 19 c, of which 17 are box and 2 open, 67 h, 5 mu. Pres. B. E. Edwards, V Pres. W. W. Cargill, Sec. H. E. West, Treas. Geo. H Clark, Supt. (North Division) Peter Valier, Supt (Southern Division), Geo. F. Smith. Capital $200,000 Office, 123 So. Fourth st. 9 2

LA SALLE, ILL.—La Salle & Peru Horse & Dummy R. R. Co. 1¾ m, 3-7½ g, 20 lb T r, 1 4-wheel box c, 3 h. Pres. F. W. Matthiessen, Sec. G. Weerts Capital, $15,000. (Owned by Matthiessen & Hegeler Zinc Co.) 6 2

City Electric Ry. Co. 9¼ m elec, 4-8½ g, 51½ lb s. b. & girder r, 9 c, of which 6 are m. c. and 3 t. c. Edison system. Pres. W. G. Reeve, Sec. F. X. Kilduff, Treas. L. B. Merrifield, Supt. E. S. Enyart. Capital $125,000. 3 2

LAKE CHARLES, LA.—Lake Charles St. Ry Co. 1¾ m, 3-8½ g, 30 lb T r, 4 c, 13 mu. Pres. P Crowley, V. Pres. J. Ryan, Sec. & Gen. Man. W Meyer, Treas. A. Meyer. Capital, $10,000; authorized $50,000. 9 2

LAFAYETTE, IND.—Lafayette St. Ry. Elec 5 m, 4-8½ g, 27-50 lb T r; 8 c, of which 6 are m c and 2 t c, Edison system. Pres. & Treas. I. J. Levering Supt. J. H. Hill. 3 2

LAMPASAS SPRINGS, TEX. — Lampasas Springs St. R. R. Co 3 m, 4-8½ g, 35 lb. T r, 4 c, 16 mu. Pres. R. E. Maddox, Sec. & Treas. W. H. Little Gen. Man. E. P. Maddox, Capital $21,000; authorized, $100,000 Office, Elm st. 1 2

LANCASTER, O.—Lancaster St. R. R. Co. 4.4¾ m, 4-8½ g, 50 lb girder r, 7 c, 18 h. Pres. W. Duffy, V. Pres, J. S. Blackaller Sec. C. F. Nester, Treas. & Man. A. Bauman. Supt. W. De Witt Bauman. Capital $50,000. 6 2

LANCASTER, PA.—Lancaster & Millersville R. R. Co. Elec. 7¼ m, 5-2½ g, 66 lb T r, 16 c, of which 10 are m. c, Pres. J. A. Doyle, V. Pres. M. L Herr, Sec. J. Bowsman, Treas. E. McGovern. Gen Man. & Supt. W. Ring. Capital, $250,000. 10 1

Lancaster City & West End St. Ry. Co. Elec. 14 7-9 m, 5-2½ g, 52, 66 & 72 lb Johnson girder & I r, 20 c 31 motors. Edison and Daft systems. Pres. John A Coyle, V. Pres. M. L. Herr, Sec. J. W. B. Bausman Treas E. McGovern, Supt. Wm. Ring, Cashier, C. E Long. Capital, $385,000. a 7 1

LANSING, MICH.—Lansing City Ry. Co. Elec 6½ m, 4-8½ g. 35 & 45 lb s b & T r, 17 c, of which 11 are 4-wheel box & 6 4-wheel open, & 6 m c, Westinghouse system. Pres. H. L. Hollister, Sec Treas. & Man. M. D. Skinner. Capital $50,000. Office, 1 106 Washington Ave., South Lansing. 1 2

LARCHMONT, N. Y.—Larchmont Horse R. R Co. 1½ m, 4-8½ g, 25 & 38 lb T & girder r, 3 box c, 8 h. Pres. C. H. Murray, V. Pres. E. E. Flint, Sec. & Treas. W. H. Campbell, Larchmont, N. Y. Capital $25,000. 3 2

LAREDO, TEX.—International Bridge & Tramway Co. 5 m, 3-9 g, 20 lb r, 10 c & 10 freight forms 50 mu. & h. Pres. P. Ornelas.

Laredo Electric St. Ry. Co. 4 m, 4 g, 25 lb T r, 6 m c. Edison system. Gen. Man. B. M. Hammond, Supt. C. F. Yaeger. Capital, $373,320; authorized $1,200,000; bonds, $500,000. Office, Salinas & Farragut sts. 6 2

LARNED, KAN.—Larned St. Ry. Co. 1¾ m, 3-6 g, flat r, 2 2-h c, 4 mu. Pres. W. Scott, Sec. G. H. Mize Treas. P. K. Krider, Gen. Man. Ledru Silvey. Office Masonic Temple block. Have taken up track and suspended operations, 2 2

LAWRENCE, KAN.—Lawrence Transportation Co. 5¼ m, 4-1 g, 38 lb Johnson girder r, 9 c, of which 6 are 4-wheel box and 3 4-wheel open, 54 h. Pres & Treas. H. Tisdale. V. Pres. J. W. Parker, Sec. H. B Lawton, Supt. W. McElheny. Capital $35,000. 9 2

LAWRENCE, MASS.—Merrimack Valley St. R R. Co. Elec. 15 m, 4-8½ g, 40, 45, 48 lb T. tram & girder r, 48 c, of which 35 are m c and 13 t c. T-H and Detroit systems. Pres. J. N. Beckley, Sec. & Treas. A E. Butler, Gen. Man. & Supt. N. E. Morton Capital $180,000. Bonds, $350,000. Office, 563 Essex St. 4 2

LEAVENWORTH, KAN.—Leavenworth & Suburban R. R. Co. 5 m, 4-8½ g, 22 lb flat r, 14 c, 15 h 31 mu. Pres., Supt. & Gen. Man. Geo. A. Baker, Sec W. Dill, Treas. G. Burrows. Office 113 Fifth ave. Capital $250,000. 6 2

Leavenworth Rapid Transit Co. 10 m, 4-8½ g, 56 lb T r, 10 c, 5 motors. Gen. Man. L. M. Erb. Controlled by K. C. W. & N. W. Ry. 2 90

LEBANON, MO.—Lebanon Light & Water Co. Elec. ¾ m, 4-8½ g, 48 lb T r, 1 m. c. Westinghouse system. Pres. B. F. Hohart, V. Pres. E. B. Loveland Sec. & Treas. W. P. Heath, Man. I. E. Fulkerson. Capital $100,000. Bonds, $100,000. 9 2

LEBANON, PA.—Lebanon & Annville St. Ry. Co Elec. 11½ m, 5-3 g, 40-50 lb girder & T r, 12 m c, Edison system. Pres. Adolphus Reinoehl, Sec. E. H Brooks, Treas. F. Reinoehl, Supt. W. H. Conrad Capital $100,000. 9 2

LEWISTON, ME.—Lewiston & Auburn Horse R.R. Co. 14 m, 4-8½ g, 42 & 45 lb tram & T r, 20 c, of which 10 are 4-wheel box and 10 4 wheel open, 85 h. Pres. & Gen. Man. Frank W. Dana, Sec. & Treas. H. C. Little. Supt. F. H. Turgeon. Capital $97,800; authorized $100,000. Bonds $85,000. 9 2

LEXINGTON, KY.—Passenger & Belt Ry. Co (Includes Lexington City Ry.) Elec. 13 m, 4-8½ g 50lb T r; 31 c, of which 21 are m c and 10 t c Edison & T-H systems. Pres. C. H. Stoll, V. Pres. W J. Longbridge, Sec. F. V. Bartlett, Treas. R. P. Stoll Supt. R. H. Smith. Capital $1,000,000. Office, Main and Cheapsides ts. 3 2

LEXINGTON, MO.—Lexington & Kansas City Land & Investment Co. 2½ m, 4-4 g, 30 lb r, 2 c, 8 h. Pres. R. G. Estell, V. Pres. W. Z. Hickman, Sec. & Treas. Jas. Wentworth. 6 2

LIMA, O.—The Lima Electric Ry. Co. 4 m, 4-8½ g 40 lb Johnson steel r; 9 c, of which 7 are m c and 2 t c Van Depoele system. Pres. W. R. Kimball, V. Pres & Treas. W. W. Hazzard, Sec. & Supt. W. H. Thompson. Capital paid in $200.000. 3 2

LINCOLN, NEB.—Lincoln St. Ry. Co. Elec. 50 m, 4-8½ g, 40, 56, 70 lb T & girder r, 80 c, of which 40 are m c and 40 t c. T-H generators, Westinghouse and Short motors. Pres. F. W. Little, Sec. W. H. Clark Treas & Gen. Man. C. C. Upham. Capital, $1,200,000; authorized, $2,000,000. Bonds, $600,000. 9 2

Home St. Ry. Co. 11 m, of which 3 are horse and 8 elec, 4-8½ g, 35 lh T and 45 lh girder r, 9 c, of which 6 are m c and 3 t c. Westinghouse system. Pres J. H. McMurtry, V. Pres. & Gen. Man. E. Finney Sec. & Treas. K. K. Hayden. Capital $300,000. Office 133 North 12th t. 9 2

LITTLE ROCK, ARK.—Capital St. Ry. Co. (Leased and operated by City Electric Ry. Co.

The City Electric Ry. Co. (operates Capital St. Ry.) 18.2 m, of which 1 is horse and 17.2 elec. 4-8½ g, 35, 38 & 48 lb T & girder r, 72 c, of which 2 are h c 28 m c and 42 t c, 62 mu. T-H system. Pres. & Gen Man. H. P. Bradford, V. Pres. G. B. Rose, Sec. W. H Sutton. Asst. Gen. Man. W. A. Davis, Jr, Capital $500,000. Bonds, $600,000. 9 2

LOCKPORT, N. Y.—Lockport St. R. R. Co. 3½ m, 4-8½ g, 42 lb s b r, 8 4-wheel box c, 32 h. Pres & Treas. John Hodge, Attor D. M. Ashley, Supt. S A. Seahury. Capital $35,000. a 3 1

LOGANSPORT, IND.—Logansport Ry. Co. Elec 4½ m, 4 g, 40 lb T r, 5 m. c. Edison system. Pres S. Spencer, Sec. & Treas. F. D. Raymond, Gen. Man J. T. McNary. Address care Drexel, Morgan & Co box 3036, N. Y. city. 6 2

LONDON, ONT.—London St. Ry. Co. 10 m, 4-8½ g, 30 lb r, 30 c, 82 h. Pres. V. Cronyn, Sec. Jas. H. Flock, Treas. Chas. Currie, Supt. Henry T. Smith. Capital $100.000. Office, Richmond st. 1 2

LONG ISLAND CITY, N. Y.—Steinway Ry Co. of Long Island City. Elec. 32.25 m, of which 30 are horse and 2.25 elec. 4-8½ g. 47, 66, 70 lb Duplex r 99 c, of which 93 horse and 6 m c, 279 h. Pres. G. A Steinway, V. Pres. H. Ziegler, Sec. L. Von Bernuth, Treas. H. D. Low, Supt. A. D. Moulton. Capital, $2,500,000. Bonds, $600,000. Office, 111 E. 14th st New York. 9 2

Long Island City & Newtown Ry. Co. Elec. 6¾ m, 4-8½ g, 45-55 lb r, 27 c, 7 m c. Edison system. Pres Isaac Buchanan, N. Y. City, Sec. Geo. S. Crawford Brooklyn, N. Y., Treas. Patrick J. Gleason, Sec Thomas Burke, Supt. Michael Conway. Capital $150,000. Offices, 112 Front st. 3 1

Riker Ave. & Sandford's Point R. R. Co. 4 m, 4-8½ g, 47 lb c h r. Operated under lease by Steinway Ry Co. of Long Island City. Pres. J. Hempted, Supt. A. D. Moulton. Capital, $20,000. N. Y Office, Steinway Hall. 9 2

LONGVIEW, TEX.—Longview & Junction St. Ry. 5¼ m, of which 1¼ are horse and 4 cable; 3-6 g 16 lb r, 2 c, 4 mu. Pres. W. S. Mayfield, Sec. & Treas W. D. Stallings, Gen. Man. T. H. Huffman. Capital $4,500. 3 2

LOS ANGELES, CAL.—Pacific Ry. Co. of Chicago, Ill., 42 m, of which 21 are horse & 21 cable, 3-6 & 4-8½ g, 40 lb girder r, 134 c, of which 34 are h. c, 50 g. c. & 50 t. c, 125h. 82 mu. Receiver, J. F. Crank, Supt. J. J. Akin. Capital, $2,500,000. Bonds $2,500,000. Office, 701 Grand ave. 9 2

Los Angeles Consolidated Electric Railway Co. (Includes Depot and Los Angeles Ry. & Vernon St. Ry.) 45 m, of which 10 are horse & 35 elec. 3-6 g, 45 lb girder r, 75 c, 60 h, 30 mu. Westinghouse system. Pres M. H. Sherman, V. Pres. J. M. C. Marble, Sec. F. V McDonald, Gen. Man. E. P. Clark, Supt. A. Barrett Office, Central ave. & 7th st. 3 2

Main St. & Agricultural Park R. R. Co. 9.72 m, 3-6 g, 16 lh. T. r, 31 c, 105 h. Pres. W. J. Brodrick. V Pres. F. E. Rowan, Sec. A. C. Taylor, Treas. Farmers' & Merchants' Bank, Supt. Wm. Hawks, Capital $200,000, Office, 234 N. Main St. 9 2

Temple St. Cable Ry. Co. 4¾ m, 3-6 g, 38 lb Johnson girder r, 10 g. c. Pres. P. Beaudry, V. Pres. O. Morgan, Sec. & Gen. Man. F. W. Wood, Treas. Frank A. Gibson, Supt. J. Fowler. Capital $400,000. Office, 129 Temple St. 2 2

LOUISVILLE, KY.—Louisville Ry. Co (includes all lines in the city). Elec. 135 m, of which 95 are horse and 40 elec, 5 g, 42, 58¾ lb c. b. r, 425 c, of which 269 are h. c, 65 m c and 91 t c, 2011 mu. T-H and Short systems. Pres. J. B. Speed, V. Pres. St. John Boyle, Sec. & Treas. R. A. Watts, Gen. Man. T. J Minary, Supt. B. B. Gilman. Capital, $6,000,000 $5,000,000 common, $1,000,000 preferred. Office, 500 Twelfth st. 6 2

LOWELL, MASS.—Lowell & Suburban Ry. Co Elec. 41 m, 4-8½ g, 35, 40, 45, 50, 60, 90 lb T, girder and tram r, 105 c, of which 53 are m c and 52 t c Bentley Knight, T-H & Westinghouse systems. Pres E. M. Tucke, V. Pres. A. Fels, Sec. & Gen. Man, P. F Sullivan, Treas. P. Parker. Capital, $400,000. Bonds $600,000. 11 2

LYNCHBURG, VA.—Lynchburg St. Ry. Co. Elec. 5½ m, 4-8½ g, 35-42 lb T & tram r, 8 c, of which 6 are box m. c. and 2 open m. c. Eickemeyer overhead system. Pres. Stephen Adams, Sec. P. O. Adams Gen. Man. & Supt. B. Flanagan. Capital $100,000. Office, 807 Main st. h 3 1

Lynchburg Electric Ry. Co. 5 m, 4-8½ g, 45 lb r, 4 m. c. Edison system. Pres. P. J. Otey, Supt. J. A. Humphries. Capital $60,000. 6 2

LYNN, MASS.—Lynn Belt Line St. Ry. Co. Elec 10.42 m, 4-8½ g. 45 lb Johnson girder and T r. 22 m c 2 h. T-H system. Pres. Q. A. Towns, Sec. F. W Jones, Treas. W. B. Littlefield, Supt. T. W. Adams Capital $200,000. Bonds $100,000. Office, 43 Spring st. 6 2

Lynn & Boston R. R. Co. Elec. 55.9175 m, of which 34.9719 are horse and 20.9456 elec., 4-8½ g, 35-70 lh tram, girder & T r, 251 c, of which 233 are horse and 18 m c; 895 h. T-H. system. Pres. Amos F. Breed V. Pres. & Clerk, E. Francis Oliver, Treas. C. Williams. Supt. Elwin C. Foster. Capital, $700,000; authorized, $1,000,000. Bonds $7,000,000. Boston office, 13 Tremont Row. Supt's office, 214 Broadway, Chelsea, Mass. 5 2

LYONS, IA.—Clinton & Lyons Horse Ry. Co. 10 m, 3-8 g, 30-45 lb T & girder r, 24 c, of which 10 are 4-wheel box and 14 are 4-wheel open, 44 h, 16 mu. Pres. & Gen. Man. D. Joyce, Sec. W. T. Joyce, Supt. Frank Crapser. Capital $25,000. f 3 1

M

MACON, GA.—Macon City & Suburban St. R.R. Co. Elec. 15 m, of which 6½ are horse and 8½ elec 4-8½ g, 20 & 30 lh. T r, 28 c, of which 12 are m c and 16 t c; 60 h. T-H. system. Receiver, E. E. Winters Office, 809 Poplar st. 3 2

Central City St. Ry. Co. Elec. 5 m, 4-8½ g, 30 lb T r, 4 motor c. Leased to Macon City & Suburban. 7 0

Metropolitan St. Ry. Co. 5¾ m, 4-8½ g. 40 lb steel T r, 5 m c. T-H system. Pres. E. G. Harris, Sec. W. F. Elder, Treas. & Gen. Man. L. A. Mitchell Capital $100,000, authorized $500,000. 9 2

McKEESPORT, PA.—McKeesport & Reynoldton Pass. Ry. Co. Elec. 8 m, 5-2½ g, 38 & 52 lb Johnson girder r, 13 c, of which 9 are m. c. and 4 t. c. Pres. J. C. Smith, V. Pres. E. P. Dougiass, Sec. W. B. Peters, Treas. E. F. Woods, Supt. L. Richardson. Capital, $125,000; authorized $300,000. Office, 5th ave. & Market st. 6 2

McPHERSON, KAN.—McPherson St. Ry. Co. 4 m, 3-6 g, 20 lb T r, 3 2-h. c., 20 h. Pres. & Man. Wm West, Sec. F. P. Holt. Capital $100,000. 1 2

MADISON, IND.—Madison St. Ry. Co. 2½ m, 4 g, 15 lb tram r, 7 c, 3 h, 13 mu. Pres. & Gen. Man. Jacob Wendel, Sec. E. J. Colgate, Treas. J. W. Thomas. Capital $13,000; authorized $15,000. Office 301 Front st. 9 2

MADISON, WIS.—Madison City Ry. Co. 5½ m, 4 g, 26 & 35 lb T r, 17 c, of which 12 are 4-wheel box & 5 4-wheel open, 6 h, 74 mu. Pres. C. B. Holmes, Sec. & Treas. E. A. Holmes, Supt. Geo. H. Shaw. Office Main & Baldwin sts. 4 1

MALDEN, MASS.—East Middlesex St. Ry. Co. 16.13 m, 4-8½ g, 35 & 40 lb T & tram & Richards r, 58 c, of which 23 are box and 35 open, 204 h. Pres Amos F. Breed, Treas. D H. Sweetser, Supt. Welsey Wentworth. Capital, $300,000. Office, 35 Congress st., Boston. 9 2

MANCHESTER, N. H.—Manchester Street Ry Co. 10 m, 3 g, 35 lb tram r, 34 c, of which 18 are box and 16 open, 151 h. Pres. C. Williams, Treas. C. H. Bartlett. Gen. Man. N. H. Walker. Capital $25,000. 1 2

Massabesic Horse R. R. Co, 6 m. Pres. G. Foster Sec. Geo. I. McAllister, Treas. C. F. Morrill. Capital $100,000. Office, 6 Opera Block. 9 2

MANKATO, MINN.—Mankato St. Ry. Co. 3½ m, 3-6 g, 27 lh steel r, 5 c, of which 3 are m. c, 16 h Pres S. Lamm, Sec. & Treas. John C. Noe, Gen. Man. W M. Farr. Capital, $50,000. Office, 121 Hickory st Mankato. 9 2

MANSFIELD, O.—Citizens' Elec. Ry., Lt. & Power Co. 8 m, 4-8½ g, 45 & 60 lb T & tram r, 12 box m. c. Westinghouse system. Pres. Clark Rude, V Pres. & Treas. R. Carpenter, Sec. S. C. Cummings Capital $80,000; authorized $125,000. Office, Power Station, N. Main st. 8 2

MARINETTE, WIS.—Marinette Gas, Elec. Lt. & St. Ry. Co. 5 m, 4-3½ g, 32, 35, 52 lb T & tram r 12 c, of which 8 are m c & 4 t c. 3 h. T-H system. Pres. & Gen. Man. H. C. Higgins, V. Pres. A. C. Merryman, Sec. G. W. Hanley, Treas. J. T. Hancock Capital $100.000. Bonds $50,000. 9 2

MARION, IND.—Marion St. Ry. Co. Elec. 10½ m, 4-8½ g, 35. 38 lb T and girder r, 11 c, of which 6 are m c and 5 t c. T-H system. Pres. Eli Holderman, V. Pres. J. A. Holderman, Sec. & Treas. C. W. Holderman, Supt. W. C. Whinney. Capital, $80,000. 9 1

MARLBORO, MASS.—Marlboro St. R. R. Co. Elec. 3½ m, 4-8 g, 38 lb Wharton girder r, 8 m c Edison system. Pres. R. Alley, Treas. A. C Weeks, Gen. Man. & Supt. H. E. Bradford. Capital $50,000. Office, 59 Main st. 11 2

MARQUETTE, MICH.—Marquette City & Presque Isle Ry. Co. Elec. 5 m, 4-8½ g, 50 lb Johnson girder r, 5 c, of which 3 are m c & 2 t c. T-H system. Pres. F. O. Clark, Sec. M. E. Asire, Treas. J. Conolly, Supt. J. Donn. Capital $200,000. 10 1

MARSHALLTOWN, IA.—Marshalltown Passenger Ry. Co. 3 m, 4 g, 25 lb T & tram r, 7 c, 21 h. & 2 mu. Pres. C. C. Gilman, Sec. & Gen. Man. A. E. Shorthill, Treas. J. L. Williams. f 7 1

MARTINSBURG, W. VA.—Martinsburg St. Ry. Co. 3 m c. Edison system. 7 2

MARYSVILLE, CAL.—M'ville & Yuba City St R. R. Co. 4 m, 3-6 g, 16 lb T r, 5 c, 4 h, 14 mu. Pres. D E. Knight, V. Pres. S. H. Bradley, Sec. W. T. Ellis, Jr Supt. L. Graves. Capital $40,000. Office, cor. D & 1st sts. 9 2

MAYSVILLE, KY.—Maysville St. R.R. & Transfer Co. Elec. 4 m, 4-8½ g, 40 lb T r, 12 c, of which 5 are m c and 7 t c. Pres. A. M. J. Cochran, Sec Treas. & Gen, Man. R. A. Cochran, Jr., Supt. of lines cars, &c., J. Limbrick. Capital $30,900; authorized $100,000. Bonds $20,000. Office, Court st. 9 2

MECHANICSBURG, ILL. — Mechanicsburg & Buffalo Ry. Co. 7¼ m, 3-10 g, 16 & 20 lb T r, 3 4-wheel opon c, 4 mu. Pres. J. B. Hunter, V. Pres. H. Thompson, Sec. J. T. Fullenwider. Treas. A. T. Thompson Capital, $12,000. b 7 1

MEMPHIS, TENN. Citizens' St. R R. Co. Elec 40 m, of which 10 are horse and 30 elec., 4-8½ g, 40 & 76 lb Johnson girder r, 140 c, of which 80 are h. c. & 60 m. c., 540 mu. Edison system. Pres. C. H. Ruddock, V. Pres. L. E. Wright, Sec. & Man. R. Semmes, Treas. L. R. Godwin. Office, 474 Main st. 10 1

City & Suburban Ry. Co. Elec. 7½ m. 4-8½ g, 45 & 52 lb T & Johnson girder r, 10 c, of which 5 are m c and 5 t c. T-H system. Pres. Holmes Cummings, V Pres. T. J. Latham, Sec. & Treas. J. L. Norton, Gen Man. R. T. Sherrill. Capital stock, $150,000; authorized, $165,000. Office, 56 E Court st. 10 2

East End Ry. Co. 6½ m steam, 4-8½ g, 35-50 lb steel T r, 13 c, 4 steam dummies. Pres. W. M. Sneed V. Pres. B. M. Stratton, Sec J. R. Long, Treas. W. D. Bethel, Gen. Man. & Supt. Geo. H. Bunch. Capital $150,000; bonds $150,000. Office, 310 2nd st. 9 2

Memphis & Raleigh Springs Ry. Co. 11 m, 6 m c. T-H system. 7 2

MENOMINEE, MICH.—Menominee Elec. Ry. & Pow. Co. 6.9 m, 4-8½ g, 40 lb T r, 12 c, of which 8 are m c & 4 t c. Edison system. Pres. A. Spies. V Pres. P. A. Van Bergen, Sec.. Treas. & Gen. Man E. Daniell. Capital, $110,000. Bonds, $500. 9 2

MERIDEN, CONN.—Meriden Horse R. R. Co 7 m, 4-8½ g, 35 & 40 lb T r, 21 c, 90 h. Pres. Geo. R Curtis, Sec. & Treas. Chas. L. Rockwell, Supt. T West. Capital, $80,000. Bonds, $70,000. 5 2

MERIDIAN, MISS.—Meridian St. Ry. Co. 6 m of which 1½ are steam and 4½ horse, 4-8½ g, 25 & 36 lb T & flat r, 10 c, 50 mu. Pres. Geo. S. Covert, Sec J. M. Kelley, Supt. & Gen. Man. J. L. Handley. Capital, $30,000. 3 1

Meridian Dummy Line Ry. Co. 2 m, 4-8½ g, 40 lb T r. 6 c. Pres. W. W. George, V. Pres. C. C. Coffee Sec. H. S. King, Engs. Beard & Brandon. Capital $20,000. 3 1

MERRILL, WIS.—Merrill Ry. & Lighting Co Elec. 1½ m, 4-8½ g, 38 lb Johnson girder r, 3 m c. Pres. F. P. Hixon, V. Pres. R. Werdner, Sec., Treas. & Gen. Man. E. S. King, Capital, $20,000. Bonds, $40,000. Office, 990 Main St. 6 2

MICHIGAN CITY, IND.—Citizens' St. Ry. Co Elec. 3½ m, 4-8½ g, 30 lb r, 4 c, 6 m c, 6 h, 3 mu. Pres. F. Riedie, Sec., Treas. & Man. F. H. Root. Office 216 West Washington st., South Bend, Ind. 7 2

MIDDLETOWN, CONN.—Middletown Horse R. R. Co. 3½ m, 4-8½ g, 36 & 38 lb Johnson & T r, 9 c, of which 7 are 4-wheel box and 2 4-wheel open, 40 h. Pres. John M. Douglas, V. Pres. A. C. Allison Sec. & Treas. J. K. Guy, Gen. Man. & Supt. C. C Atwell. Capital, $23,000; authorized, $50,000. Office 232 Main st. 9 2

MIDDLETOWN, O.—Middletown & Madison St. R.R. Co. 2 m, 4-8½ g,—r, 4 c, 8 h. Pres. C. F. Gunckel, Sec. & Treas. E. W. Gunckel, Supt. D. L. Sutphin 1 2

MILFORD, MASS.—Milford & Hopedale St. Ry. Co. Elec. 6 m, 4-8½ g, 30 & 60 lb tram r, 6 4-wheel box c. Hopedale storage battery system. Pres. & Gen. Man. E. P. Usher, Treas. A. G. Morse. Capital $60,000. Bonds, $60,000. Office, 23 Court st, room 618 9 2

MILLEDGEVILLE, GA.—Milledgeville & Asylum Dummy Line R. R. 4 m, 4 8½ g, 30 lb r, 2 c motors. Pres. W. W. Lumpkin. Capital, $25,000. 1 8 0

MILLERSVILLE, PA.—Lancaster & Millersville St. R.R. Co. (See Lancaster, Pa.)

MILWAUKEE, WIS.—Milwaukee Electric Ry. Co 13 m, 4-8½ g, 45 lb girder r. 23 c, of which 13 are m c and 10 t c. T-H and Edison systems. Pres. J. A. Hinsey, V. Pres. & Treas. C. Pfister, Sec. K. Landsee, Gen. Man. & Supt. G. J. Melms. Capital, $500,000. Office, 387 Milwaukee St. 9 2

Milwaukee St. Ry. Co. (Includes Milwaukee & Whitefish Bay.) Elec. 40 m, of which 18 are horse and 22 elec, 4-8½ g, 70 lb girder r; 130 c, of which 30 are h c and 100 m c, 500 h. T-H and Edison systems. Pres. H. Villard, V. Pres. H. C. Payne, Sec. & Treas. C. A. Spofford, Asst. Sec. G. O. Wheatcroft, Gen. Man. (city division) G. W. Hommell, Man. (Cream City division) A. W. Lynn, Supt. (city division) G. W. Kemmerlein. 3 2

Milwaukee & Wauwatosa Electric Co. 4 m, 4-8½ g, 65 lb girder r, 4 m c. Edison system. Pres. C. Stickney, Sec. & Treas. G. Pabst, Gen. Man. E. D. Hoyt. Capital $75,000. Office 917 Chestnut st. 7 2

West Side St. Ry. Co. Elec. 21 m, of which 2 are horse and 19 elec. 4-8½ g, 63 lb girder r, 55 c, of which 3 are h c, 3 m c and 25 t c. 35 h. Edison system. Pres. Washington Becker, Sec. Thos. J Durnin, Supt. A. McNaughton. 3 2

MINNEAPOLIS, MINN.—Minneapolis St. Ry. Co. Elec. 127 m, 4-8½ g, 45-78 lb r Johnson girder r, 500 c of which 200 are m. c. and 300 t. c. Edison, Short & T-H systems. Pres. Thos. Lowry, V. Pres. & Gen Man. W. J. H'eld, Sec. E. H. Center, Treas. M. B. Koon, Supt. W. J. Hield. Capital, $5,000,000. Office 200 3d ave. N. 11 1

MOBILE, ALA.—Mobile St. Ry. Co. 31 m, of which 24 are horso and 7 steam, 35-68 lb T & girdor r 73 c, of which 65 are 4-wheel box and 8 8-wheel box, 2 h, 270 mu. Pres. W. M. Duncan, V. Pres. Gaylord B. Clark, Sec. & Gen. Man. R. K. Warren, Supt. W. F Tucker. Capital, $500,000. In hands of receivor. 6 2

Mobile Electric Ry. Co. 10 m, 4-8½ g, 45 lb T r, 12 c, of which 6 are m c & 6 t c. Pres. J. Wilson, Sec. & Gen. Man. J. H. Wilson. Capital, $500,000. 10 2

MOHAWK, N. Y.—Mohawk & Ilion Horse R.R. Co. 1¾ m, 4-8½g, 30 lb flat & T r, 4 c, of which 3 are box and 1 open. (Cars towed by contract.) No h. Pres. J. B. Rafter, V. Pres. C. W. Carpenter, Sec. H. D. Alexander, Treas. R. M. Devendorf. Capital, $15,000. 3 2

Herkimer & Mohawk St. Ry. Co. See Herkimer.

MOLINE, ILL.—Davenport & Rock Island Ry. Co. Elec. 39½ m, of which 3 are horse and 36½ elec 4-8½ g, 52 lb girder r, 105 c, of which 10 are h c, 55 m c and 40 t c; 40 h. T-H system. Pres. D. H. Louderback, V. Pres. J. J. Mitchell, Sec. & Treas. J. F Lardner, Supt. H. Schnitger. Capital, $836.000; authorized, $1,500,000; bonds $600,000. Office, 2d & Rock Island sts Davenport, Ia. 6 2

Moline Central St. Ry. Co. Elec. 4 m, 4-8½ g 35, 50 & 57 lb T & Wharton girder r, 4 m. c. & 1 t. c Edison & Westinghouse systems. Pres. & Gen. Man S. H. Velie, V. Pres. L. S. McCabe, Sec. E. H. Guyer Treas. C. F. Hemenway, Supt. W. A. Reed. Capital, $33,000; authorized. $100,000. Bonds, $11,500; authorized, $18,000. Office, 322 16th st. 6 2

MONTGOMERY, ALA.—Montgomery Terminal & St Ry. Co. 10¾ m, 4 g, 30, 42 & 56 lb c b & T r, 22 c, 139 mu, 1 dummy engine. Pres. J. W. Dimmick V. Pres. John D. Roquemore, Sec. J. C. Virden, Treas G. W. Craik, Gen. Man. E. L. Coolahan. Office, Madison ave. & Bainbridge st. 1 2

Montgomery & Cloverdale Electric Ry Co. 7 m 4-8½ g, 45 lb T & 51 lb girder r, 7 m c. T-H system Pres. A. W. Le Bron, V. Pres. & Gen. Man. F. B Pickering, Sec. H. E. Heller, Treas. R. P. Dexter Capital, $350,000. Bonds, $350,000. 11 2

MONTREAL, CAN.—Montreal St. Ry. Co. Elec 59.35 m, of which 47.35 are horse & 12 elec. 4-8½ g, 44 lb r, 200 c, 100 sleighs, 75 'buses, 1200 h. Royal, Edison and Westinghouse systems. Pres. L. J. Forget, V Pres. & Gen. Man. H. A. Everett, Sec. & Treas. E Lusher, Supt. J. J. Franklin. Capital authorized $2,000,000. Bonds, $300,000; authorized, $1,000,000. 11 2

Royal Electric Co. 1 m c. Short system. 5 2

MT. CLEMENS, MICH.—Mt. Clemens St. Ry Co, Ltd. 1⅝ m, 4-8½ g, 35 lb tram r, 3 c, 3 h. Pres. C. W. D Miller, Sec. A. H. Pomeroy, Treas. & Gen. Man. J T. Kelley, Supt. A. W. Bishop. Capital, $10,000 authorized, $25,000. General office, Berea. O. 9 2

MT. VERNON, N. Y.—Mount Vernon & East Chester Ry. Co. 4 m, 4-8½ g, 48 lb c. b. r, 11 c, 34 h Pres. C. Strauss, Sec. W. H. Martens Treas. D. O'Brien, Supt. J. H. Small. Capital, $60,000. Bonds $75,000 6 2

MUNCIE, IND.—Muncie St. Ry. Co. 8 m steam 4-8½ g, 35 lb T r. 14 c, 4 steam motors. Pres. Fred. E Smith (Montpelier, Vt.) V. Pres. J. G. Reed, Sec. C H. Church, Treas. E. Wells. Supt. F. G. Brownell Capital, $150,00. Office, Boyce ave. 9 2

MUSCATINE, IA.—Muscatine City Ry. Co. 3½ m, 3-6 g, 24 lb r, 7 c, 30 h & mu. Pres. Fred Daut, V. Pres. J. Carskaddan, Sec. A. G. Butler, Treas. S. M. Hughes. 4 0

MUSKEGON, MICH.—Muskegon Ry. Co. Elec 15 m, 4-8½ g, 30 lb T & 38 lb girder & T r, 33 c of which 18 are m c & 15 t. c. Short system. Pres. F. A Nims, V. Pres. J. W. Moon, Sec. R. A. Fleming, Treas Wm. B. McLaughlin, Supt. W. Horn. Capital $100,000. Office, 77 W. Western ave. 3 2

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NANTUCKET BEACH, MASS.—Nantucket Beach St. Ry. Co. 2¼ m, 5-8½ g, 35 lb T r, 2 c, 11 h. Pres. H. H. Pratt, Sec. and Treas. J. F. Simmons, Gen. Man. & Supt. T. G. Macy. Capital $30,000. Office, 55 Equitable Bldg, Boston. 9 2

NASHUA, N. H.—Nashua St. Ry. Co. 7 m 3 g, 35 lb T, tram & girder r, 22 c, of which 9 are 4-wheel box and 13 4-wheel open, 80 h. Pres. G. H. Knowles V. Pres. J. A. Fisher, Sec. & Treas. J. D. Chandler Supt. G. E. Mudgett. Office 85 Kinsley st. e 3 1

NASHVILLE, TENN.—United Electric Railway 52 m, 5 g, 35, 45 lb T & girder r, 63 m c. Edison, T-H & Westinghouse systems. Pres. T. W. Wrenne, V. Pres I. T. Rhea, Sec. & Treas. G. W. Cunningham, Gen Man. E. G. Connette. Capital, $1,000,000. 1 2

Citizens' Rapid Transit Co. Elec. 4.47 m, 5 g, 45 lb Johnson & 40 lb T r, 5 m c. Edison system. Pres. W H. Mitchell, Sec. & Treas. Wm. S. Jones, Man. D Deaderick. Capital stock issued, $20,000. Bonds $60,000. 9 2

Nashville, Elec. Lt. & Power Co. 7 m c. Detroit system. 5 2

Nashville & West Nashville St. Ry. Co. Dummy Line, 7 m, 4-8½ g, 46 lb T & Johnson r, 8 c, 4 engines Pres. L. H. Davis, V. Pres. M. S. Cockrill, Sec. J Woods, Jr. Capital $81,000. 6 2

Overland Ry. Co. Elec. and steam 9¼ m, 4-8½ g, 45 lb Johnson steel r, 19 c, of which 12 are steam 5 m c, and 2 t. c. T-H. system. Pres. F. W. Hunter, V. Pres. H. B. Stubblefield, Sec. & Treas. J. L. Stubblefield, Supt. T. R. Donahue. Capital, $100,000. Bonds $143,000. 3 2

NATCHEZ, MISS.—Natchez St. Ry. Co. 5 m 4-8½ g, 25-52 lb girder, flat & T r, 7 c, 20 mu. Pres & Supt. Maurice Moses, Sec. & Treas. A. Moses. Capital, $25,000; authorized, $100,000. Office Natchez Savings Bank. Main & Pearl sts. 9 2

Bluff City Ry. Co. 2 m, of which 800 ft. is incline plane, 6-2 g, incline 3-6 g, remainder 24 c, 1 h, 4 mu Pres. S. E. Rumble, V. Pres. A. C. Britton, Sec. T. V Wensel, Gen. Man. & Supt. F. L. Rumble. Capital $100,000. Office, Main and Broadway. 6 2

NATICK, MASS.—Natick & Cochituato St. Ry. 3 m, 4-8½ g, 35 lb T & flat r, 8 c, of which 5 are 4 wheel box and 3 4-wheel open, 25 h. Pres. Harrison Harwood, Clerk Frank H. Hayes, Supt. Geo. F. Keep Treas. W. H. Bent. Capital, $25,000. 1 2

Natick Electric St. Ry. Co. 4 m, 4-8½ g, 45 lb T r 4 m c. T-H & Short systems. Pres. A. C. Pond, Treas. T. T. Robinson, Supt. H. W. True. Capital $6,000; authorized, 360 000. 6 2

NEBRASKA CITY, NEB.—Nebraska City St Ry. Co. 3½ m, 4-8½ g, 20, 40 & 45 lb Johnson & T r 4 c, 10 h, 16 mu. Pres. & Gen. Man. H. H. Bartling, V. Pres. W. A. Cotton, Sec. J. C. Watson, Treas. W. L. Wilson. Capital, $17,500; authorized $50,000. 3 2

NEENAH, WIS.—Menasha & Neenah St. Ry. Co. 10 m, 4 8½ g, 35 lb tram r, 4 c, 12 h. Pres. L. Clark, Sec. C. Briggs, Treas. R. F. Knott, Gen. Man. & Supt. O. L. Hine. 8 2

NEW ALBANY, IND.—New Albany Ry. Co. 7 m, 4-10½ g, 25 lb T r, 30 c, of which 23 are box & 7 open, 82 mu. Pres. J. F. Gebhart, Sec. & Treas. W. C Crane, Supt. Geo. Hines. Capital, $30,000. Bonds $150,000. a 3 1

Highland R.R. Co. 2 m, 3 m c. Edison system. 7 2

NEW BEDFORD, MASS.—Union St. Ry. Co Elec. 16½ m, of which 3.8 are elec. and 12.7 horse 4-8½ g, 38, 50 lb tram & girder r, 74 c, of which 61 are h c, 8 m c and 5 t c, 236 h. T-H system. Pres. & Gen Man. J. Irvine. Sec. W. H. Allen. Treas. E. S. Brown Supt. A. P. Smith. Capital $260,000. Bonds, $100,000 Office, 55 Weld st. 11 2

NEW BRITAIN, CONN.—New Britain Tramway Co. 5½ m, 4-8½ g, 35 & 40 lb T r, 9 c, 53 h. Pres. P C. Dolan, Sec. & Treas. P. H. Dolan. 10 1

NEW BRUNSWICK, N. J.—New Brunswick City Ry. Co. 4¼ m, 4-8½ g, 43 lb c. b. & girder r, 12 c, 23 h. Pres. H. Congar. V. Pres. A. Le Massena, Sec & Treas. W. B. Price, Supt. W. F. Price. Capital $100,000. Bonds, $25,000. Office, Sanford st. 3 2

NEW CASTLE, PA.—New Castle Electric St. Ry. Co. 2¼ m. 4-8½ g, 45 lb girder r, 4 m c. T-H & Westinghouse systems. Pres. T. W. Phillips, V Pres. Gen. Man. & Supt. Wm. M. Brown, Sec. & Treas. S. S. Hamilton. Capital stock, $35,000; authorized, $40,000. 1 2

NEW DECATUR, ALA.—Decatur St. Ry. Co. 5 m, 4-8½ g. 20 lb. T r, 5 4-wheel box c, 32 mu. Pres W. W. Hedges, V. Pres A. C. Hartshorne, Sec., Treas & Gen. Man. W. A. Bibb. Capital, $100,000. 9 2

NEW HAVEN, CONN.—Fair Haven & Westville R. R. Co. 11 m, 4-8½ g, 50 lb T & c b r, 50c, 300 h Pres. H. B. Ives, Sec. & Treas. L. Candee, Supt Walter A. Graham. Capital, $400,000. Office 730 Chapel st. 10 1

Morris Cove Electric Ry Co.

New Haven & Centreville Horse R.R. Co. 2¾ m, 4-8½ g, 46 lb c b r, 9 c, 62 h. Pres. & Gen. Man. C Pierpont, Supt. T. R. Hull. Capital $31,000. Authorized $40,000. Office, 1 Broadway. 3 2

New Haven & West Haven Horse R. R. Co. (operate Winchester Ave. R.R.) Elec 12¾ m, 4-8½ g, 56-60 lb steel T r, 51 c, of which 25 are m c and 25 t c. Westinghouse & Short systems. Pres. A. C. Pond. V Pres. & Gen. Man. I. A. Kelsey, Sec. & Treas. S. A Stevens. Supt. W. W. Ward. Capital, $100,000. Bonds $50,000 6 2

State Street Horse R.R. Co. (Includes Whitney Avenue.) 6 m, 4-8½ g, 42-50 lb T & c b r. 18 c, 86 h Pres. S. R. Blatchley, V-Pres. C. A. Warren, Sec. & Treas. J E. Emery, Supt. Geo. Wells. Office, 16 Exchange Bldg. 3 2

Whitney Avenue Ry. Co. Leased to State St. Horse R. R. Co.

Winchester Ave. R. R. Co., 1.6 m, 4-8½ g, 50 lb T r 2 c, 16 h. Pres. I. A. Kelsey, Sec. S. A. Stevens Capital, $40,000. Leased to New Haven & West Haven Horse R.R. Co. 6 2

NEW ORLEANS, LA.—Canal & Claiborne R. R. Co. 13½ m, 5-2½ g, 37 45 & 50 lb tram & girder r, 40 box c, 200 mu. Pres. E. J. Hart, Sec. & Supt. Jos. H DeGrange. Capital, $240,000. Bonds $150,000. Office 6 Camp st. 9 2.

Algiers & Gretna Ry. Co 3¾ m, 3 g, 30 lb T r, 4 c, 19 h. Pres. J. E. Auvray, Sec. Wm. Bogel, Supt. John Reaney. Office, 382 St. Charles st. b 10 0

Crescent City R. R. Co. 26 m. 5-2½ g, 35-47 lb c. b. & T r, 80 c, 47 h. 413 mu. Pres. W. J. Behan Sec. & Treas J. R. Juden, Supt. A. V. Smith. Capital $1,150,000. Authorized $2,000,000. Bonds $140,000 9 2

New Orleans & Carrollton R.R. Co. 17 m, 4-8½ g, 30-45 lb T & flat r, 60 c, 65 h, 250 mu. Pres. Jos. Hernandez. Sec. & Treas. Walter V. Crouch, Gen. Man. & Supt. Chris. V. Haile Capital $800,000. Bonds $300,000. Office, 17 Baronne St. 3 2

New Orleans City & Lake R.R. Co. 66 m, 5-2½ g, 40 & 46 lb flat & T r, 150 c, 36 coaches, 7 locomotives, 900 mu. Pres. J. A. Walker, Sec. C. W Bredow, Supt. F. Wintz. Capital, $1,500,000. Office 102 Canal st. 9 2

Orleans R. R. Co. 9½ m, 5 g, 35-40 lb T r, 32 c, 125 h, 30 mu Pres. & Supt. B. Beoubay. Sec. & Treas P. Cougot. Capital $185,000. Authorized $500,000 Bonds $21,000. Office, cor. White & Laharpe sts 10 1

St. Charles St. R. R. Co. Operates 3 lines. 11¼ m 5-2½ g, 40 lb s b r, 66 4-wheel box c, 260 mu. Pres. & Supt. Alden McLellan, Sec. N. Riviere. Capital, $594-350. Authorized $600,000. Bonds $135,000. Office, cor. Carondelet & 8th sts. 9 2

NEW ROCHELLE, N. Y.—New Rochelle Ry. & Transit Co. 8 m, 4-8½ g, 38 lb Johnson r, 14 c. of which 10 are 4-wheel box & 4 4-wheel open, 40 h Pres. Thos. E. Crimmins, Sec. & Treas. C. Strauss Supt. Frank Ryan. 3 2

NEW WESTMINSTER, B. C.—New Westminster & Vancouver Tramway Co. 15 m, 4-8½ g, 40 lb T r, 10 m c. Edison system. Pres. D. Oppenheimer Supt. J. F. Davis. 9 2

NEW WHATCOM, WASH.—Bellingham Bay Electric Ry. Co. 3½ m, 4-8½ g, flat r, 6 c, of which 4 are m. c. and 2 t. c. Pres. J. H. Steuger, Sec. C. W. Dorr, Treas. J. W. Morgan. Capital $200,000. 3 2

Lake Whatcom Electric Ry. Co. 8 m. c. T-H system. 1 2

NEW YORK, N.Y.—Broadway & Seventh Ave. R.R. Co. (Leased to Houston St., West St. & Pavonia Ferry R.R. Co.) 23 m, 4-8½ g, 47-60 lb r, 227 4-wheel box c, 1,900 h. Pres. Henry Thompson, Sec. & Treas Thos. F. Ryan, Supt. Henry A. Newell, Engr. G. W. McNulty. Capital. $2,150,000. Bonds, $2,125,000. Gen Office, 761 7th Ave. Engineer's Office, 113 W. 38th st 7 2

Central Crosstown R. R. Co. (Includes Christopher & Tenth St.) 11.7 m, 4-8½ g, 52 lb r, 157 box c, 846 h Pres. Geo. S. Hart, V. Pres. A. Cammack, Sec. Milton I. Masson, Treas. E. Burton Hart. Office, 170 Christopher st. Capital, $600,000. Bonds, $250,000. 7 2

Central Park, North & East River R.R. Co. 26 m, 4-8½ g. 60 lb r, 196 c, of which 136 are box and 60 open, 1,157 h. Pres. G. H. Scribner, V. Pres. C. D Wyman, Sec. & Treas. J. L. Valentine, Supt. J. H Oakley. Office, 789 Tenth Ave. Capital $1,800,000 Bonds, $1,200,000. 7 2

Christopher & Tenth St. R. R. Co. Pres. J. Downey V. Pres. I. Hendrix, Treas. Geo. W. Linch. (Leased to and operated by Central Crosstown R. R. Co.) 2 2

Dry Dock, East Broadway & Battery R.R. Co. 18½ m, 4-8½ g, 60 lb c b r, 181 c, of which 173 are box and 8 open, 943 h. Pres. William White, Sec. & Treas. Richard Kelly, Auditor E. T. Landon, Supt. Fred F. White. Capital, $1,200,000. Bonds, $840,000 Office, 605 Grand st. 7 2

Eighth Ave. R.R. Co. 20 m, 4-8½ g, 60 lb r, 165 c of which 125 are box and 40 open, 1155 h. Pres. Geo. Law, V. Pres. Jacob Hays, Sec. & Treas. James Affleck, Supt. E. R. Sherman. Capital $1,000,000. Bonds $1,000,000. Office, Eighth Ave. & 50th st. 6 2

Forty-second Street & Grand Street Ferry R.R. Co. 10.25 m, 4-8½ g, 60 to 64 lb r, 72 c, of which 52 are box and 20 open. 480 h. Pres. J. M. Calhoun, Sec. Chas. P. Emmons, Treas. R. J. Jacobs. Capital $748,000; authorized, $750,000. Bonds, $236,000. Office 653 W. 42d st. 7 2

Forty-second St., Manhattanville & St. Nicholas Avenue Ry. Co. 19.82 m, 4-8½ g, 47-60 lb r, 91 c, 838 h. Pres. John S. Foster, Sec. C. F. Naething, Treas Jacob Fleischhauer, Supt. S. M. Sisson. Capital $2,500,000. Bonds, $2,725,000. Office, 118 E. 42 st. 7 2

Houston St, West St. & Pavonia Ferry R.R. Co (includes Chambers St. & Grand St. Ferry and Metropolitan Crosstown; also operates Broadway & 7th Ave., Sixth Ave. R.R. and Ninth Ave. R.R.) 13 m owned, 23 m leased, 4-8½ g, 60 lb c b r. 45 box c, 370 h. Pres. J. D. Crimmins, V. Pres. H. Thompson, Sec T. F. Ryan, Treas. Daniel B. Hasbrouck, Gen. Man T. H. McLean. Capital, $1,050,000. Bonds $500,000. Office 415 E. 10th st. 7 2

Jerome Park R. R. 1 2-3 m, 4-8½ g, 56 lb r. Pres. W. A. Duer, Sec. Fred A. Lovecraft, Treas. Theodore Moss. Service furnished by N. Y. C. & H. R. R. R. Office, 115 Broadway. 6 2

Metropolitan Traction Co. (controls Broadway & Seventh Avenue, Houston Street, West Street & Pavonia Ferry, Ninth Avenue, Sixth Avenue, Central Park, North & East River, and Twenty-third Street railways, which, with exception of latter are operated by the Houston St., West St. & Pavonia Ferry R. R. Co.) Pres. Henry Thompson, Sec. & Treas Thos. F. Ryan. Capital $30,000, 000. 9 2

New York & Harlem R.R. Co. 17¾ m, 4-8½ g, 47, 60 75 lb r, 185 box c, 1,600 h. Pres. C. Vanderbilt, V. Pres C. C. Clarke, Sec. & Treas. Ed. V. W. Rossiter, Supt Alfred Skitt, Pur. Agt. A. Bourne. Capital. $10,000,-000. Bonds, $12,000,000. Office, Grand Central Depot 7 2

Ninth Ave. R. R. Co. 16 m, 4-8½ g, 45 & 60 lb T r, 60 c, of which 40 are 4-wheel box and 20 4-wheel open, 542 h. Pres. Geo. Law, V. Pres. Jacob Hays, Sec. & Treas. J. Affleck. Capital $800,000. No bonds. Offices 814 Ninth Ave. (Leased to Houston St., West St. & Pavonia Ferry. R. R. Co) 7 2

North & East River R. R. Co. 3 m, 4-8½ g. 45 lb s-b r, 12 c, 75 h. Pres. O. M. Child, V. Pres. E. T McLaughlin, Sec. F. C. Gaffney, Treas. T. F. Carney Supt. W. Farrell. Capital, $300,000. Bonds, $125,000 Office, Front St. near Fulton St. 7 2

Second Ave. R.R. Co. 23 m. 4-8½ g, 60 lb r, 337 c, of which 169 are box and 168 open, 1938 h. Pres. G. S. Hart, Sec. J. B. Underhill, Treas. H. E. Doremus. Capital $1,860,000, authorized $2,500,000. Bonds $1,750,000. Office Second ave. cor. 96th st. 6 2

Sixth Ave. R.R. Co. 9⅞ n, 4-8½ g, 60 lb r, 122 c, of which 102 are box and 20 open, 925 h. Pres. Frank Curtiss. Sec. & Supt. E. H. Garrison. Capital $1,500,000 Bonds $500,000. Office 758 6th ave. (Leased to Houston St., West Street & Pavonia Ferry R. R. Co.) 7 2

Third Ave. R. R. Co. 28¾ m, of which 11½ are cable and 16⅞ horse, 4-8½ g, 60 lb r 401 c, of which 336 are h c & 65 g c; 1750 h. Pres. A. J. Elias, V. Pres Henry Hart, Sec. Alfred Lazarus, 136 W. 61st st Treas. J. Beaver, 310 E. 124th st.; Supt. John H Robertson, 158 E. 66th st.; Mech. Engr. of 10th ave. and 125th st. C. G. Bliss, Chief Engr. of Construction A. H. Lighthall. Capital, $4,000,000; authorized, $5,000,000; Bonds, $5,000,000. Office, 65th St. & Third ave. 9 2

Twenty-third St. Ry. Co. 14¾ m, 4-8½ g, 50 lb c b & tram r, 101 c, 975 h. Pres. W. L. Elkins, Philadelphia V. Pres. P. A. B. Widener, Philadelphia, Sec. & Gen Man. Thos. H. McLean, Treas. C. E. Warren. Capital $600.000. Bonds, $400,000; Broadway Surface Bonds $375,000. Office. 621 West 23d st. 7 2

Twenty-eighth & Twenty-ninth sts. R. R. Co. 9.13 m, 4-8½ g, 60 lb. steel grooved r, 40 c. Pres. J. H Crane, V. Pres. D. D. Conover,, Sec. D. J. Apgar Capital $500,000. Bonds, $500,000. Office, 45 William st. 7 2

Union Ry. Co. Elec. 18 m, of which 3 are horse and 15 elec. 4-8½ g, 78 lb girder r, 109 c, of which 49 are h c and 60 m c, 300 h. T-H system. Pres. & Gen. Man. E, A. Mahar, V. Pres. C. A. Stadler, Sec. & Treas. T. W. Alcott, Supt. J. Carrigan. Capital, $1,000,000; authorized, $2,000,000. Bonds, $1,000,000. Office 2389 3d ave. 7 2

NEWARK, N. J.—New Jersey Transit Co. (Includes Newark Passenger Ry. and Rapid Transit Ry.) 75 m. 5-2½ g, 50, 57 & 60 lb tram & girder r, 277 c, of which 200 are h. c. and 77 m. c, 300 h, T-H and Edison systems. Pres. Thos. C. Barr, V. Pres. J. J Waterbury, Sec. T. H. Wentworth. Treas. E. N. Hill Supt. J. N. Akarman. Office, Prudential Building 9 2

Newark & S. Orange, St. Ry. Co. Elec. 13 m, 5-2½ g, 90 lb girder r, 30 m. c. Westinghouse system Pres. E. S. Ward, V. Pres. G. Kreuger, Sec. & Treas W. Scheerer, Gen. Man. & Supt. A. Radel. Capital $1,500.000. Bonds, $1,500,000. Office S. Orange Ave and S. 19th st. 8 2

NEWARK, O.—Newark & Granville Elec. St. Ry. Co. (Includes Newark City Ry.) 13 m, 4-8½ g, 30-51½ lb T & girder r, 22c, of which 10 are m c & 12 t c. T-H and Edison systems. Pres. R. Scheidler, V. Pres. J. A. Flory, Sec. & Gen. Man. W. C. Christian, Treas. F. A. Crane, Supt. H. R. Scheidler. Capital, $72,000. Authorized $100,000. Bonds $120,-000. 3 2

NEWBURGH, N.Y.—Newburgh St. Ry. Co. 5 m 4-8½ g, 40 lb T r, 13 c, of which 11 are box and 2 open 72 h. Pres. M. H. Hirschberg, V Pres. J. C. Adams Sec. & Treas. Wm. Moores. Gen. Man. & Supt. W P. Rayland. Office, 246 Broadway. 6 2

NEWBURYPORT, MASS.—Newburyport & Amesbury St. R. R. Co. Elec. 19.584 m, 4-8½ g, 35 & 40 lb T r, 37 c of which 20 are m c and 17 t c, 6 h T-H system. Pres. Chas. Odell. Sec. & Treas. J. H. Crandell, Supt. C. F. Dennis. Capital, $80,000. Bonds $350,000. Office, 32 Market sq. 9 2

NEWPORT, KY.—Cincinnati, Newport & Covington Ry. Co., Newport Division. (See Covington, Ky.)

NEWPORT, R. I.—Newport St. Ry. Co. Elec 4.4 m, 4-8½ g, 45 lb T r, 15 c, of which 9 are m c and 6 t c, T-H system. Pres. A. C. Titus, Sec. & Treas Francis Burdick, Supt. F. E. Johnston. Capital stock $100,000. Office, Spring & Franklin sts. 9 2

NEWTON, KAN.—Newton City St. Ry. Co. 6 m 3 g, 20 lb T r, 6 c, 24 h. Pres. Allen Moore, V. Pres J. M. Ragsdale, Sec. & Treas. W. G. Oldfield. Capital $60,000. Not being operated. 9 2

NEWTONVILLE, MASS.—Newton & Boston St Ry. Co. Elec. 3¾ m, 4-8½ g, 56 lb T r, 10 m. c. T-H system. Pres. & Gen. Man. H. B. Parker, Treas. J. L Richards. Supt. F. C. L. Henderson. Capital $50,000 9 2

NIAGARA FALLS, N. Y.—Niagara Falls & Suspension Bridge Ry. Co. Elec. 10 m, 4-8½ g, 62 lb girder r, 20 c, of which 10 are m c and 10 t c. T-H system. Pres. & Gen. Man. C B. Gaskill, V. Pres. H L. Taylor, Sec. & Treas, Chas. B. Hill, Supt. J. C Brewster. Capital $250,000. Bonds, $56,000. 6 2

NIAGARA FALLS, CAN.—Niagara Falls, Wesley Park & Clifton Tramway Co. 4 m, 4-8½ g, 30 & 45 lb T r, 10 c. of which 8 are 4-wheel box & 2 4-wheel open, 40 h. Pres. J. H. Mooney, Treas. John N. Hayward, Supt. C. Black. Capital $50,000. 3 2

NORFOLK, NEB.—Norfolk St. Ry. Co. 2½ m 4-6 g, 16 lb T r, 4 4-wheel box, 10 h. and 4 mu. Pres R. A. Stewart, V. Pres. Dr. A. Bear, Sec. N. A. Rainbolt, Treas. C. B. Burrows. Supt. F. H. Foye, Capital, $51,000. Office, 400 Main st. 9 2

Norfolk St. Ry. Cons. Co., 2 m., 1 m. c. Edison system. 7 2

NORFOLK, VA.—Norfolk City R. R. Co. 6 m 5-2 g, 45, 50, 65 lb tram, girder & s b r, 32 c, 120 h. Pres. W. H. Taylor, Sec. & Treas. H. C. Whitehead Supt. Jas. J. Ferris. Capital, $100,000; Bonds, $125-000. Office, 125 Main st. 9 2

The Suburban & City Ry. & Improv't Co. 3½ m, 5-2 g, 40 lb s. b. r, 15 c, of which 9 are 4-wheel box & 6 4-wheel open, 59 h. Pres. Jas. W. McCarrick, Sec. & Treas. H. C. Whitehead, Supt. E. W. Savage. Capital $50,000. Bonds $75,000. Office, 125 Main st. 9 2

NORRISTOWN, PA.—Citizens' Pass. Ry. Co. 3¾ m 5-2½ g, 52 lb tram r, 10 4-wheel box c, 43 h. Pres. John Stingluff, V. Pres. W. H. Bodey, Sec. Geo. R. Kite, Treas. G. Shannon, Supt. Charles Naylor. Capital, $50,000; authorized $80,000. 3 2

Norristown Pass. Ry. Co. 4 m, 5-2½ g, 45 & 50 lb tram & girder r, 9 c, of which 8 are 4-wheel box and 1 4-wheel open, 28 h. 6 mu. Pres. H. M. Lutz, V. Pres W. R. Pechin, Sec. N. R. Haines, Treas. J. C. Smith Supt. Louis Heck. Capital, $45,000. 7 1

NORTH ADAMS, MASS.—Hoosac Valley St. Ry Co. Elec. 6 m, 4-8½ g, 40 lb. T & flat r 11 c, of which 7 are 4-wheel box, 4 4-wheel open & 5 m c. T-H system. Pres. C. Q Richmond. Gen. Man. A Fitzsimons. Capital $50,000. 1 2

NORTHAMPTON, MASS.—Northampton St Ry. Co. 3½ m, 4 8½ g, 35 lb T and tram r, 11 c, 66 h Pres. J. C Hammond, Clerk J. A. Sullivan, Treas. & Supt. E. C. Clark. Capital $50,000; bonds $25,000. 3 2

NORWALK, CONN.—Norwalk Horse R. R. Co 3½ m, 4-10 g, 56 lb T r, 8 c, 43 h. Pres, James W. Hyatt, Sec. F. T. Brady, Supt. Edwin G. Hoyt. Capital $50,000 6 2

NORWICH, CONN.—Norwich St. Ry. Co. 11 m, 4-8½ g, 35, 45, 50 lb T r, 32 c, of which 22 are h c and 10 m c, 90 h. Short system. Pres. C. P. Cogswell, Sec., Treas., Gen. Man. & Supt. E. P. Shaw, Jr. Capital $60,000. Bonds, $100,000. 6 2

O

OAKLAND, CAL.—Broadway, Berkeley & Piedmont R.R. Co. 9 m, 5 g, 40 lb r, 24 c, 100 h. Pres. W. B. Morse, Sec. S. Howe, Supt. & Treas. M. Howe, Office, 522 Fourteenth st 1 5

Central Avenue Ry. Co. Elec. 5½ m, 4-8 g, 45 lb Johnson girder, 12 m c, T-H system. Pres. Edw Pollitz, Sec. H. J. Lask. Capital, $1,000,000. 4 1

Consolidated Piedmont Cable Co. Elec. 24 m, of which 6 are horse, 13 cable and 5 elec. 3-6 & 5 g, 25 & 40 lb girder r, 52 c, of which 17 are h. c., 25 g. c, 5 m c and 5 t c, 120 h. Pres. E. A. Heron, V. Pres. E. W. Playter, Gen. Man. & Supt. H. P. Garthwaite. Capital, $1,500,000; authorized, $2,000,000. Bonds, $600,000. 6 2

Highland Park & Fruit Vale R. R. 10 m, 4-8½ g 45 lb girder & T r, 9 c, 30 h. Pres. E. C. Sessions, Sec F. J. Woodward. Capital, $500,000. 2 2

Oakland Consolidated St. Ry. Co. Elec. 30 m. 3-6 g, 40 lb combn. steel r, 26 c, of which 24 are m. c. and 2 t. c. Edison & T-H systems. Pres. G. W. McNear V Pres. J. E. McElrath, Sec. C. S. Houghton, Treas 1st Nat. Bank, Supt. D. Rutherford. Capital. $200,000 Bonds, $250,000. Office 47th st & Grove. P. O. Box 126. 9 2

Oakland, Brooklyn & Fruit Vale R. R. Co. 2 1-5 m 5 g, 35 lb flat r, 6 c, 53 h. Owners P. I. Co. Supt. Geo Y. Loring. Office, 4th & Townsend sts. 4 0

Oakland Cable Ry. Co. 5 1-5 m, 4 g, 40 lb, Iron r 12 c. Owners P. I. Co. Supt. Geo. Y. Loring. Office 4th & Townsend sts. 4 0

Oakland R. R. Co. Elec. 16 m, 3 g, 60 lb T r, 18 m c. T-H system. Owners P. I. Co., Supt. Geo. Y. Loring. Office, 4th & Townsend sts. 4 0

Oakland, San Leandro & Haywards Ry, Co. Elec 16 m, 3-6 g, 35, 40 girder & T r, 25 m. c. T-H system Pres. H. W. Meek, V. Pres. W. J. Landers, Sec. A. L Stone, Treas, C. E. Palmer. Supt. F. M. Leland Capital, $500,000. Bonds, $250,000. Office, 908 Broadway. 9 2

OGDEN CITY, UTAH.—Ogden City St. Ry. Co. Elec. 10 m, 4-8½ g, 30 lb T r, 20 c, of which 12 are m.c and 8 t. c. Pres. H. M. Beardsley, V. Pres. H. M Jarvis, Sec. & Supt. R. M. Spivey, Treas. S. L. Conklin. Capital, $350,000. 9 2

OGDENSBURG, N.Y.—Ogdensburg St. Ry. Co. 5m 4-8½ g, 25 lb. T r, 7 c of which 5 are box and 2 open, 2 sleighs 24 h. Pres. W. H. Daniels, Sec. E. A. Newell Treas. A. E. Smith. Gen. Man. H. B. Howard, Supt. H. Hickock. Capital $30,000. 6 2

OLEAN, N. Y.—Olean St. Ry. Co. 2.45 m. 3-6 & 4-8½ g, 25-50 lb T r, 4 box c, 14 h. Pres. & Supt. John Fobes, V. Pres. C. S. Carey, Sec. & Treas. G. H. Strong. Capital, $16,000. Office, 264 Union st. 6 2

OLYMPIA, WASH.—Olympia Light & Power Co. Elec. 4 m, 4-8½ g, 40 lb T r, 5 m c. T-H system. Pres. E. T. Young, V. Pres. R. Frost, Sec. & Gen. Man. A. H. Chambers, Treas. G. D. Shannon, Supt. C. McClelland. Capital, $250,000. 7 2

West Side Ry. Co. 2 m c. Edison system. 7 2

OMAHA, NEB.—Omaha St. Ry. Co. Elec. 84½ m, of which 9½ are cable 55 electric and 20 horse railroad, 4-8½ g, 35, 45, 58½ lb T & girder r, 236 c of which 77 are m c, 22 g c and 137 t c and h c. Edison and T-H systems, 150 h. Pres. Frank Murphy, V Pres. Guy C. Barton, Sec. D. H. Goodrich, Treas. W W. Marsh, Gen. Man. W. A. Smith, Supt. F. A Tucker. Capital, $5,000,000. Bonds, $2,150,000. 6 2

Omaha & Council Bluffs Ry. & Bridge Co. Elec High steel bridge spans the Missouri river. 20 m 4-8½ g, 40, 45 & 56 lb girder & T r. 56 c, of which 36 are m c & 20 t c. T-H & Edison systems. Pres John T. Stewart, V. Pres. G. C. Barton, Sec. Geo. F Wright, Treas. J. H. Millard, Supt. A. K. Stone. 1 2

Patrick Land Co. Elec. 2 m. c. Detroit System 8 2

ONEIDA VILLAGE, N. Y.—Oneida Ry. Co. 3 m 4-8½ g, 47 lb c b r, 3 box c, 9 h. Pres. A. E Northrup, Sec., Treas. & Gen. Man. H. C. Stone. Supt. G. Leggett. Capital $15,000. 6 2

ONEONTA, N. Y.—Oneonta St. R. R. Co. 2¾ m 4-8½ g, 35 & 38 lb T & flat r, 4 c of which 3 are 4-wheel box and 1, 4-wheel open, 12 h. Pres. & Supt. Geo. I. Wilber, V. Pres. D. F. Wilber, Sec. & Treas. T. D Tallmadge, jr. Capital $20,000. a 3 2

ONTARIO, CAL.—Ontario & San Antonio Heights Ry. Co. 8½ m, 4-8½ g, 30 lb T r, 24-wheel open c 4 h. Pres. C. E. Harwood, V. Pres. & Gen. Man C. Frankish, Sec. W. E. Collins. Capital $150,000. 7 2

ORANGE, N. J.—Orange Crosstown and Bloomfield St. Ry. Co. 7 m, 5-2 g, 38 lb Johnson girder rail, 13 box c, 86 h. Pres. & Gen. Man. Francis M Eppley, Sec. Thos. Marsh, Treas. Edw. A. Pearson Supt. J. Waller. Capital stock, $60,000; bonds, $60,000 h 4 1

ORANGEBURG, S. C.—Orangeburg St. Ry. Co. 2½ m, 4-9 g, 40 lb. T r, 6 c, 4 h, 6 mu. Pres. & Gen. Man J. W. H. Dukes, V Pres. N. H. Bull, Sec. & Treas. B H. Moss. Capital, $11,000. 1 2

ORLANDO, FLA.—Orlando St. Ry. 3 m, 4-9 g, 30 lb T r, 3 c, 10 mu. Pres. & Gen. Man. N. L. Mills, V. Pres. R. E. Green. Capital $10,000; authorized $50,000. 10 1

OSHKOSH, WIS.—Oshkosh St. R. R. Co. 8¼ m. 4-8½ g, 30 lb, tram r, 13 c, of which 10 are 4 wheel box & 3 4-wheel open, 57 h. Pres. Chas. Barber, V. Pres. J. H. Porter, Sec. & Treas J. H. Jenkins, Gen. Man. & Supt. C. E. Montgomery. Office, 222 Main st. 9 2

OSKALOOSA, IA.—Oskaloosa St. Ry. & Land Co 5 m. 4 g, 16-40 lb T r, 4 4-wheel box c, 20 h. Pres. W M. Peatman, Sec. & Supt. C. Winter. Treas. W. G. Clark. Capital, $30,000. Office, 213 High Ave., West. 3 2

OSWEGO, N. Y.—Oswego St. Ry. Co. Elec. 7 m, 4-8½g, 51-72 lb T & girder r, 12 c, of which 7 are m c and 5 t c. T-H system. Pres. M. E. Graves, V. Pres M. B. Richardson, Sec. J. P. Phelps. Treas. & Man E. A. Van Horn. Capital, $125,000. Office, East First & Bridge sts. 9 2

OTTAWA, ILL.—Ottawa Electric St. Ry. 8 m 4-8½ g, 56 lb girder r, 8 motor and 4 trail c, T-H system. Pres. T. J. Evans, Sec. & Treas. T. P. Bailey Gen. Man. H. A. Kin. Capital, $100,000. 6 2

OTTAWA, ONT.—Ottawa Electric St. Ry. Co., Ltd 12 m, 4-8½ g, 40, 52 and 56 lb T and girder r, 20 m c Westinghouse system. Pres. J. W. McRae, V. Pres G. P. Brophy, Sec. & Treas. J. D. Fraser, Gen. Man T. Ahearn, Supt. J. E. Hutcheson. Capital, $256,000 authorized, $500,000. 6 2

Ottawa City Passenger Ry. Co. 6 m, 4-8½ g, 30 lb O'Brien & s. b. r, 29 c and other vehicles, 54 h. Pres. W. Y. Soper, V. Pres. R. Blackburn, Sec. J. D. Fraser. Capital $84,000; authorized $100,000. 9 2

OTTUMWA, IA.—Ottumwa Electric Ry. Co. 7 m, 4-8½ g, 30 & 40 lb girder & T r, 12 c, of which 11 are m c and 1 t c. Gen. Elec. system. Pres. & Gen. Man. W. R. Daum, V. Pres. C. F. Blake, Sec & Treas. C. H. Brampton, Supt. H. C. Davis. Capital $237,500; authorized, $500,000. Bonds, $100,000. Office 102 S. Market st. 9 2

OWENSBORO, KY.—Owensboro City R. R. Co 5½ m, 4-8 g, 20 lb T r, 15 c, of which 8 are 4-wheel box and 7 4-wheel open, 40 mu. Pres. Jno. Gilmore, Sec & Treas. J. D. Powers, Supt. R. H. Neely. Capital $25,000. e 7 1

OWOSSO, MICH.—Owosso & Corunna St. Ry Co. 4½ m, 35 lb T r. Heeley motor system. Pres C. D. Haines. 1 2

P

PADUCAH, KY.—Paducah St. Ry. Co. Elec. 8½ m, 4 8½ g, 35 lb T r, 20 c, of which 12 are m c and 8 t c Edison system. Pres. Geo. C. Thompson, V. Pres Henry Burnett, Sec. & Treas. T. J. Flournoy, Supt A. S. Thompson, Supt. Mo. Pow. D. B. Simon. Capital, $115,000; authorized, $200,000. Bonds, $100,000. Office, 1342 Broadway. 6 2

PALATKA, FLA.—Palatka & Heights St. Ry Co. 2 m, 3 g, 30 lb centre bearing r, 2 c, 2 mu. Pres Wm. P. Craig, Sec. Marcus Loab, Treas. & Gen. Man. W. C. Snow. Capital, $10,000. 6 2

PARIS TEX.—Paris Elec. Lt. & Ry. Co. 5 m, 4-8½ g, 22 & 36 lb T & flat r, 10 c, of which 8 are 4-wheel box & 2 4-wheel open, 45 mu. Pres. J. J. Walsh, V. Pres. S. J. Wright, Sec. & Treas. B. J. Baldwin, Jr., Supt. R. F. Grimes. Capital, $200,000; authorized, $300,000; Bonds, $150,000. Office over Farmers' & Merchants' Bank. 3 2

PARKERSBURG, W. VA.—Park City St. R. R Co. 5 m, 4 8½ g, 40 lb flat & T r, 7 c, 14 h, 14 mu Pres. D. Gould, V. Pres., & Sec. R. Couts, Treas W. H. Wolfe, Gen. Man. & Supt. W. A. McCosh. Capital, $40,000; authorized $75,000. Office 332 Juliana st. 3 2

PASADENA, CAL.—City Ry. Co. 5¼ m, 4-8½ g 16, 20, 30 lb T & flat r, 5 c, of which 2 are 4-wheel box & 3 4-wheel open; 8 h. Pres. & Gen. Man. A. J Painter, Sec. M. D. Painter. Capital, $20,300; authorized, $50,000. 11 2

Alhambra & Pasadena St. Ry. Co. (See Alhambra, Cal.)

Colorado St. Ry Co. 5½ m, 3-6 g, 16 lb. T r, 5 c, 9 h Pres. & Gen. Man. Geo. F. Foster, V. Pres. T. P. Lukens, Sec. E. E. Jones. Capital, $50,000. Office, 50 South Los Robles Ave. 6 2

Pasadena St. Ry. Co. (Fair Oaks and Kansas.) 6½ m, 3-6 g, 16 lb T r, 5 box c, 8 h. Pres. & Gen Man. R. Williams, V. Pres. G. R. Thomas. Sec. P. G. Wooster, Treas. P. M. Green. Capital, $20,300 authorized, $50,000. Office, Wooster Block. 9 2

PATERSON, N. J.—Paterson Ry. Co. Elec. 36 m of which 3 are horse & 33 elec., 4-8½ g, 40 & 58½ lb c b & T r, 110 c, of which 60 are m c, 40 t c & 10 h c 50 h. T-H., Westinghouse and Edison systems. Pres Garret A. Hobart, V-Pres. H. Romaine, Sec. A. A Wilcox, Treas. E. T. Bell, Gen. Man. E. J. Lawless Supt. M. Pettigrew. Capital $1,250,000. Bonds $375,000 8 2

Paterson Central Electric R. R. Co. 4 m, 4-8½ g, 45, 58½ lb T & girder r, 18 c. Westinghouse system. Pres. W; Strange, V. Pres. W. Pennington Sec. J. R. Beam, Treas. J. A. Morrisse, Supt. W Ring. Office, 148 Ellison st. 10 2

PAWTUCKET, R. I.—Pawtucket St. Ry Co. Elec 15 m. of which 8.5 are horse and 6.5 elec; 4 g, 54-60 lb Prov. girder & T r, 50 c, of which 35 are h c, 11 m c and 4 t c, 138 h. T-H system. Pres. A. B. Chace, V. Pres. A. H. Littlefield, Sec. & Treas. Gen. Man. C. F. Luther, Treas. E. N. Littlefield. Capital $200,000. Office, 54 Broad st. 6 2

Interstate St. Ry. Co. Elec. 32 m, 4-8½ g, 50 lb T r, 8 m c. T-H system. Pres. H. M. Daggett, Jr Sec. G. Webster, Treas. W. N. Otis. Capital, $400,000; authorized, $500,000. 7 2

PEABODY, MASS.—Essex Electric St. Ry. Co (See Salem, Mass.) 11 0

PENSACOLA, FLA.—Pensacola Terminal Co 17 m, of which 7 are horse and 10 steam, 4-8½ g, 30, 56 lb T r. 12 c, 60 h, 3 mu. Pres. G. Gordon, V-Pres. & Gen. Man. C. M. Boulder, Sec. & Supt. S. F. Chipley Treas. W. H. Knowles. Capital $50,000; authorized $150,000. Bonds $60,000. 3 2

PEORIA, ILL.—Central Ry. Co. Elec. 20 m 4-8½ g, 48½-57 lb girder r, 103 c of which 33 are m. c and 70 t. c. 28 h. T-H system. Pres. J. B. Grecnhut Gen. Man. J. Finley, Sec. J. N. Ward, Treas. E. Calardan, Supt. J. E. Finley. Capital, $600,000 Office, 400 S. Adams st. 3 2

Fort Clark Horse Ry. Co. Elec. 14 m, 4-8½ g, 38, 50, 75 lb Johnson girder r, 28 c, of which 14 are m c & 14 t c. T-H system. Pres. & Gen. Man. J. H. Hall, Sec. & Treas. Willis Hall, Supt. J. D. Hall. Capital. $252,000; authorized, $500,000. Bonds, $250,000. Office, 1600 Perry st. 6 2

PETERSBURG, VA.—Petersburg St. Ry. Elec. 3¾ m, 4-8½ g, 45 & 47 lb r, 8 m c. T-H system. Pres., Gen. Man. & Pur. Agt. George Beadle. Sec. W. S Phelps, Treas. A. Wright, Supt. F. G. Beadle. Capital, $100,000. Bonds, $100,000. 1 2

Petersburg & Asylum Ry. Co. Dummy. 3½ m, 4-8½ g, 50 lb T r, 1 dummy, 4 pass. c, 2 freight c. Pres & Treas. G. Beadle, Sec. J. Mann. Capital $20,000. Bonds $30,000. 6 2

PHILADELPHIA, PA.—Citizens' Pass. Ry. Co. 10½ m, 5-2 g, 45 & 47 lb girder & tram r, 65 c, 430 h. Pres. Chas. E. Ellis, Sec. J. Q. Adams, Treas A. A. Stull. Office, S. W. cor. 11th & Colona sts Capital, $10,000. 9 2

Empire Pass. Ry. Co. 8½ m, 5-2 g, 45 lb r. Pres James McManes, Sec. and Treas. D. W. Dickson (Leased by Philadelphia Traction Co.) Office, N. E cor. 41st & Haverford sts. Capital, $600,000. 9 2

Frankford & Southwark Phila. City Pass. R.R. Co. 20½ m, 5-2 g, 45, 47 & 78 lb girder & Tram r, 110 4-wheel box c, 832 h, 10 steam dummies. Pres. Jeremian J. Sullivan, V. Pres. Geo. S. Gandy, Sec. Thos S. Harris, Treas. R. C. Brewster, Supt. W. H. Janney Capital $1,250,000. Office, 2501 Kensington ave. 9 2

Germantown Pass. Ry. Co. 29½ m, 5-2½ g, 47 lb r, cars and horses leased. Pres. C. W. Walton, Sec. & Treas. J. Koch. Capital, $1,500,000. (Leased to People's Pass. Ry. Co.) Office, 1,001 Chestnut st. 6 2

Green & Coates R. R. Co. (Leased to People's Pass Ry. Co. Pres. Moses A. Dropsie, Sec. & Tre as. S Renshaw. Office, 1001 Chestnut street. Capital $500,000. 6 2

Hestonville, Mantua & Fairmount Pass. R.R. Co. 20 m, 5-4½ g, 45 lb r, 96 c, 525 h. Pres. W. Verner, V. Pres. I. Blum. Sec. & Treas. W. R. Benson. Capital, $2,050,000. Office, 4,300 Lancaster ave. 6 2

Lehigh Ave. Ry. Co. 8 m, 5-2¼ g, 47 lb s b r, 8 4-wheel box c, 64 h. Pres. Frank Weckerly, Sec. & Treas. R. C. Brewster. Capital $300,000. 9 2

Lombard & South Sts. Pass. Ry. Co. 21 m, 5-2 g, 50 lb girder & c r, 78 c, 443 h. Pres. W. H. Sheimerdine Sec. & Treas. R. B. Selfridge, Gen. Supt. J. H. Fresh Special Agt. McClellan Hersh. Capital, $625,000 authorized, $750,000. Bonds, $282,100. Office, 2509 South st. 9 2

People's Pass. Ry. Co. 46¼ m, 5-2 g, 47 to 57 lb tram & girder r, 167 c, 1564 h. Pres. R. W. Carson, Sec. & Treas. David C. Golden, Gen. Supt. J. A Rigg. Capital, $2,075,000; authorized, $2,250,000. Office, 8th & Dauphin sts. 6 2

Philadelphia City Pass. Ry. Co. 12.417 m, 5-2½ g, 47 & 78 lb r. Pres. Wm. W. Colket, Sec. & Treas. T. W Pennypacker. Capital, $1,000,000. Office, 202 Walnut place. Leased to W. Phila. Pass. Ry. Co. 6 2

Philadelphia Traction Co. 169 m, of which 135 are horse and 34 cable, 5-2½ g, 47 & 78 lb r, 830 c, of which 660 are h. c. and 170 g c. 4172 h. Pres. P. A. B. Widener, V. Pres. W. L. Elkins, Sec. & Treas. D. W Dickson, Gen. Man. J. T. Gorman. Office, n w cor 41st and Haverford sts. Capital, $6.000,000. 3 2

Philadelphia & Darby Ry. Co. 6½ m, 5-2½ g. 42 lb r. Pres. Beauveau Borie, Sec. & Treas. Wm. W Colket. Office, 202 Walnut pl. Leased to Phila. City Pass. Ry. Co. Capital, $200,000. 6 2

Philadelphia & Gray's Ferry Pass. R. R Co. Leased by Philadelphia Traction Co.

Ridge Ave. Pass. Ry. Co. 16 m, 5-2 g, 48 lb flat r, 60 c, 385 h. Pres. E. B. Edwards, V. Pres. J. Lambert, Sec. & Treas. Wm. S. Blight, Supt. W. Myers. Capital, 420,000; authorized, $750,000. Office, Ridge & Susquehanna aves. 6 2

Schuylkill River Pass. Ry. Co. 3.11 m, 5-2 g, 41 lb r. Prey. Oliver Hopkinson, Sec. J. Crawford Dawes. Capitals $500,000. Leased to Philadelphia & Gray's Ferry Pass. R. R. Co. 9

Second & Third Sts. Pass. Ry. Co. 37 m, 5-2¼ g, 47 to 55 lb r, 111 c, 717 h. Pres. H. T. Potts, Sec. Charles D. Matlack, Treas. W. F. Miller, Supt. D. W. Stephens Capital, $1,060,200. Office, 2,653 Frankford ave. 9 2

Seventeenth & Nineteenth Sts. Pass. Ry. Co. 8.12 m Pres. Matthew S. Quay, Sec. & Treas. John B. Peddle. Capital, $500,000. Leased to Philada. Traction Co. a 12 1

Thirteenth & Fifteenth Sts. Pass. Ry. Co. 15 m, 5-2 g, 47 lb tram r, 89 4-wheel box c, 640 h. Pres. B. S Kunkel, Sec. & Treas. I. P. Richardson. Office, Fidelity Insurance & Safe Deposit Co. 325 Chestnut St Leased to Phila. Traction Co. 6 2

Union Pass. Ry. Co. 70 m, 348 c, 1,724 h. Pres. P. A. B. Widener, V. Pres. W. L. Elkins, Sec. & Treas. John B. Peddle, Capital, $1,500,000. Leased to Phila. Traction Co. 9 2

West Philadelphia Pass. Ry. Co. 22½ m, 5-2½ g, 47 & 78 lb r. Pres. P. A. B. Widener, Sec. & Treas. D. W Dickson, Supt. Jas. T. Gorman. Capital, $750,000 Office, 41st & Haverford sts. Leased by the Phila Traction Co. 9 2

PHILLIPSBURG, N. J.—Phillipsburg Horse Car R. R. Co. 2¾ m, 4-8 g, 3 lb r, 4 c, 13 h. Pres. Daniel Runkle, Sec. & Treas. James W. Long. Sold to Easton Transit Co. 9 0

PHŒNIX, ARIZ. T.—Phœnix St. Ry. Co. 6 m, 3-6 g, 20 lb r, 4 c. Pres. M. H. Sherman, Sec. J. McMillan. c 7 1

PIERRE, S. DAK.—Pierre City Ry. Co. 4.1 m 4-8½ g, 27-35 lb r, 5 open c, 7 h, 16 mu. Pres. W. G Warden, V. Pres. Randal Morgan, Sec., Supt. & Gen. Man. S. B. Wallace. Capital $75,000. 6 2

PINE BLUFF, ARK.—The Citizens' St. Ry. Co 12½ m, 4 & 4-8½ g, 20, 35, 45 lb T r, 28 m. c. 8 h, 142 mu. Pres. T. S. James, Sec. A. Murray, Treas. & Gen. Man. W, Jones, Supt. M. Jones, Capital, $200,000. Bonds $90,000. Office, 207 Main St. 2 2

PIQUA, O.—Piqua St. Ry. Co. Elec. 4 m, 4-8½ g, 45 lb Johnson girder and 35 lb T r, 10 c of which 6 are m c and 4 t c. Edison system. Pres. A M. Orr V. Pres. D. Spencer, Sec. & Gen. Man.. F. C. Davies Treas. L. M Flesh. Capital $75,000. 6 2

PITTSBURGH, PA.—Allegheny Traction Co. 7 m, 5-2½ g, 45 lb tram r, 16 c, 125 h & mu. Pres. G. B. Hill, Sec. A. M. Neeper, Treas. J. D. Nicholson. Capital $350,000. 9 2

Birmingham, Knoxville & Allentown Traction Co 1.4 m. horse and 1,600 ft. cable, 5 g, 45 lb steel & T r 9 c, 24 h. Pres. H. S. A. Stewart, Sec. Danl. Beech Treas. T. H. Given, Supt. M. S. Holden. Capital $100,000. 11 1

Central Traction Co. 8½ m, of which 5 are horse & cable & 3½ elec. 5-2½ g, 65 lb girder r, 30 c, of which 4 are h c, 17 g c, 3 m c and 6 t c, 8 h. Westinghouse system. Pres. Geo. I. Whitney, V. Pres. T. A. Gillespie, Sec. J. F. Miller, Treas. C. Wright, Supt. W. C. Smith. Capital, $1,500,000; bonds $375,000. Office 33d st. & Huron Avenue, 3 2

Citizens' Traction Co. 25 m of which 6 are horse, 12 cable and 7 elec. 5-2½ g, 54 & 65 lb girder & tram r, 80 c, of which 4 are 4-wheel box, 10 m. c. and 66 g. c. 36 h. Westinghouse motors and Edison generators. Pres. Jno. G. Holmes, V. Pres. H. S. A. Stewart, Sec. C. M. Gormly, Treas. N. Holmes, Supt. J. E. Rugg. Capital, $3,000,000; bonds $1,250,000. Office, Jackson Bldg. 3 2

Duquesne Inclined Plane Co. 1,586 ft., 5 g, 60 lb T r 2 c. Pres. S. Severance, V. Pres. F. B. Nimick, Sec. K. Q. Brigham, Treas. S. Severance, Jr., Supt. Geo. L. Holliday. Capital, $50,000. 9 2

Duquesne Traction Co. Elec. 28 m, 5-2½ g, 48 lb girder r, 60 m c, T-H. system. Pres. C. L. Magee, V. Pres. ————, Sec. Jas. L. McDevitt, Treas. Jno F. Steel. Capital, $3,000,000. Bonds, $1,500,000 Leased to Pittsburgh Traction Co, 9 2

Federal St. & Pleasant Valley Ry. Co. Elec. 25 m 4-8½ g, 50, 52 & 66 lb girder & tram r, 65 c, of which 59 are m c and 6 t c; 24 h. Edison, Westinghouse and Bentley-Knight systems. Pres. & Gen. Man D. F. Henry, Sec. Wm. H. Graham, Treas. R. F Ramsey, Supt. W. M. Ramsey. Capital, $1,400,000 Bonds, $1,250,000. Consolidated with People's Park Pass. R. & Observatory Hill Ry. Office, 42 Sixth Ave Pittsburg, Pa. 9 2

Fort Pitt Inclined Plane Ry. Co. 350 ft., 10 g, 2 c Pres. Wm. Flinn, Sec. & Supt. S. H. French, Treas. F. L. Stephenson. Capital, $60,000. Office 125 Fourth Ave. 3 2

Knoxville Inclined Plane Co. 2,640 ft. 9 g, 60 lb. T r, 2 c. Capital $150,000. Office 96 Diamond st.

Monongahela Inclined Plane Ry. Co. 2 planes, 640 ft, 5 & 12 g, 45 & 80 lb T r, 2 pass. 2 freight c. Pres. Jas. M. Bailey, Sec. Treas. & Supt. John L. Awl. Capital, $200,000 3 2

Penn. Inclined Plane Ry. 840 ft, 10 g, 60 lb T r Pres. Joshua Rhodes, 1st ave.

Pittsburgh, Allegheny & Manchester Traction Co. Elec. 18 m, of which 1¼ are horse and 16¾ elec. 5 2½ g. 63 lb girder r, 72 c of which 1 is h c, 61 are m c, and 10 t c. T-H system. Pres. J. H. Dalzell, V. Pres Joshua Rhodes, Sec. A. M. Neeper, Treas. W. Montgomery Gen. Man. G. F. Greenwood. Capital, $3,000,000. Bonds, $1,500,000. Office, S. Market & Liberty sts. and Beaver st & Island ave, Allegheny. 6 2

Pittsburgh & Birmingham Traction Co. Elec. 13¾ m of which 6½ are horse & 7 elec, 5-2⅛ g, 63½ lb girder & 47 lb tram r, 16 c, 60 h, 30 m c. T-H, Short & Edison systems. Pres. H. S. McKee, Sec. F. J. Tener, Treas. Daniel Beach, Supt. Miller Elliott. Capital $3,000,000. Bonds $1,500,000. Office, 30th & Carson sts. 9 2

Pittsburgh & Castle Shannon R. R. (Includes 2 inclines). 6¾ m, 3-4 g, 60 lb r, 7 c. Incline No. 1, 1,375 ft. 10 g, 60 lb T r, 2 c. Incline No. 2, 2,112 ft. 10 g, 60 lb T r, 2 c. Pres. Walter Chess, V. Pres. J. M. Bailey, Sec. & Treas. E. J. Reamer, Supt. O. A. Rogers. Capital, $481,000. Bonds, $200,000. 9 2

Pittsburgh & West End Pass. Ry. Co. 10¾ m, 5-2½ g, 45 lb tram r, 22 c, 105 h, 40 mu. Pres. & Treas. John C. Reilly, Sec. Thomas S. Bigelow, Supt. William J Burns. Capital, $200,000. Bonds $75,000. Office, Wabash ave. 10 1

Pittsburgh Traction Co. Cable. 12.67 m, of which 10.67 are cable and 2 elec, 5-2 g. 65 lb. girder r, 74 c 2 m. c. Short system. Pres. Geo. W. Elkins, V. Pres. C. L. Magee, Sec. and Treas. J. G. Traggard, Gen. Man. W. L. Elkins, Supt. —— McDowell Ch. Eng'r J. M. Gorman. Capital $2,500,000. Bonds $75,000. Office, 310 Fifth ave. 9 2

Schenley Park & Highland Ry. Co. Elec. 3 m. 5-2½ g, 40 & 45 lb T & girder r, 5 m c. Daft system Pres. Thos. A. Noble, Sec. & Supt. S. J. MacFarren Treas. E. F. Hays, Capital $100,000. 3 2

Second Avenue Pass. Ry. Co. Elec. 10¾ m, 5-2½ g 54 lb Johnson & T r. T-H & Westinghouse systems Pres. Jas. D. Callery, Sec. C G. Milnor, Treas. John W. Taylor, Gen. Man. W. J. Burns, Supt. John Murphy. Capital, $300,000. Bonds $150,000. Office Glenwood, 23d Ward. 9 2

St. Clair Inclined Plane Ry. Co. 2,060 ft., 7 g, 56 lb T r, 2 box c. Pres. W. S. Hughes, V. Pres. Geo. B Blood, Sec. W. S. Jones. Treas. R. B. Mellon. Capital, $150,000. Bonds $75,000. Office, South Side at head of plane. 8 2

Suburban Rapid Transit St Ry. Co. Elec. 5½ m 5-2½ g, 52 lb Johnson girder r, 13 m, c. N. E. T. Co.'s system. Pres. W. T. Cowan, Sec. & Treas. Thos. A Noble. Gen. Man. J. Saltz. Capital $100,000; authorized, $120,000. Bonds $100,000. 9 2

PITTSFIELD, MASS.—Pittsfield Electric St. Ry Co. 3½ m. 4-8½ g, 35 & 40 lb flat r, 9 c of which 4 are m. c. and 5 t. c., 3 h. Westinghouse system. Pres. Jos. Tucker. Sec. J. M. Stevenson, Treas. & Gen. Man. C. E. Merrill, Supt. E.W. Godfrey. Capital $40,000. Office 140 North St. 9 2

PLAINFIELD, N. J.—Plainfield St. Ry. Co. 4 m c. T-H. system. 7 2

PLYMOUTH, MASS.—Plymouth & Kingston Ry. Co. Elec. 6½ m. 4-8½ g, 35 lb T r, 10 m c. T-H system. Pres. J. H. Cunningham, Sec. T. Loring, Treas. J. D. Thurber, Supt. & Gen. Man. C. E. Barnes. Capital $70,000; bonds $35,000. 9 2

POMONA, CAL.—San Antonio & Holt Ave. St. R. R. Co. 2 m, 3-6 g, 16 lb T r, 3 c, 6 mu. Pres. H Eno, V. Pres. J. E. Packard, Sec. H. S. Flinney, Treas O. F. Giffin, Supt. F. G. Haley. Capital, $50,000. 3 2

Orange Grove St. R. R. Co. 4 m, 3-6 g, 16 lb T r, 3 c, 8 mu. Pres. J. D. Carson, Sec. Treas. & Supt. W M. Woody. Capital $25,000. a 5 1

PORT ARTHUR, ONT.—Town of Port Arthur Electric Ry. 4 m elec. 4-8½ g, 40 lb T r, 4 c, of which 2 are m c and 2 t c. Edison system. Capital $75,000 W. P. Cooke, Chairman of the Elec. Ry. Committee 10 1

PORT HURON, MICH.—City Electric Ry. Co. 9 m, 4-8½ g, 45 lb T r, 20 c, of which 12 are m c and 8 t c, T-H system. Pres. W. Canh m, Sec. & Treas. F J. Dixon, Gen. Man. A. Dixon. Capital $100,000 Bonds $13,500. 9 2

PORT TOWNSEND, WASH.—Port Townsend St. Ry., Light & Power Co. 4¼ m, 4-8½ g, 38 & 40 lb T & girder r 3 m. c. T-H system. Pres. F. W Hastings, V. Pres. & Gen. Man. J. V. Shephard, Sec & Treas. C. P. Swigert. Capital, $150,000. 5 1

Port Townsend Belt Ry. Co. 4 m, 8 m c. Edison system. 7 2

PORTLAND, CONN.—Portland R. R. Co.

PORTLAND, ME.—Ocean St. R.R. Co Operated by Portland R. R. Co.

Portland R. R. Co. Elec. 14.6 m, of which 3½ are elec, 4-8½ g, 35-45 lb T & s b r, 53 c, of which 31 are box & 21 open, 8 m c, 265 h. T-H system. Pres. R. J Libby, Treas. & Gen. Man. E. A. Newman. Capital $200,000. Office 471 Congress st. 3 1

PORTLAND, ORE.—Portland Consolidated St Ry. Co.

City Cable Co. 7½ m, 3-6 g, 22, 38 Comb. r, 23 c Pres. G. P. Lent, V. Pres. W. R. Smith, Sec. & Gen Man. F. I. Fuller, Treas. L. L. Hawkins. Capital $25,000; authorized $50,000. Bonds $400,000. Office Mill & Chapman sts. 10 2

City & Suburban Ry. Co. Elec. 41 m. of which 14 are horse, 15 elec. and 12 steam, 3-6 g, 30, 40 lb T & girder r, 62 c, of which 35 are h. c., 18 m. c. and 9 steam, 200 h. T-H., Edison and Westinghouse systems. Pres. H. Failing, V. Pres. T Woodward. Sec. & Treas. C. F. Swigert, Gen. Man. H. C. Campbell, Supt. J. W Campbell. Capital, $1,000,000. 11 1

City & West Portland Park Motor Co. 6 m, 4-8½ g 45 - 50 T r, 17 c, 2 steam motors. Pres. E. T. Johnson, V. Pres., Treas. & Gen. Man. T. A. Wood, Sec. W. H. Wood. Capital $100,000. Bonds $100,000. Office Room 1, L O. O. F. Temple. 7 2

East Side Ry. Co. Elec. 14 m of which 7 are steam & 7 elec., 4-8½ g, 30, 40 lb T r, 11 c of which 7 are m c and 4 t c, 3 steam motors. Edison system Pres. & Gen. Man. G. A. Steel, V. Pres. & Treas. J Steel, Sec. J. B. Clelland. Capital $125,300; authorized $250,000. 6 2

Portland Cable Ry. Co. 5½ m. 3-6 g, 38 lb comb'n r 22 comb'n c. Pres. C. H. Woodard, V. Pres. W. K Smith, Sec. E. D. Whill, Treas. L L. Hawkins, Supt. & Gen. Man. G. W. Lynch. Capital, $370,000; authorized $500,000; bonds $340,000. Office 151h & Mill sts. 2 2

Portland Consolidated St. Ry. Co. Elec. 29.1 of which 6.6 are steam & 22.5 elec. 3, 3-6, 4-8½ g, 35, 40 lb T r, 80 c. of which 3 are steam motors 7 coaches, 9 flat c, 56 m c. and 5 t c. Edison & Westinghouse systems. Pres. G. B. Markle, V. Pres. J. Steel, Sec D. F. Sherman, Treas. J. L. Hartman, Supt. J. E Thielsen. Capital, $525,000; authorized $1,000,000 Bonds $660,000. Office 224½ Washington St. 10 2

PORTSMOUTH, O.—Portsmouth St. R. R. Co. 3½ m, 3-6 g, 18 lb r, 7 c, of which 5 are 4-wheel box & 2 4-wheel open, 10 h. Pres. James Skelton Sec & Supt. Geo. B. Chase. Capital $25,000. Not in operation. 9 2

PORTSMOUTH, VA.—Portsmouth St. Ry. Co 4.17 m, 4-8½ g, 30 lb s b r, 9 c, 21 h. Pres., Treas. & Gen. Man. B. Bruenn, V. Pres. Wm. H. Steward, Sec. P. G. Chamberlain. Supt. W. T. Cross. Capital $50,000; bonds $50,000. Office, 63 Wall st., New York. 3 2

POTTSVILLE, PA.—People's Ry. Co. Elec. 4½ m, of which 3½ are steam and 1 elec., 4-8½ g, 50, 60 lb flat T r, 8 c. Short system. Pres. T. A. Reilly Sec. & Supt. Wm. D. Pollard. Office, 221 S. Centre st. 6 2

Schuylkill Electric Railway Co. 9 m, 4-8½ g, 45 lb r, 14 c, of which 12 are m. c. and 2 t. c. Short system. Pres. & Gen. Man. J. K. Sigfried, V. Pres. F. G Yuengling, Sec. J. Newlin, Treas. J. F. Zerby, Asst Man. R. Sigfried. Capital, $150,000. Bonds, $70,000. 9 2

POUGHKEEPSIE, N. Y.—City R. R. Co. 4½ m 4-8½ g. 42 lb s b & c b r, 10 c, 47 h. Pres. W. H Young, V. Pres. E. S. Atwater, Sec. S. Woodell, Treas Edmund Young, Supt. C. M. Davis. Capital $80,000; authorized $85,000. Office, 491 Main st. 6 2

PROVIDENCE, R. I.—Union R. R. Co. Elec 60 m, of which 52 are horse and 8 elec; 4-8½ g, 54, 70, 90 lb girder r, 315 c, of which 288 are h c and 27 m c 1,616 h. T-H system. Pres. J. Metcalf, V. Pres. L. Sharpe, Sec. Henry V. A. Joslin, Treas. C. A. Babcock, Gen. Man. A. T. Potter. Capital, $2,000,000. Office, 18 Westminster St. 9 2

Providence Cable Tramway Co. 3 m cable. Also run over 6 m of Union R. R. with horses, 4-8½ g, 38 & 50 lb Lane r, 57 c of which 20 are 4-wheel box & 23 4-wheel open, 14 g, c. 168 h. Pres. B. A Jackson, Sec. H. V. A. Joslin, Treas. C. A. Babcock Gen. Man. A. T. Potter, Supt. M. H. Bronsdon. Capital, $300,000; authorized, $400,000. Office, 18 Westminster St. (Stock held by Union R. R. Co.) 9 2

PROVO CITY, UTAH.—Provo City Ry Co. 9 m 4.8½ g, 30 lb steel T r, 8 c, of which 5 are closed and 3 flat, 2 steam motors. Pres. T. Holbrook, V. Pres R. H. Dodd, Sec. M. Snow, Gen. Man. R. Bachman Jr. Capital, $55,000. Address P. O. Box 278. 7 1

PUEBLO, COLO.—Pueblo City Ry. Co. Elec. 25 m, 4 g, 35 & 40 lb T r. 28 c, of which 21 are m c and 7 t c. T-H system. Pres. J. E. Downey, V. Pres. A. W. Chamberlain, Sec. & Gen. Man. J. B. Downey, Treas. G. H. Hand, Supt. & Elec'n B. O. Boswell. Capital, $500,000; bonds $500,000. 3 2

PUNXSUTAWNEY, PA.—Punxsutawney St. Pass. Ry. Co. Elec. 2 m. 4-8½ g, 51½ lb girder r, 3 m c. Westinghouse system. Pres. M. J. Dinsmore, V. Pres. J. K. North, Sec. A. J. Truitt, Treas., Gen. Man. & Supt. L. C. Myers. 8 2

PUT-IN-BAY, O.—Put-In-Bay Water Works, Light & Ry. Co. Elec. 3.75 m, 4-8½ g, 45 lb T r, 8 c, of which 4 are m c, and 4 t. c. T-H system. Pres. G. H. Ketchum, V. Pres. and Gen. Man. J. K. Tillotson, Sec. and Treas. F. M. Ohl. 8 1

Q

QUEBEC, CAN.—Quebec St. Ry. Co. 2.4 m, 4-8¾ g, 45 lb Phila. r, 12 c, 2 busses, 11 sleighs, 54 h Pres Chas. St. Michel, V. Pres. W. Hossack, Sec., Treas Supt. & Man., F. T. Boomer. Capital $50,000. Authorized $100,000. Box 74, St. Rochs, P. O. 6 2

St. John St. Ry. Co. Lim. 1½ m, 4 8¾ g, 35 lb s.b. r, 4 4-wheel box c, 19 h. Run a 'bus service out 4 m. from city limits, connecting with car service Pres. A. Robertson, V. Pres. W. DeQuincy Sewell, Sec. & Man. W. W. Martin. Capital, $30,000. Office, 562-4 St. John St. 3 2

QUINCY, ILL.—Quincy Horse Ry. & Carrying Co., Elec. 11½ m, 5 g, 38, 45, 62 lb T & girder r, 22 c of which 15 m c & 7 t c, 4 mu, T-H. system. Pres W. S. Warfield, Sec. & Supt. E. K. Stone, Jr., Treas F. W. Meyer. a 10 1

QUINCY, MASS.—Quincy St. R. R. 4¾ m, 4-8 g 35-40 lb T r, 10 c. Leased to Quincy & Boston St. Ry. Co. 8

Quincy & Boston St. Ry. Co. Elec. 7½ m, 4-8 g, 30, 35 & 38 lb T & flat r, 13 c, of which 7 are m c & 6 t c, T-H system. Pres. J. R. Graham, Sec. & Treas. F. H Smith, Supt. B. J. Weeks. Capital, $100,000. Loan $20,000. 3 2

Manet St. Ry. Co., Elec. 3.75 m, 35-45 lb T & Johnson girder r. 6 c, of which 2 are m c. Edison system Pres. A. D. S. Bell, Treas. C. A. Potter, Supt. G. W Morton. Office Newton, Mass. 1 2

R

RACINE, WIS.—Belle City St. Ry. Co. Elec. 8 m, 4 g, 32 to 45 lb tram r, 12 c, 75 h, 14 m c. Detroit system. Pres. & Treas. C. H. Holmes, V. Pres. & Gen. Man. A. Shumon, Sec. J. E. Dodge. Capital $100,000. Office, 823 Lake ave. 6 2

RALEIGH, N. C.—Raleigh St. Ry. Co. Elec 6 m, 4-8½ g, 30& 35 lb T & flange r, 11 c, of which 8 are m c and 3 t c. Edison system. Pres. J. C. George Sec. & Treas. W. G. Weld. Gen. Man. S. W. Huff Capital stock, $25,000. Bonds $125,000. 6 2

RAPID CITY, S. DAK.—Rapid City St. Ry. Co 2 m, 4 g, 25 lb r, 2c, 4 h. Pres. E. B. Chapman. V Pres. James Halley, Sec., Treas. & Supt. J. W. Post Capital $100,000. 10 1

READING, PA.—Reading City Pass. Ry. Co. 23 m, 5-2½ g 38, 45, 50, 52 & 60 lb tram & girder r, 76 c 324 h. Pres. & Gen. Man. B. F. Owen, V. Pres. Jas. L Douglas, Sec. & Treas. H. A. Muhlenberg. Capital $281,250. Office, Fifth & Penn sts. 9 2

East Reading R. R. Co. Elec. 5¾ m, 5-2 g, 42 lb T & girder r, 9 c of which 8 are m c & 1 t c. Edison & Westinghouse systems. Pres. A. J. Brumbach, V Pres. J. G. Leinbach, Sec. & Gen. Man. M. Shaaber Treas. J. W. Levan, Asst. Gen. Man. C. E. Lenhart Capital $100,000. 6 2

Neversink Mountain R. R. Elec. 11 m, 4-8½ g, 50, 70 lb T r, 13 c, of which 7 are m c and 6 t c, 1 steam motor. Edison system. Pres. H. T. Kendall, V. Pres G. Burke, Sec. H. Fry, Treas. D. W. Stehman, Gen Man. Paul D. Muiholland. 9 2

Reading & South Western St. Ry. Co. Elec. 5½ m 4-8½ g, 40-56 lb T & girder r, 10 c, of which 6 are m c and 4 t c. T-H & Edison systems. Pres. H. Ahrens, V. Pres. J. B. Sterley, Sec. Treas. & Supt. G W. Keim. Capital, $130,000. Office, Water st., below Chestnut. 6 2

RED CLOUD, NEB.—Street Ry. 7½ m, 3 c, 12 mu. Proprietor, L. M. Crabill. 10 0

REDLANDS, CAL.—Redlands St. Ry. Co. 3½ m, 4-2 g 20 lb T r, 1 open c, 8 mu Pres. A.E. Sterling V. Pres. E. W. Wilmot, Sec. G. E. Ellis, Treas. First National Bank. Capital, $50,000. 2 2

RED OAK, IA.—Red Oak St. R.R. Co. 1¾ m, 4-2½ g. 20 lb flat r, 2 c, 4 mu. Pres. Gen. Man. & Supt. M. Bonham, V. Pres. J. Hayes, Sec. F. M. Byriket. Capital $75,000. 7 1

RICHMOND, IND.—Richmond City Elec. St. Ry Co. 13 m, 4-8½ g, 35 lb T r. 20 c, of which 12 are m. c & 8 t. c. T-H system. Pres. J. C. Shaffer, Sec. R. B Harrison, Gen. Man. W. H. Shaffer, Elec'n. A. H Hickly. Capital $200,000. 10 1

RICHMOND, VA.—Richmond Ry. & Electric Co. 41 m, 4-8½ g, 45-55 lb flat and c b r, 73 m. c. and t. c 12 h. c. Edison and Westinghouse systems. Pres. J P. Munn, Sec. D. B. Toucey, Treas. & Gen. Man. G E. Fisher. Capital, $1,250,000; authorized, $2,000,000 Office, 909 Bank st. New York office, 63 Wall st. 12 1

Richmond & Manchester Ry. Co. Elec. 8 m, of which 3 are horse & 5 elec., 4-8 g, 41 h & mu, 10 c Edison system. Pres. J. F. Bradley, Sec. & Treas. W C. Seddon, Supt. B. R. Selden. Office, Semmes Ave Manchester. a 1 1

North Side Land & Highland Park R. R. Co. Elec 3 m, 50 lb T & flat r. Edison system. Pres. N. V Randolph, V. Pres. B. F. Johnson, Sec. & Treas. F Mosby, Gen. Man. J. D. Mosby. Operated by Richmond & Manchester Ry. Co. 8 1

RIVERSIDE, CAL.—Riverside & Arlington St. Ry. 8 m, 4-6 g, 22-34 lb T r, 6 c, of which 3 are 4-wheel box & 3 4-wheel open, 19 mu. Pres. S. C. Evans V. Pres. O. Backus, Sec. & Gen. Man. W. E. Keith, Treas. Riverside Banking Co., Asst. Supt. J. C. Little. Capital $200,000. 3 2

ROANOKE, VA.—Roanoke St. Ry. Co. Elec. 16 m of which 4 are horse, 8 steam and 4 elec. 4-8½ g, 50 lb T r, 14 c, of which 4 are h c, 5 m c. and 5 t c, 17 mu. Westinghouse & Edison systems. Pres. S. W Jamison, V. Pres. J. T. Engleby, Sec. G. C. McCahan Gen. Man. & Supt. W. F. Carr. Capital, $300,000 Bonds, $200,000. Office, Didier Block. 6 2

ROCHESTER, PA.—People's Electric St. Ry. Co. 4½ m, 5-2 g, 45 lb girder r, 4 m c. T-H system Pres. H. P. Brown, Sec. J. P. Stone, Treas. C. H Bentel, Supt. C. A. Danals. Capital, $150,000. Bonds $50,000. 9 2

ROCHESTER, N. Y.—Rochester Ry. Co. Elec 60 m, of which 13 are horse & 47 elec. 4-8½ g. 52-78 lb girder & T r, 263 c, of which 126 are h c, 100 m c, and 37 t c, 332 h. Short system. Pres. John N. Beckley, V. Pres. B. Graham, Sec. C. A. Williams, Treas. F. P. Allen. Capital, $5,000,000; bonds $3,275,000. Office 267 State st. 3 2

Grand View Beach Railway Co. Elec. 9½ m, 4-8½ g, 40 lb T r, 14 c. of which 7 are m. c. and 7 t. c. Detroit Elec. Works system. Pres. H. H. Craig, V. Pres M. Doyle, Sec. & Treas. J. M. Kelley, Gen. Man. & Supt. E. A. Roworth. Capital, $100,000. Bonds $200,000. 5 2

Rochester Electric Ry. 8.86 m, 4-8½ g, 40 lb T r, 21 c, of which 11 are m c. and 10 t. c. T-H. & Short systems. Pres. A. Luotchford, Sec. & Treas. M. H. Briggs, Gen. Man. & Supt. C. A. Dorr. Capital $200,000. 6 2

ROCK ISLAND, ILL.—Rock Island & Milan St Ry. Co. 6½ m, 4-8½ g, 20, 30 & 40 lb r, 8 pass c, 8 ft c 7 h, 2 motors, Pres. H.C. Connelly, Sec. J. M. Buford Treas. P. Fries. e 90

ROCKAWAY, N. Y.—The Rockaway Village Ry. Co. 1 m, 4-8½ g, 47 lb c. b. r, 3 c, of which 2 are box and 1 open, 10 h. Pres. C. A. Cheever, V Pres. J. D. Cheever, Treas. D. L. Haight, Sec. J. S Auerbach, Supt. Andrew McTigue. Capital $25,000 Office. 13 Park Row, New York. 9 2

ROCKFORD, ILL.—Rockford City Ry. Co. Elec 15 m. 4-8½ g, 40-45 lb tram & T r; 17 m. c, 5 h. T-H system. Pres. R. N. Baylis, Sec. G. W. Carse, Treas W. H. McCutchan, Gen. Man. T. M. Ellis, Supt. A. J Elliot. Capital $150,000. Bonds $125,000. 6 2

West End St. Ry. Co. Elec. 5 m, 4-8½ g, 40,45 lb T & girder r, 13 c, of which 10 are m. c. and 3 t. c Short system. Pres. J. S. Ticknor, V. Pres. O. W Haegg, Sec. & Treas. F. A. Ticknor, Supt. A. Roso borough. Capital, $50,000; authorized $75,000. Office 205 S. Main st. 6 2

ROCKLAND, ME.—Rockland, Thomaston & Camden St. Ry. Co. Elec. 10 m, 4-8½ g, 50 lb r, 12 c, of which 11 are m c and 1 t c. Edison system. Pres. G. E. Macomber Augusta, Me.; V. Pres. H. L. Shepherd, Sec. H. W. Heath, Treas. A. D. Bird, Supt. H. C. Weston. Capital, $300,000. 7 2

ROCKPORT, TEX.—Aransas Pass St. Ry. Co 4 m, 4 g, 20 lb T r, 2 c, 8 mu. Pres. H. W. Davis V. Pres. W. P. Poland, Sec. & Treas. D. W. Booth Capital, $25,000. Address Box 129, P. O. 9 2

ROME, GA.—Rome St. R. R. Co. 7¾ m, 4-8 g, 20, 30 & 40 lb. T r, 10 c, 20 h, 3 motors. Pres. John S Lausen, Sec. & Treas. S. H. Buck, Gen. Man. J. J Seay. Capital, $20,000. Office, East First St. 9 2

North & South St. Ry. Co., 2½ m, 4-9g, 20 lb c b r, 3c 14 h. Pres. J. A. Stansbury, Treas. Jos. J. Printup Sec. Henry Harvey, Connects with all depots, except East Rome. Passes all hotels. Office, 400 Broad st. j 2 90

ROME, N. Y.—Rome City St. Ry. Co. Elec. 6¾ m 4-8½ g, 38½ lb girder r, 14 box c, 44 h. Pres. & Supt. W. P Rayland, V. Pres. C. W. Dayton, New York City; Sec. & Treas. Wm. Moores, New York City. Capital, $50,000. Bonds $125,000. Offices, 115 John st., Rome, and 7 Broadway, New York City. 9 2

RONDOUT, N. Y.—Kingston City R. R. Co. 3 m 4-8½ g, 40 lb c b r, 8 box c, 43 h. Pres. James G. Lindsley, V. Pres. S. D. Coykendall, Sec. & Treas. Peter E. Schoonmaker, Auditor Oscar L. Eastman, Gen. Man. Geo. Coykendall, Supt. E. S. Hewitt. Capital $50,000; bonds $31,000. 9 2

ROXBOROUGH, PA. — Manayunk & Roxborough Incline Plane & Ry. Co. 7¼ m, 5-2½ g, 48 lb r, 5 c, 36 h. Pres. C. J. Walton, Sec. W. H. Lewis Treas. C. T. McClinchy, Supt. A. Tebben. Capital $58,475. Office Roxborough. 7 1

RUTLAND, VT.—Rutland St. Ry. Co. 8 m, 4-8½ g, 20 lb Tr 10 c, of which 8 are 4-wheel box & 2 4-wheel open, 28 h. Pres J. W. Cramton, Sec. S. M. Wilson, Treas. N. K. Chaffee. Supt. M. McKeough. Capital $50,000; bonds $28,000. Office 60 State St. 9 2

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SACRAMENTO, CAL.—Sacramento City Ry. Co. 9 m, 5 g, 16 to 35 T & s r, 30 c, 100 h. Sold to central St. Ry. Co.

Highland Park Ry. 1½ m, 5 g, 16 lb. r. Sold to Central St. Ry. Co.

Central St. Ry. Co. Elec. (Includes Sacramento City and Highland Park). 16½ m, 4-8½ g, 30 to 65 lb girder & T r, 34 c, of which 24 are m c and 10 t c. T-H and Edison systems. Pres. J. H. Henry, V. Pres. L. L. Lewis, Sec. A. Olsen, Treas. National Bank (D. O. Mills & Co.). Gen. Man. J. B. Edson, Supt C Spangler. Capital, $500,000. Bonds, $250,000 Office, 28 & J sts., Sacramento. 9 2

SAGINAW, MICH.—City of Saginaw St. R. R. Co. 3¾ m, 4-8½ g, 42 lb c. b. r, 16 c, of which 9 are 4-wheel box & 7 4-wheel open, 80 h. Pres. David H Jerome, Sec. & Treas. Geo. L. Burrows. Supt. Fred G. Benjamin. Capital $30,000. Office, 426 N. Hamilton st. 6 2

Saginaw Union St. Ry. Elec. 30 m, of which 1 is horse & 29 elec., 45 lb tram r, 49 c, of which 5 are h. c. and 44 m. c. 12 h. Detroit system. Pres. F. E Snow, V. Pres. W. E. Jackson, Sec. & Treas. J. M Nichol, Gen. Man. W. J. Hart. Capital $200,000. 6 2

SALEM, MASS.—Naumkeag St. Ry. Co. Elec 37 m, 4-8½ g, 45-50 lb T & tram r, 110 c, of which 86 are h. c. and 24 m. c. 300 h. Pres. B. Orne, Treas. & Gen. Man. Joseph F. Hickey, Ch. Engr. J. H. Bickford. Office, 233 Essex st. 11 1

Essex Electric St. Ry. 5 m, 4-8½ g, 50 lb T r 20 c, of which 8 are box and 12 open and 6 m. c. Detroit system. Pres. O. W. Norcross, Gen. Man. F E. Farnham. Capital $50,000. 7 1

SALEM, N. C.—Winston-Salem Ry. & Elec. Co (See Winston, N. C.)

SALEM, O.—Salem Electric Ry. Co. 3½ m, 4-8½ g 45 lb Johnson girder r, 6 c, of which 4 are m. c. and 2 t. c. T-H system. Pres. & Treas. M. Davis, V. Pres. J. W. Northrop, Sec. & Gen. Man. W. H. Whildey, Supt. E. Whildey. Capital $100,000; bonds $50,000. 3 2

SALEM, ORE.—Capital City Ry. Co.. Elec. 5½ m, 4-8½ g, 30 lb. steel T r, 8 c, of which 6 are m. c. & 2 t. c. Edison system. Pres. D. Simpson, Sec. & Gen. Man. T. H. Barnes, Treas. Ladd & Bush. Capital $50,000. Office Post Office block. 3 2

SALINA, KAN.—Salina Electric Ry. Co. 5 m, 3-6 g, 40 lb T r, 10 c, of which 5 are m. c. Pres. C. L. Baum, Sec. L. S. Winter. Capital $100,000. 7 1

SALT LAKE CITY, UTAH.—Salt Lake City R. R. Co. Elec. 42 m, 4-8½ g, 30 & 35 lb. T r, 55 c. of which 50 are m c and 5 t c. Westinghouse, T-H & Edison systems. Pres. A. W. McCuno, V. Pres. R. C. Chambers, Sec, & Treas. Joseph S. Wells, Supt Walter P. Read. Capital, $300,000; authorized $1,000,000. Bonds $600,000. Office Hooper building. 9 2

Salt Lake Rapid Transit Co., Elec. 32 m, 4-8½ g, 35 79 lb T & girder r, 37 c of which 30 are m. c. and 7 t c. 3 h, 2 m. T-H., Edison and Westinghouse systems. Pres. J. S. Cameron, V. Pres. J. M. Donnellan, Sec. C. B. Jack, Treas. G. S. Garnett, Supt. A. M. Hinckley. Capital, $500,000. 6 2

West Side Rapid Transit Co. Steam. 7¼ m, 4-8½ g, 30 lb T r, 2 open c. Pres. S. F. Walker, V. Pres. A. C. Chambers, Sec. F. Harris, Treas. W. S. McCormick, Gen. Man. & Auditor, J. G. Jacobs. Capital, $112,500; authorized, $300,000. 6 2

SAN ANTONIO, TEX.—San Antonio St. Ry. Co. Elec. 40 m, 40, 50, 56 lb T r, 55 c, of which 40 are m c and 15 t c. T-H system. Pres. & Treas. W. H. Weiss, V. Pres. C. H. Weiss, Sec. E. R. Norton, Supt. J. W. Greer. Capital, $200,000; authorized, $1,000,000. Bonds, $200,000. 6 2

Alamo Electric St. Ry. Co. 10 m. 4-8½ g, 40 lb T r 20 c, of which 5 are 4-wheel box & 15 4-wheel open 10 m. c. T-H system. Pres. J. B. Shepard, V. Pres J. N. Groesbeck, Sec. E. McCrillis, Supt. J. C. Molloy Capital $200,000. 3 1

Rapid Transit St. Ry. Co. Elec. 5 m, 4-8½ g, 40 lb T r, 7 c, of which 3 are m c and 4 t c. T-H system. Pres. W. J. B. Patterson, V. Pres. R. H. Russell, Sec. & Gen. Man. G. S. Simons, Treas. C. W. Ogden, Supt. R. R. Salter. Capital, $200,000. Bonds, $100,000. 6 2

West End St. Car Co. Elec. 5½ m, 4-0 g, 30 lb T r, 6 c, of which 3 are m c and 3 t c. T-H system. Pres. & Gen. Man. G. W. Russ, V. Pres. F. H. Baldwin, Sec. J. N. Groesbeck, Treas. Thad. W. Smith, Supt. F. M. Dowden, Atty. L. W. Floren. Office, 285 Commerce St. 6 2

SAN BERNARDINO, CAL.—Southern California Motor Road Co. 12 m, 4-8½ g, 40 lb T r, 6 c, 3 steam motors. Receiver I. H. Polk, Sec. & Treas W. S. Hooper, Supt. H. T. McCrabbe. Capital $1,000,000. Office, 3rd & E Sts. 9 2

San Bernardino St. Ry. Co. 1½ m, 3 ft. g, 20 lb T r, 2 c, 2 h. Pres. I. R. Brunn, Sec. & Treas, W. S Hooper. Capital $50,000. 9 2

SAN DIEGO, CAL.—San Diego St. Car Co. 7 m, 4-8½ g, 16, 20, 30 & 38 lb r, 50 c, 200 h, 12 steam motors. Pres. Milton Santee, V. Pres. O. S. Hubbell. Capital, $250,000. a 1

San Diego Cable Ry. Co. 10¼ m, 3-6 g, 20-30 Z & T r, 14 c of which 10 are comb'n & 4 open. Pres. D. D Dare, V. Pres. S. D. Havermale, Sec. J. E. O'Brien Supt. G. B. Hursley, Gen. Man. J. C. Fisher. Capital $500,000. Office. Spruce & 4th Sts. b 5 1

San Diego Electric Ry. Co. 9 2-3 m, 4-8½ g, 16-38 lb T & flat r, 31 c, 100 h, 16 mu. Pres. A. B. Spreckels, V. Pres. & Gen. Man. E. S Babcock, Sec., Treas. & Asst. Man J. A. Flint. Capital $250,000, bonds $250,000. Office Santa Fe Wharf. 3 2

San Diego, Old Town & Pacific Beach R. R. Co. Dummy. 11 m, 4-8½ g, 40 lb. r, 11 passenger c, and 3 motors. V. Pres. J. Gruendike, Sec. & Gen. Man. D. P. Hale. Capital, $250,000. 3 2

SAN FRANCISCO, CAL.—California Street Cable R.R. Co. 11 m, 3-6 g, 34 lbs-b r, 60 c. Pres. J. B. Stetson, V. Pres. Antoine Borel, Sec. Albert Stetson Treas. A. Borel & Co., Gen. Man. & Supt. J. W. Harris. Office, 1435 California st. 9 2

Central R. R. Co. 12 m, 5 g, 45 lb tram r; 47 c, 154 h Pres. Chas. F. Crocker, V. Pres. W. V. Huntington Sec. & Gen. Man. J. L. Willcutt, Treas. N. T. Smith, Supt. J. F. Clark, Man. of Purchases & Supplies, R. P. Schwerin. Office. 4th and Townsend Sts. Capital $1,000,000. 7 2

City R. R. Co. 11 m, 5 g, 45 lb r; 77 c, 251 h. Pres Chas. F. Crocker, V. Pres. W. V. Huntington, Sec. & Gen. Man. J. L. Willcutt, Treas. N. T. Smith, Supt. N J. Balley, Man. of Purchases & Supplies, R. P Schwerin. Office, 4th & Townsend sts. 7 2

Clay St. Hill R. R. Co. (Operated by Ferries & Cliff House Ry. Co.)

Ferries & Cliff House Ry. Co. (Includes Clay St. Hill, Park & Cliff House and Powell St.) 22 m, of which 15 are cable and 6 steam. 3-6 g cable, 3 g steam, 40-45 lb r, 76 c, of which 60 are cable and 16 steam, 8 motors. Pres. W. J. Adams, V. Pres. & Treas. J. Ballard, Sec. Geo. H. Waggoner, Supt. H. H. Lynch. Capital, $2,500,000. Bonds $650,000; guaranteed $1,050,000. Office, 1201 Mason st. 3 2

Geary St., Park & Ocean R. R. Co. Cable. 9 m, 5 g 72 lb c b r; 66 c, of which 26 are g c, 4 steam motors Pres. Chas. F. Crocker, V. Pres. A Grant, Sec. & Gen Man. J. L. Willcutt, Treas. N. T. Smith, Supt. A. W Barron, Man of Purchases & Supplies, R. P. Schwerin. Capital $1,000,000. Office, 4th & Townsend Sts 7 2

Market St. Cable Ry. Co. (Operates Ocean Beach and Park & Ocean.) 28 m, of which 2 are horse & 26 cable, 4-8½ g, 37 lb combination r, 232 c of which 188 are cable & 44 h c, 153 being 8-wheel box & 44 4-wheel box & 35 8-wheel open, 93 h. Pres. Leland Stanford, V. Pres. Chas. F. Crocker, Treas. N. T Smith, Sec. & Gen. Man. J. L. Willcutt, Supt. A. W Barron, Man. of Purchases and Supplies, R. P Schwerin. Capital, $5,000,000. Office, 4th & Townsend sts. 7 2

Metropolitan St. Ry. Co. 5 m, 30 m c. T-H system. 7 2

North Beach & Mission Ry. Co. 24 m. 5 g, 45, 62 lb flat & girder r, 49 c, 450 h. Pres. G. W. McNear V Pres. J. R. Spring, Sec. H. W. Hathorne, Treas A. Meyer, Supt. M. Skelly, Asst. Supt. J. W. Reid Office, 4th & Louisa sts. Capital $2,000,000; authorized $3,000,000. 9 2

Ocean Beach Ry. Co. (operated by Market St. Cable Ry Co.) 2 m, 4-8½ g. Pres. Leland Stanford, V. Pres. Chas. F. Crocker, Treas. N. T. Smith, Sec. J. L. Willcutt. Office, 4th & Townsend sts. 12 1

Omnibus Cable Co. 56 m, of which 30 are horse and 26 cable, 3-6 & 5 g, 51 lb T & s. b. r, 213 c, of which 177 are box and 36 open and 143 g. c. 500 h, 130,000 ft. of cable. Pres. Gustav Sutro, Sec. Th. Kraus, Supt. C. L. Anderson, Ch. Engr. H. Fairchild. Capital $2,000,000. Office Howard & 10th sts. 2 2

Pacific Improvement Co. 14 m c. T-H system. 7 2

Park & Cliff House Ry. Co. Bonds $350,000. (Operated by Ferries & Cliff House Ry. Co.)

Park & Ocean R. R. Co. 9 m, 4-8½ g, 35 & 45 lb T r, 7 steam motors, 16 pass. c, of which 4 are 8-wheel box & 12 8-wheel open, 6 flat and section c Pres Chas. F. Crocker, V. Pres. Timothy Hopkins, Treas. N. T. Smith, Sec. J. L. Willcutt. Capital, $250,000. Office, 4th & Townsend sts. Operated by Market St. Cable Ry. Co. 12 1

Potrero & Bay View R. R. Co. 3¼ m, 5 g, 35 lb flat & T r, 10 1-h c, 58 h. Pres. Leland Stanford, V. Pres Chas. F. Crocker, Treas. N. T. Smith, Sec. J. L Willcutt, Supt. H. O. Rogers, Man. of Purchases & Supplies R. P. Schwerin. Office, 4th & Townsend sts. 7 2

Powell St. Ry. Co. Bonds $700,000, (Operated by Ferries & Cliff House Ry. Co.)

Presidio & Ferries R. R. Co. 11½ m of which 7½ are cable, 2 horse & 2 steam, 5 g, 40 & 42 lb c b r, 30 c of which 4 are h c and 26 g c, 30 h. Pres. & Supt. W Clift, V. Pres. G. A. Newhall, Sec. John B Leighton Treas. J. C. Johnson. Capital $550,000; authorized $4,000,000. Bonds $150,000. Office, 1,111 Union St. 6 2

San Francisco & San Mateo Ry. Co. 21 m, 4-8½ g 50 lb T & comb'n r, 33 c, of which 30 are m c and 3 t c. T-H system. Pres. & Gen. Man. B. Joost, V Pres. C. C. Butler, Sec. G. T. Smith, Treas. Nevada Bank of San Francisco. Capital $2,000,000. Bonds $1,100,000. Office 30th St. & San Jose Ave. 7 2

Sutter St. Ry. Co. 13 m of which 1.3 are horse & 11.7 cable, 5 g, 46 lb s b r, 50 c, 100 h. Pres. R. F Morrow, V. Pres. J. L. Schmitt, Sec. A. K. Stevens Treas. M. Schmitt, Supt. J. Reynolds. Office, corner Sutter & Polk sts. Capital $2,000,000. 6 2

SAN JOSE, CAL.—San Jose & Santa Clara R.R. Co Elec. 12 m, of which 1 is horse & 11 elec. 3 g, 20 & 35 lb T r, 21 c, of which 15 are m c. and 6 t. c, 20 h. T-H & Edison systems. Pres. J. H. Henry, V. Pres. & Gen Man. J. P. Burke, Sec. J. T. McGeoghegan, Supt. G K. Edwards. Capital $500,000. Office, The Alameda 6 2

First St. R. R. Elec. 10 m, 3 g, 30 lb steel T r, 12 c of which 7 are m. c. and 5 t. c. T-H system Jacob Rich, Sole Owner; Sec. E. M. Rosenthal. 2 2

First St. & San Pedro St. Depot R. R. Co. Pres. Frank C. Bethel.

San Jose & Alum Rock Park Motor Road. 4 m, 3 g, 30 lb T r; 18 c, of which 6 are Damar Best Electro Vapor motor cars and 12 t c. Capital $150,000. Address R. H. Quincey, San Jose. 3 2

Willow Glen R.R. 2½ m, 3 g, 20 lb steel T r, 3 c, 20 h Sole owner Jacob Rich, Sec. E. M. Rosenthal. 7 0

SAN LUIS OBISPO, CAL.—San Luis St. Ry Co. 2½ m, 3 g, 16 lb T r, 5 c, of which 2 are 4-wheel box & 3 4-wheel open, 10 h. Owned by West Coast Land Co. Man. C. H Phillips. Office, Higura St. 6 2

SANDUSKY., O.—Sandusky St. Ry. Co. Elec. 8 m, 4-8½ g, 45 lb Johnson girder r, 9 m. c., of which 7 are box and 2 open, Westinghouse system Pres. J. O. Moss, V. Pres. A. J. Stoll, Sec. & Treas G. F. Anderson, Supt. E. G. Schmidt. Capital $100,000, a 3 2

People's Electric Railway Co. 6¾ m, 4-8½ g, 40-45 lb T & girder r, 8 m c. Westinghouse system. Pres. H. C. Post, V. Pres. G. Barney, Sec. & Treas. A. W. Prout, Gen. Man. T. Wood, Supt. E. L. Crawford Capital $80,000; authorized $1,000,000. Bonds $31,500 Office 122 Lawrence st. 9 2

SANTA ANA, CAL.—Santa Ana, Orange & Tustin St. Ry. Co. 10 m, 3-6 g, 16 & 25 lb steel T r, 6 c, 18 h, 5 mu. Pres., Supt. & Gen. Man. M. J. Bundy, V Pres. Noah Palmer, Treas. Commercial Bank, Sec Miss. M. A. Ross-Lewin. Office, 419 North Main St Capital $50,000. a 5 1

SANTA BARBARA, CAL.—Santa Barbara St. R.R. Co. and Citizens' St. R. R. Co. of Santa Barbara. 7 m, 3-6 g, 20 lbs T r, 7 c, 36 mu. Pres. Warren Gillilen, Sec. & Supt. C. R. Diver, Treas. G. H. Bonebrake. Capital $50,000; bonds $50,000. Office, State st. 1 3 2

SANTA CRUZ, CAL.—Pacific Av. R. R. Co. 4½ m, 3 g, 20, 40 lb girder & T r, 9 c, of which 2 are box and 7 open, 15 h. Pres. A. P. Holding, V. Pres. J Lawton, Sec. J. R. Chase, Supt. & Gen. Man. E. S West. Capital, $100,000. 2 2

Santa Cruz, Garfield Park & Capitola Electric Ry Co. 8 m, 3-2 g, 45 lb comb'n & T r, 8 c, of which 6 are m c and 2 t c. T-H system. Pres. J. H. Logan, V. Pres. E. G. Green. Sec. F. W. Swanton, Treas. Bank of Santa Cruz County, Gen. Man F. W. Ely. Capital $100,000. 7 2

SANTA ROSA, CAL.—Santa Rosa, St. R. R. Co. 1½ m, 3-6 g, 12 lb T r, 5 c, 4 h, 3 mu. Pres., Sec. & Treas. M. L. McDonald, Gen. Man. & Supt. J. H. McPike. Capital, $25,000. a 3 2

South Side St. Ry. Co. 2 m, 4-8½ g 35 lb flat r, 4 c of which 1 is 4-wheel box & 3 4-wheel open, 4 h Pres. & Gen. Man. B. M. Spencer, Sec. J. W. Farnham, Supt. B. Hottenger. Capital $10,000. Office Occidental Block. 7 2

SARATOGA, N. Y.—Union Electric Ry. of Saratoga. 10 m, 4-8½ g, 50 lb T r, 20 c, of which 8 are m c and 12 t c. T-H system. Pres. C. E. Arnold Sec. M. Nussbaum, Treas. E. J. Slattery. Capital $300.000. Bonds, $100,000. 9 2

SARNIA, ONT.—Sarnia St. Ry. Co. 4 m, 4-8½ g, 40 lb Tr, 7 c, 21h. Pres. Jas. S. Symington, V. Pres James Smith, Sec. & Gen. Man. H. W. Mills. Capital, $30,000. Office, Industrial Bank Building. 9 2

SAUGATUCK, CONN.—Westport & Saugatuck Horse R. R. Co. (See Westport, Conn.

SAULT STE. MARIE, MICH.—Sault Ste. Marie St. Ry. Co Elec. 4.25 m, 4-8½ g, 20 lb T r, 5 m. c. Detroit system. Pres. Thos. Ryan, V. Pres. B. F. McEvoy, Sec. & Treas. James R. Ryan, Gen. Man. Lorenzo G. Cody, Supt. G. A. Cody. Capital, $25,300. Cash paid in to equip, $60,000. 7 1

SAVANNAH, GA.—City & Suburban R. R. 17½ m, of which 7 are horse & 10½ steam, 5 g, 35, 40, 45 lb c b & T r, 24 open c, 64 h, 82 mu. Pres. & Gen. Man. J H. Johnston, Sec. E. J. Thomas, Treas. E. Schmidt, Supt. G. W. Alley. Capital, $50,000. 3 2

Coast Line R.R. Co. 7 m, 5 g, 35 lb r, 20 c, engine, 35 h, & mu. 5 m suburban line 35 lb T r, steam. Pres. Geo. Parsons, New York, Treas. & Gen. Man. J. H. Jonhston, Sec. & Supt. A. G. Drake. Office, Bolton st. c 9

Savannah St. Ry. Elec. 12½ m, 4-8½ g, 50 lb T & c b r, 26 c, of which 17 are m c and 9 t c. T-H system. Pres. W. G. Cooper, Sec. H. C. Cunningham Treas. & Gen. Man. Clement Saussy. Capital, $100,000 authorized, $500,000. Bonds, $250,000. Office, Haversham & St. Thomas sts. 9 2

Savannah, Thunderbolt & Isle of hope Ry. Co Elec. 6 m, 5 g, 45, 50 lb c b & T r, 9 c, of which 8 are m c and 1 t c. T-H system. Pres., Treas. & Gen Man. J. H. Johnston, V. Pres. H. Parsons, Sec. E. J Thomas, Supt. G. W. Alley. 10 2

SCHENECTADY, N.Y.—Schenectady St. Ry. Co Elec. 5½ m, 4-8½ g, 60 lb steel girder r, 11 m. c. Edison system. Pres. John Kreusi, V. Pres. S. Insull Sec. F. A. Stevenson, Treas. W. E. Gilmore, Supt. R J. Sherrill. Capital $300,000. Bonds $250,000. 1 2

SCRANTON, PA.—People's St. Ry. Co. Elec (Operates Nayaug, Crosstown, Scranton Suburban & Scranton Passenger). 30 m, 4-8½ g, 40 & 52 lb girder & T r, 40 c, of which 35 are m c and 5 t c. Edison T-H & Wightman systems. Pres. R. T. McCabe V Pres. &Gen. Man. P. S. Page, Sec. & Treas. Horace E. Hand, Supt. W. S. Mears. Capital, $600,000. 7 2

Scranton Passenger Ry. Co. Gen'l Elec. and Wightman systems. Pres. P. S. Page, Sec. & Treas. H. E. Hand. Capital, $50,000. Bonds, $100,000. Owned and operated by People's St. Ry. Co. 7 2

Scranton & Suburban Ry. Co. Merged with Nayaug and Crosstown Ry. Gen'l Elec. and Wightman systems. Pres. H. M. Edwards, Sec. & Treas. H. E. Hand. Capital, $100,000. Bonds $200,000. Leased to and operated by People's St. Ry. Co. 7 2

SEARCY, ARK.—Searcy & West Point R.R. Co 8½ m, of which 3½ are horse & 5 steam, 4-8½ g, 35 lb T r, 4 c, of which 2 are h c and 2 steam; 1 mu Pres. J. Hicks, V. Pres. E. A. Robbins, Sec. W. S Lay, Treas. J. S. Sanford, Gen. Man. W. H. Lighte Att'y J. T. Heicks. Capital $75,000. 9 2

SEATTLE, WASH.—Front Street Cable Ry. Co 5 m, 4-8½ g, 45 lb flat r, 16 c, of which 6 are g c, 4 combination c and 6 t c. Pres. A. B. Stewart, V. Pres. A. P. Mitten, Sec. M. McMicken, Treas. J. Furth, Asst. Sec. W. B. Goodrich, Supt. S. Gibson. Capital $600,000 Office Madison St. Power House. 10 2

Grant Street Electric Ry. Co. 7 m, 3-6 g, 56 lb girder & T r, 12 m c. Pres. & Gen. Man. F. E. Sander V. Pres. N. B. Sander, Sec, & Treas. L. D. Bruns Ass't Sec. W. B. Goodrich, Supt. J. A. Dozier. Capital $200,000. Bonds, $125,000. 9 2

Green Lake Electric Ry. Co. 4½ m elec. 4-8½ g, 40 lb T r, 2 4-wheel box m. c. T-H system. Pres. W. D. Wood, V. Pres. & Gen. Man. E. C. Kilbourne. Sec. & Treas. C. A. Kilbourne. Capital, $60,000; authorized, $70,000. Bonds, $50,000. Office, 815 Second St. 6 2

Madison St. Cable Ry. Co 7½ m, 3-6 g, 45 lb steel r, 16 comb'n c. Pres. H. G. Struve, V. Pres. R. H Denny Sec. M. McMicken, Treas. J. Furth, Asst. Sec. W. B. Goodrich, Supt. S. Gibson. Capital $750,000. Office Madison St. Power House. 10 2

North Seattle Cable Ry. Co. 2 m, 4-8½ g. Pres. A P. Mitten, V. Pres. G. H. Heilbron, Sec. M. McMicken Treas. J. Furth, Supt. S. Gibson. Capital, $350,000 Extension of Front Street Cable Ry. Office, Madison St. Power House. 10 2

Rainier Avenue Electric Ry. Co. 8 m, 4-8½ g, 35-45 lb T & girder r, 4 m. c. T-H system. Pres. J. K. Edmiston, V. Pres. S. L. Bowman, Sec. & Treas. F. W. Goodhue, Supt. W. M. Camp. Capital $250,000. 9 2

Rainier Ry. & Power Co. 6 m, elec, 4 8½ g, 40 lb T & girder r, 8 m c. Westinghouse and Short systems. Pres. D. T. Denny, Sec. J. B. Denny, Treas. Geo. Kinnear. Capital, $500,000. 12 1

Scattle City Ry. Co. Cable. 5 m. 3 g, 16 lb T r, 28 c, of which 12 are g. c. & 16 t. c. Pres. S. C. Wilmans V. Pres. F. W. Wilmans, Sec. O. S. Buckbee, Treas 1st Nat. Bank, Gen. Man. A. F. Haas. Capital, $600,000 Office, Power House, Yessler Ave. 9 2

Seattle Consolidated St. Ry. Co. Elec. 22½ m, 4-8½ g, 40-45 lb T & girder r, 26 m c T-H system. Pres. & Gen. Man. L. H. Griffith, V. Pres. J. F. Hale, Sec. V. H. Smith, Treas. E. C. Kilbourne, Aud'r A. Dunn. Capital $1,200,000; authorized $1,500,000. Bonds $861,000. Office 5th & Pine sts. 7 2

South Seattle Cable Ry. Co. Elec. 5 m, 4-8½ g T r, 2 m c. T-H system. Pres. A. P. Mitten, V. Pres G. H. Heilbron, Sec. M. McMicken, Treas. J. Furth Asst. Sec. W. B. Goodrich, Supt. S. Gibson. Capital $450,000. Office Madison St. Power House. 10 2

Union Trunk Line. 10¾ m, of which 10 are elec and ¾ cable; 4-8½ g, 15 m c. T-H system. Pres, E F. Wittier, V. Pres. J. F. McNaught, Sec. J. D Lowman. Capital, $1,000,000. 12 1

West Seattle Cable Ry. Co. 4 m, 3-6 g, 4 c. Pres. T. Ewing. Capital $150,000. 12 1

West St. & North End Electric Ry. Co. 10 m, 4-8½ g, 35 & 50 lb T & girder r, 14 c, of which 13 are m c and 1 t c. T-H system. Pres. D. H. Gilman V. Pres. & Sec. W. R. Ballard, Gen. Man. & Supt. S L. Shuffleton. Capital, $1,000,000. Office, 3rd & Union Sts. 6 2

SEDALIA, MO.—Sedalia St. Ry. Co. Elec. 4 m 4 motor c, Edison system. Pres. Joseph D Sicher V. Pres. Louis Deutsch, Treas. F. H. Guenther, Sec Chas. S. Conrad. Office Third & Ohio sts. f

The Electric Ry., Light & Power Co. of Sedalia. 8 m, 4-8½ g, 35 lb T r, 18 c, of which 4 are h. c, 8 m. c and 6 t. c. Edison system. Pres. W. E. Sterne, V Pres. R. R. Moore, Sec. Treas. & Man. D. C. Metsker Supt. Chas. Carroll. Capital, $200,000. Bonds, $175-000. Office, 207 E. 3d St 9 2

SELMA, ALA.—Selma St. & Suburban Ry. Co. Dummy. 8 m, of which 2½ are horse and 5½ steam 4-8½ g, 20 & 35 lb T r, 10 c, of which 6 are h c and 4 t c, 1 steam motor, 20 mu. Pres. S. H. March, Sec. & Treas. R. H, McFadden. Capital, $30,000. 3 2

SENECA FALLS, N. Y.—Seneca Electric Ry Co 3½ m, 4-8½ g, 40 lb T r, 6 c, of which 2 are m c, & 4 t c. T-H system. Pres. S. L. Phillips, V. Pres. & Treas. J. H. Gould, Sec. C. H. Williams, Supt. E. F. Slack. Capital, $50,000. 9 2

SHAMOKIN, PA.—Shamokin Electric St. Ry. Co 2¼ m, 5-2 g. 48½ lb girder r, 3 m c. T-H. system Pres. & Gen. Man. E. C. Hamilton, Sec. J. J. John Treas. M. Markle, Supt. W. B. Rommel. Capital $50,000. 2 2

SHEBOYGAN, WIS.—Sheboygan City R. R. 9½ m, 4-8 ½ g, 35-40 tram r, 10 c, 20 h, 30 mu. Pres. J. M Saemann, Sec. & Treas. F. I. Saemann, Supt. C. F Bacon. Address, J. M. Saemann & Son. Capital $50,000. 7 2

SHEFFIELD, ALA.—Sheffield St. Ry. Co. 9 m, 4-8½ g, 35 lb steel r, 5 c, 2 steam motors. Pres. H. B. Tompkins, Supt. W. S. White, Asst. Supt. P. N. Totten, Sec. M. McTyer. Treas. C. D. Woodson. Capital $50,000. e 9

SHERMAN, TEX.—Sherman City R. R. Co. 4 m 4 8½ g, 20,35 lb T r, 9 c, 50 mu. Pres. & Owner C. W Batsell, Treas. J. M. Batsell. Office, Mulberry st. 6 2

College Park Rapid Transit Co. Elec. 5 m. 4-8½ g 25 lb T r, 5 m. c, Edison system. Pres. J. M Culiers, V. Pres. J. R. Cole, Sec. C. W. Lewis, Treas J. P. Harrison, Supt. H. C. Morrow. Capital, $24,000 authorized, $100,000. 1 2

SHREVEPORT, LA.—Shreveport City R.R. Co. 1½ m, 4-4 g, 46 lb r, 6 c, 14 h. Pres. S. Levy, Jr., V. Pres. P. J. Trezevant, Sec. Jules Dreyfuss. 9

Shreveport Ry. & Land Improvement Co. Elec. 5¼ m, 4-8½ g, 40-45 T & Johnson girder r, 8 c, of which 4 are m. c. & 4 t. c. T-H system. Pres. S. B. McCutchen, Sec. W. B. Jacobs, Gen. Man. J. R. Jones, Supt. J. G. Keller. Capital, $32,000; authorized $100,000. Bonds $100,000. Office 525 Spring St. 9 2

SIOUX CITY, IA.—Sloux City St. Ry. Co. Elec 17 m, 4 g, 30, 40, 45 & 58½ lb. girder r, 50 c, of which 27 are m. c. and 23 t. c., T-H, Westinghouse & Edison systems. Pres. Jas. F. Peavey, V. Pres. J. Hornick, Sec. & Treas C. L. Wright, Supt. A. B. Peavey Capital, $300,000; authorized, $1,500,000. Office, Second & Water sts. 6 2

Riverside Park Ry. Co. 9 m elec., 4-8½ g, 40 lb steel T r, 20 c, of which 6 are m. c. 8 t. c. and 5 freight c Westinghouse system. Pres. O. J. Taylor, V. Pres. Jas E. Booge, Sec. & Treas. C. M. Swan, Supt. B. J. Jones Capital $250,000. Office, United Bank Bldg. 9 2

Sioux City & Morning Side Ry. Co. Dummy. 6 m, 4-8½ g, 50 lb T r, 6 c. Pres. J. N. Jackson, Sec. T. C. Prescot, Treas. D. L. Pratt. Capital $100,000. 3 2

Sioux City & Leeds Electric Ry. Co. 5.9 m, 4-8½ g T r, 5 m c. Detroit system. Sec. C. C. Peirce. 8 2

Sioux City Cable Ry. Co. 7 m, 4-8½ g, 45 lb Johnson girder r, 34 c, of which 14 are g c and 20 t c. Pres J. Peirce, Sec. D. T. Hedges, Treas. W. V. Hedges, Gen. Man. & Supt. C. Moller. Capital, $250,000. 9 2

Sioux City Rapid Transit Co. Steam. 5½ m, of which 2 m are elevated track; 4-8½ g, 35 &50 lb T r, 8 8-wheel c. Pres. J. F. Cheney, V. Pres. S. W. Skerry Sec. H. W. Rice, Treas. A. S. Garretson, Gen. Man & Supt. J. C. Twombly. Capital, $150,000; authorized $1,000,000. Bonds, $250,000. Office, Chamber of Commerce Bldg. 2 2

SIOUX FALLS, S. DAK.—City St. Ry. Co. 9 m 4-g½ g, 30 lb. r, 6 c, 40 h. Pres. R. S. Pettigrew, V. Pres. L. T. Dunning, Sec. & Treas. S. L. Tate. 3 2

S. Dakota Rapid Transit Ry. Co. Elec. 7¾ m, 4-8½ g, 35 & 45 lb T & tram. r, 5 c, of which 3 are m c and 2 t c. Edison system. Pres. & Gen. Man. W. R. Kingsbury, V. Pres. C. W. Hubbard, Sec. J. T. Tuttle, Jr., Treas. C. E. Johnson, Supt. R. L. Wells Capital, $100,000. Bonds, $75,000. 6 2

SOUTH BEND, IND.—South Bend & Mishawaka St. Ry. Co. Elec. 15 m, of which 5 are horse and 10 elec; 4-8½ g, 35 lb T & tram r, 15 c, of which 2 are h c, 8 m c and 5 t c; 13 h. T-H system. Pres. J McM. Smith, Gen. Man. C. F. Bolling. Capital $200,000; authorized, $250,000. Bonds, $250,000. 2 2

SOUTH CHICAGO, ILL.—See Chicago.

SOUTHINGTON, CONN.—Southington & Plantsville Tramway Co. Elec. 2 1-6 m, 4-8½ g, 25 lb T r, 2 m. c. T-H. system. Pres. J. H. Osborne, V. Pres. R. W. Cowles, Sec. & Gen. Man. L. E. Southworth, Treas. S. Walkley, Supt. T. L. Dawson. Capital, $20,000. Bonds, $16,000. Office, Centre st. 9 2

SPOKANE WASH.—Spokane & Montrose Motor R. R. Co. Elec. 3¼ m. 3-6 g, 30 & 35 lb T r, 4 m c T-H and Short systems. Pres. & Treas. Francis H. Cook, V. Pres. E. A. Routhe, Sec. L. C. Cook. Capital $50,000. Bonds $40,000. 3 2

City Park Transit Co. Elec. 7 m, 4-8½ g, 35 lb. T r, 5 m. c. Lidgerwood system.. Pres. D. Glass, Sec & Treas. C. Glass, Supt. E. J. Comley. Capital $250,000. 10 2

Spokane Electric Ry. Co. (controlled by Washington Water Power Co.) Capital $100,000. 7 2

Spokane Cable Ry. Co. (controlled by Washington Water Power Co.) Capital, $200,000. 6 2

Spokane St. Ry. Co. (Controlled by Washington Water Power Co. Includes Spokane Electric Ry. and Spokane Cable Ry.) Elec. 25 m, of which 3 are cable and 22 elec., 4-8½ g, 30, 35 & 40 lb T r, 46 c, of which 6 are g c, 26 m c and 14 t c. T-H and Edison systems. Capital, $500,000. Bonds of all roads authorized, $600.000.

SPRINGFIELD, ILL.—People's Electric Ry. Co Elec. 11½ m, 4-8½ g, 40 lb T r, 42 c, of which 12 are open, 17 m c and 13 t c. Detroit and Edison systems. Pres. & Gen. Man J. H. Schirck, Sec. Chas. F. Herr man, Treas. Frank Reisch, Supt. D Grady. Capital, $200,000. Bonds, $200,000. Office Washington st. 6 2

Springfield City Ry. Co. Elec. 10½ m, 4 8½ g, 35, 40 60 lb Johnson girder & T r, 22 c, of which 14 are m c and 8 t c, 4 h. T-H system. Pres., Treas & Gen. Man. R. N. Baylles, V. Pres. G. T. Van Ginkel, Sec. Ed. W. Payne, Supt. F. Eck. Capital, $125,000. Office, Monroe st., bet. 4th & 5th. 6 2

SPRINGFIELD, MASS.—Springfield St. Ry. Co. Elec. 20¾ m, of which 8¾ miles are horse and 17½ elec, 4-8½ g, 56 lb T r, 100 c, of which 8 are h. c. and 92 m. c. T-H system. Pres. John Olmsted, Treas. & Man. A. E. Smith. Capital $700,000. Office cor. Main & Carew sts. 6 2

SPRINGFIELD, MO. — Metropolitan Electric Ry Co. 15 m, 4-8½ g, 45 lb Johnson girder r, 30c of which 16 are m. c. and 14 t. c.. Westinghouse system. Pres. B. F. Hobart, Sec. & Gen. Man. Frank B. Smith. Capital, $550,000; authorized, $600,000. Bonds, $550,000. 6 2

SPRINGFIELD, O.—Citizens' St. R.R. Co. 17 m, 4 g, 36 lb tram r, 38 c, 204 h. Pres. Ross Mitchell V. Pres. A. S. Bushnell, Sec. & Treas. Chas A Harris, Supt. W. H. Hanford. Capital $200,000. Office, Lagonda House block. 7 2

Springfield Electric Ry. Co. 5 m, 6 m. c. T-H system. 7 2

STAMFORD, CONN.—Stamford Street R. R. Co. 4½ m, 4-8½ g, 25 lb T r, 9 c, 35 h. Pres. & Treas. R A. Fosdick, V. Pres. Wm. W. Gillespie, Sec. L. J. Curtis, Supt. Wm. H. Hay. Capital $82.000; authorized $100,000. Bonds $51,000. Office, Fessenden Block. 3 2

STATEN ISLAND, N. Y. — Staten Island Belt Line R. R. Co. 9 m, 4-8½ g, 25 lb T r, 10 c, 3 h. Receiver James D. Van Hoevenburg, 189 Broadway New York, Pres. M. E. Graves. Office, Tompkinsville. 9 2

Port Richmond & Prohibition Park R. R. Co. Elec 2 m, 4-8½ g, 56 lb flat r, 15 c. Pres. J. Starbuck V. Pres J. C. Thompson, Sec. & Treas. R. G. Vilas Capital, $50,000. Office, West New Brighton, N. Y 7 2

South Beach Ry. Co. Elec. 6 m, 4-8½ g, 45 lb T & flat r, 10 c. Pres. F. H. Skeele, V. Pres. A. L. King Sec. E. S. Kaufman, Treas. V. A. Krepps, Gen. Man A. H. Farrar. Office, 38 Wall st., N. Y. j 8 0

STAUNTON, VA.—City St. Car Co. 5½ m, 4 8½ g 25 & 42 lb. T & girder r, 13 4-wheel box c, 70 mu Pres. E. K. Sibley, New York; V. Pres. D. D. Parmley; Treas. Andrew Spotts, New York; Gen. Man. R. D Apperson, Staunton, Va. Capital $50,000. 1 2

ST. CATHARINE'S, ONT.—St. Catharine's, Merritton & Thorold St. Ry. Co. Elec. 8½ m, 4-8½ g, 30 lb T & flat r. 10 c, of which 8 are m. c. and 2 t. c. Van Depoele system. Pres. W. B. Gilleland. V. Pres. & Gen. Man. T. Nihan, Sec. & Treas. T. E. Nihan, Jr. Capital, $80,000. Office, St. Paul st. 3 2

ST. CLOUD, MINN.—St. Cloud City St. Car Co. Elec. 4 m, 4-8½ g, 40 lb T r, 4 m c. T-H system. Pres. C. P. McClure, V. Pres. O. W. Baldwin, Sec. Frank Tolman, Treas. A. G. Whitney, Supt. J. S. Bassett 5 2

St. Cloud & Sauk Rapids Ry. Co. 3 m, 2 m c. T-H system. 7 2

STEUBENVILLE, O.—Steubenville Ry. & Elec. Co. 5 m, 4-8½ g, 35 lb girder r, 6 m. c. Edison system. Pres. D. B. Toucey, V. Pres. W. B. Donaldson, Sec. & Treas. T. N. Motley, Supt. J. F. Flood. Capital, $70,000. Office, 96 Broadway, New York. 3 2

STERLING, ILL.—Union St. Ry. of Sterling & Rock Falls. 7 m, 7 m c. Edison system. Pres A.H. Howland, Sec. & Supt. W. J. Watson, Treas. G A. Ellis. 7 2

STILLWATER, MINN.—Stillwater St. Ry. Co. Elec. 5 m, 4-8½ g. 30 lb. T & tram r, 6 m. c. Edison system. Pres. W. L. Allen, V. Pres. T. O. Swiney Sec. & Treas. E. D. Allen, Supt. J. S. Barrett. Office Davenport, Ia. 7 1

STILLWATER, N. Y.—Stillwater & Mechanicville St. Ry. Co. 4½ m, 4-8½ g, 25-30 lb T & flat r, 4 c, of which 3 are 4-wheel box and 1 4-wheel open, 8 h Pres. & Gen. Supt. W. L. Denison, V. Pres. P. Van Vechten, Sec. & Treas. Edw. I. Wood, Supt. & Gen. Man. W. L. Denison. Capital $40,000. 6 2

ST. JOHN, N. B.—St. John St. Ry. Co. Elec. 7 m. 4-8½ g, 45-60 lb r, 8 m c. Edison system. Pres. & Treas. John F. Zebley, Sec. Austin Gallagher. Office Room 39 Drexel Bldg., New York, and St. John, N. B. 6 0

ST. JOSEPH, MICH.—St. Joseph & Benton Harbor Electric Ry. & Light Co. 5 m, 4-8½ g, 45 & 52 lb T & Johnson r, 16 c, of which 4 are h c, 6 m c and 6 t c. 29 h. Pres. & Gen. Man. W. W. Bean, V. Pres. G. M. Bell, Sec. W. H. Hull, Treas. W. G. Keith, Supt. H. C. Mason. Capital, $100,000. 6 2

ST. JOSEPH, MO.—People's St. Ry., Electric Light & Power Co. 10 m, 4-8½ g, 28, 35 & 52 lb flat girder & T r, 33 c, Pres. J. T. Gardiner, V. Pres. & Man. W. T. Van Brunt (St. Joseph). Sec. J. B. Newcomer, Supt. J. H. Van Brunt. Office, 511 Francis s 6 2

Union Ry. Co. Eloc. 11 m, 4-8½ g, 78 lb. Johnson girder r, 34 m. c., 24 motors. Pres. Jas. Craig, V Pres. H. King, Sec. & Treas. A. Steinecker, Supt. C Wilson, Gen. Man. T. Steinecker. Capital $500,000 c 3 1

ST. LOUIS, MO.—Baden & St. Louis R. R. 3 m, 4-10 g, 24,28,42½ lb T & tram r, 12 c, 27 h. Pres. & Gen. Man. Geo. S. Caso, V. Pres. F. J. McMaster Supt. H. Nelson. Capital, $50,000. Office, Broadway near Baden ave. 6 2

Benton-Bellefontaine Ry. Co. Elec. 13 m, 4-10 g, 78 lb girder r, 50 c, of which 36 are m. c. and 14 t. c. T-H system. Pres. James Campbell, V. Pres. & Gen Man. Robert McCulloch, Sec. W. F. Reed, Supt. J W. Todd. Capital, $325,000; authorized, $500,000 Bonds, $500,000. Office, 4238 N. 20th st. 9 2

Cass Avenue & Fair Ground Ry. Co. (operates Northern Central and Union Rys.) 8½ m, 4-10 g 52 lb., r, 60 c, of which 30 are box & 30 open, 320 h & mu. Pres. D G. Hamilton (Chicago) V. Pres. & Gen. Man. Robt. McCulloch, Sec. & Treas. C. N Duffy, Capital $300,000. Office 3,820 Easton Ave. 6 2

Citizens' Ry. Co. 16 m, 13 of which are cable, & 3 horse 4-10 g, 63 lb girder r, 172 c, of which 57 are box, 60 open & 55 g. c, 67 h & mu. Pres. D. G. Hamilton (Chicago), V. Pres. & Gen. Man. Robt. McCulloch Sec. & Treas. C. N. Duffy. Capital $1,500,000. Office, 3,820 Easton Ave. 6 2

Forest Park & Laclede Ave. & Fourth St. Ry. Co Elec. Operated by Missouri R. R. Co.

Fourth St. & Arsenal Ry. Co. 5 m, 4-10¾ g, 44 lb steel tram r, 12 box c, 90 h. Pres. Chas. Green, V Pres. & Gen. Man. J. Mahoney, Sec. & Treas. R. J. Macdonald. Capital $150,000. Office 1,801 Park ave. 1 2

Jefferson Ave. Ry. Co. 5.7 m, 4-10 g, 56 lb tram r 40 c, of which 20 are box & 20 open, 190 mu. Pres P C. Maffit, Sec. W. D. Henry, Supt. T. W. Murphy Gen, Man. J. Scullin. Capital $112,000. Office, Jefferson ave. & Gravois road. 3 1

Lindell Ry. Co. Elec. 70 m, 4-10 g, 78 lb girder r, 220 c, of which 110 are m. c. and 110 t. c. Edison and Short systems. Pres. Geo. D. Capen, V. Pres. Chas. F. Orthwein, Sec. & Treas. Jas. Adkins, Gen. Supt. Geo. W. Baumhoff. Capital, $2,500,000. Bonds $1,500,000. Office, Flincy & Vandeventer Aves. 1 2

Midland St. Ry. Co. Elec. 3 m, 4-10 g, 35 lb T r, 4 c, of which 2 are m c and 2 t c. T-H system. Pres. F. Kuhn, V. Pres. E. C. Robbins, Sec. & Treas. G. Kingsland, Gen. Man. E. H. Benvist. Capital $20,000. Office, 823 N. 2d St. 8 2

Missouri R.R. Co. Elec. 27.52 m, 9.06 of which are cable and 18.46 elec. 4-10 g, 63 lb girder r, 290 c, of which 40 are g. c. 44 m. c. and 206 t. c. T-H. system. Pres. & Gen. Man. P. C. Maffit, V. Pres. J R. Llonberger, Sec. & Treas. F. R. Henry, Supt. James F Davidson. Capital $2,300,000; authorized $2,400,000 Bonds, $500,000. Office, 10 S. Compton Ave. 6 2

Mound City Ry. Co. Elec. 8 m. 25 m, c., 25 t. c. T-H system. Pres. John Scullin, V. Pres. Frank Carter Sec. Jas. H. Roach, Treas. C. M. Seaman, Supt. Jas Scullin. Capital $1,000,000; authorized $1,525,000. Office, 2,500A St. Louis ave. 3 1

Northern Central Ry. Co. 11 m, 4-10 g, 52 lb girder r, 60 c, of which 30 are box & 30 open, 186 h 70 mu Pres. D. G. Hamilton (Chicago), Treas. C. N. Duffy, Gen. Man, Robt. McCulloch, Supt. Thos. F. Bergin. Capital $200,000. (Leased to Cass Ave. & Fair Grounds Ry Co.) 6 2

People's R. R. Co. Cable. 10 m, 4-9¼ g, 78 lb girder r 120 c, of which 40 are g c and 80 t c, 20 h. Pres. Chas Green, V. Pres. & Gen. Man. J. Mahoney. Sec. & Treas. Jos. Perry, Supt. Pat'k Shea. Capital $1,000,000; authorized $1,200,000. Office, 1,810 Park ave. 2 2

Southern Ry. Co. Elec. 16 m, 4-10 g, 78 lb girder r, 80 c, of which 28 are m c and 52 t c. T-H system Pres. Tom L. Johnson, V-Pres. A. V. Du Pont, Sec Treas. & Gen. Man. Jos. S. Minary, Supt. J. C. Allen Office, 4,041 So. Broadway. 9 2

St. Louis R. R. Co. Cable. 14¾ m, 4-10 g, 78 lb girder r, 320 c, of which 80 are g. c. 120 box & 120 open c Pres. D. G. Hamilton (Chicago), V. Pres. C. Pepper Sec. & Treas. R. B. Jennings, Gen. Man. Robt. McCulloch. Capital, $1,000,000. 2 2

St. Louis & East St. Louis Electric Ry. Co. 2 m 4.10 g, 48-56 lb Johnson girder r, 12 m. c. T-H system. Pres. D. R. Powell, V. Pres. C. C. Carroll Sec. D. T. Breck. Asst. Supt. W. H. Williams. Capital $250,000; Bonds, $75,000. Office, 115 N. 3d st. a 3 2

St. Louis & Suburban Ry. Co. Elec. 28 m, 4-10 & 3 g, 35,40,69 lb T & girder r, 45 m c and 60 t c. T-H system. Pres. C. H. Turner, V. Pres. S. M. Kennard, Sec & Treas. S. D. Barlow, Jr., Gen. Supt. T. F. Sneed Capital, $2,500,000. 6 2

Union Depot R. R. Co. Elec. 30 m, 4-10 g, 50 & 78 lb girder r; 196 c, of which 60 are m c and 136 t c T-H system. Pres. John Scullin, V. Pres. & Treas. C M. Seaman, Sec. Jas. H. Roach, Supt. Jas. Scullin Capital $1,200,000; authorized $2,200,000. Office, Gravois & Jefferson aves. 3 1

Union R. R. Co. 8 m, 4-10 g, 52 lb r, 85 c, 299 mu. Pres. D. G. Hamilton (Chicago), V. Pres. & Gen. Man Robt. McCulloch, Sec & Treas. C. N. Duffy. Capital $600,000. Office, 3.820 Easton ave. (Leased to Cass Ave. & Fair Grounds Ry. Co.) 7 2

STOCKTON, CAL.— Stockton Electric Ry. Co Elec. 12 m, 3-6 g, 45 lb. s. b & T r, 20 c. of which 11 are m. c. and 9 t. c. Westinghouse & T-H systems. Pres I. S. Bostwick, Sec. J. Lyfe, Treas. E. R. Hedges, Supt G. E. Ladd. Capital. $500,000. 9 2

STONEHAM, MASS.—East Middlesex St. R. R. Co. 15¾ m, 4-8½ g, 35 lb r, 56 c. 217 h. Pres. A. F. Breed, Sec. L. F. Arnold, Treas. D. H. Sweetser, Supt W. Wentworth. Capital $300,000. Bonds, $225,000. Office, 35 Congress st., Boston. 6 2

ST. PAUL, MINN.—St. Paul City Ry. Co. Elec 95 m, of which 15 are cable and 80 elec, 4-8½ g 54-60 lb Johnson girder & T r, 305 c, of which 104 are g c, and 201 m. c. Edison and T-H systems, Pres Thos Lowry, V. Pres. C. G. Goodrich, Sec. A. Z. Levering Treas. W. R. Merriam, Supt. H. M. Sloan. Capital $5,000,000. Office cor. Smith ave. & Ramsey st. 6 2

N. St. Paul Ry. Co, 5 m c. T-H system. 7 2

St Paul & White Bear Ry. Co. 12 m, 8 m c. T-H system. 7 2

STREATOR, ILL.—Streator Ry. Co. Elec. 5½ m 4-8½ g, 56-67 lb T & girder r, 6 m c. T-H. system Pres. P. F. Barr, V. Pres. D. Heenan, Sec. W. Reeves, Treas. J. C. Barlow, Gen. Man. W. Miller. Capital $250,000. 3 2

STROUDSBURG, PA.—Stroudsburg Passenger Ry. Co. 1¾ m, 4-8½ g, 28-30 lb T r, 3 box c, 9 h 3 mu. Pres. & Treas. J. Lantz, Sec. Jacob Houser Gen. Man. W. Kistler. Capital, $25,600. 3 1

ST. THOMAS, CAN.—St. Thomas St. R. R. Co. 2 m, 3-6 g, 30 lb tram r, 4 c, 8 h. Pres. Cameron Currie, V. Pres. J. Winter, Sec. C. W. Smith, Treas S. Hendrie, Man. J. Campbell. Office, St. Thomas Ont. f 10 0

SUNBURY, PA.—Sunbury & Northumberland St Ry. Co. Elec. 3½ m, 5-2 g, 56 lb girder r, 4 m. c. Westinghouse system. Pres. D. Coolidge, Sec. & Treas. S. P Wolverton, Supt. F. S. Drake. Capital $125,000. 9 2

SYRACUSE, N. Y.—People's R. R. Co. 20 m, 4-8½ g, 47, 57, 66½ lb. r, 72 c, of which 31 are box and 41 open, 300 h. Pres. A. N. Palmer, Sec. H. H. Durr. Treas. F. W. Barker, Gen. Man. J. H. Maffitt. Gen. office, 75 Genessee st., Utica, N. Y. Capital $1,000,000. 11 1

Eastward Heights & De Witt R. R. Co. Dummy 10 m, 4-8½ g, 40 lb T r, 1 c, 1 steam motor. Pres. N L. Williams, Treas. G. B. Leonard, Supt. L. A. Williams. 9 2

Syracuse Consolidated St. Ry. Co. (Includes Fifth Ward, Fourth Ward, Genessee & Water St., Seventh Ward, Syracuse & Geddes, Third Ward and Woodlawn & Butternut railways). Elec. 36 m, of which 16 are horse and 20 elec, 4-8 g, 35 to 66½ lb girder, s b & T r, 100 c, of which 52 are box, 17 open and 31 m c, 320 h. T-H system. Pres. J. Dunn, Jr., Sec. T. L. Poole, Gen. Man. E. F. Rice, Supt. A. Bartlett. Capital, $1,250,000. Office, 3 Syracuse Sav. Bank Bldg. 4 2

T

TACOMA, WASH.—Tacoma Ry. & Motor Co. Elec. 24.28 m of which 22.64 are elec. & 1.64 cable, 3-6 g, 40, 45 & 66 lb girder r, 31 c, of which 26 are m. c. & 5 g. c. Edison system. Pres. Paul Schultze, V Pres. J. M. Ashton, Sec. P. H. Kershaw, Treas. T. B Wallace, Supt. G. W. Gabriel, Aud'r G. W. Bird Capital $500,000. Office, "A" & 13th sts. 2 2

Tacoma & Puyallup R. R. Co. Dummy. 16 m, 3-6 g 40 lb T r, 19 c, of which 5 are pass. & 14 frt. Pres. R F. Radebaugh, V. Pres. & Treas. Frank O. Meeker Sec. G. W. McAllister, Supt. O. Woods. Capital $100,000. Office 113 Railroad st., Tacoma. a 3 1

Point Defiance, Tacoma & Edison Ry. Co. 7 m 3-6 g, 42 lb T & steel r, 10 c, of which 3 are m c and 7 t c. Edison system. Pres. R. F. Radebaugh, Sec. S. Rice, Treas. T. B. Wallace, Supt. N. Lawson. Office, 915 Railroad st. 3 2

Tacoma & Fern Hill St. Ry. Co., 936 Pacific Ave. 3 m, 3-6 g, 40 lb T r, 2 c, steam motors. Pres. Geo Browne, V. Pres. R. F. Radebaugh, Sec. & Treas Newman Kline. e 8

Tacoma & Stellacoom Ry. Co. Elec. 13 m, 3-6 g, 4 & 45 lb T & girder r, 7 8-wheel box m c. T-H system Pres. H. M. Byllesby, V. Pres. H. W. Goode, Sec. & Treas. R. S. Hill, Gen. Man. S. B. Livermore. Capital $500,000. Office, Room 113 Abbott block. 2 2

TAMPA, FLA.—Tampa St. Ry. & Power Co 18 m, 4 8½ g, 25, 30 lb T r. 10 m c. Pres. & Gen. Man. J. H. Ahearn; V. Pres. J. R. Ritter, Sec. J. Wright Treas. A. G. Clay, Supt. C. E. Parcell. Capital $500,000; authorized $1,000,000. Bonds $500,000. 8 2

TAUNTON, MASS.—Taunton St. Ry. Co. 9¾ m 4-8½ g, 40, 45 lb T & Johnson r, 23 c, of which 13 are box and 10 open. 90 h. Pres. Wm. C. Lovering, Treas Henry M. Lovering, Supt. Geo. C. Morse. Capital $100,000. 6 2

TERRE HAUTE, IND.—Terre Haute St. Ry. Co Elec. 11.3 m, of which 1.3 are horse and 10 elec, 4-8½ g, 40 & 45 lb T & Johnson girder r, 50 c, of which 18 are m c and 32 t c, 14 h. 16 mu. Westinghouse system Pres. R. W. Rippetoe, V. Pres. W. Kidder, Sec. & Treas L. D. Thomas. Capital, $158,000. Office, 100 N. Ninth st. 7 1

TEXARKANA, ARK.—Texarkana St. Ry. Co Elec. 5 m, 4-g, 30 lb T r, 8 c, of which 6 are 4-wheel box & 2 4-wheel open, 38 mu. Pres. J. Deutschman V. Pres. B, Collins, Sec. F. W. Offenhauser, Treas G. W. Fouke, Supt. B. M. Foreman. Capital $40,000 k 3 1

TIFFIN, O.—Tiffin St. Ry. Co. 5¾ m, 4-4½ g, 35 lb. girder r, 17 c, 36 h. Pres. D. A. Lindley, Sec. & Treas. T. B. Williams, Supt. Joseph Murphy. a 5 0

The Electric Ry. & Pow. Co. 5 m 4 8½ g, 50, 7 2 lb T & girder r, 10 m. c. Pres. G. D. Loomis, Sec. J. F Bunn, Treas. B. W. Crobaugh, Supt. J. P. Meyers Capital, $50,000. 8 2

TOLEDO, OHIO.—Toledo Consolidated St. Ry Co. Elec. 57 m, of which 27 are horse & 30 elec. 4-8½ g, 56 & 70 lb girder r, 80 c, 49 motors, 425 h. T-H, Westinghouse and Eickemeyer systems. Pres. Norman B. Ream (Chicago), V. Pres. & Gen. Man. Albion E Lang, Sec. Chas. L. Wight, Supt. Chas. A. Denman Capital $1,500,000. Office, 336 Summit st. 3 2

Toledo Electric St. Ry. Co. 27 m, 4-8½ g, 45, 52, 85 lb Johnson girder & T r, 61 m c, 9 h. T-H & Westinghouse systems. Pres. D. Robison, Jr, V. Pres. L S. Baumgardner, Sec. & Gen. Man. J. J. Robison Treas. W. F. Robison. Capital, $800,000. Bonds $800,000. Office, cor. Madison & Summit Sts. 6 2

TONAWANDA, N. Y.—Tonawanda St. R. R. Co Elec. 10 m, 4-8½ g, 56 lb T r, 8 c ot which 4 are m c and 4 t c. T-H system. Pres. & Gen. Man. G. P Smith, Sec. A. J. Hathaway, Treas G. C. Herschell Capital $55,000; authorized $75,000. Office, Main st North Tonawanda. 6 2

TOPEKA, KAN.—Topeka Ry. Co. Elec. 36 m of which 16 are horse & 20 elec., 4 & 4-8½ g, 25, 30 & 40 lb T, girder & tram r, 82 c, of which 39 are h c, 30 m c and 13 t c, 173 h. T-H. system. Pres. C. C. Baker Sec. & Treas. R. M. Gage, Gen. Man. R. M. Patten Supt. E. H. Littlefield. Capital $2,000,000. Office 110 W. 10th st. 6 2

Topeka Belt Ry. Co. Steam. 4 m, 4-8½ g, 45 lb T r, 11 c, 2 steam motors. Pres. Chas. S. Gleed, Sec. & Treas. J. Mackenzie. Gen. Man. J. D. Livingston Supt. E. H. Litticfield. Capital, $1,000,000. Office 110 W. 10th st. 6 2

East Side St. Ry. Co. 10 m, 4-8½ g, 35-45 lb T r, 4 c, 5 freight, 3 motors. Receiver A. G. Bradstreet, Supt. W. W. Bright. f 2 90

West Side Circle Ry. Co. Steam. 6 m, 4 8½ g, 40 lb T & girder r, 2 c, 3 steam motors. Pres. C. S Gleed, Sec. & Treas. G. H. Noite. Capital, $50,000 authorized, $100,000. Office, Knox Building 9 2

TORONTO, ONT.—Toronto Ry. Co. 70 m. 4-10¾ g, 30 lb r, 252 c, 1,380 h. Pres. W. McKenzie, V. Pres. & Man. H. A. Everett, Sec. & Supt. James Gunn, Treas. J. R. Grace. Offices 94 & 96 King st., east. 7 2

Metropolitan St. Ry. Co. Elec. 3 m, 3 m c. T-H system. 7 2

TRENTON, N. J.—Trenton Pass. Ry. Co. Elec 30 m, of which 19 are horse and 11 elec.; 45-78 lb tram & girder r, 75 c, of which 60 are h c and 15 m c 250 h. 6 mu. Short system. Pres. & Gen. Man. L Perrine, Jr., V. Pres. S. K. Wilson, Sec. J. H. Solomon Treas. G. H. Parker, Supt. P. E. Hurley. 6 2

TRINIDAD, COLO.—Trinidad St. Ry. Co. 3 m 3 g, 14 lb T r, 6 c, 35 h. Pres. S. H. Jaffa, Sec. & Treas. D. A. Chappell, Supt. D. C. Snodgrass. b 7 1

TROY, N. Y.—Troy & Albia Horse R. R. Co. Elec 3.33 m, 4-8½ g, 35-45 lb. r, 26 c, of which 7 are box, 7 open and 12 m. c, 52 h. T-H. and Edison systems. Pres. Chas. Cleminshaw, V. Pres A. N. Brady, Sec. J. J. Hagen, Supt. W. H. Bean. Capital $50,000. Office, Albia stable. a 3 1

Troy City Ry. Co. Elec. 3½ m, 4-8½ g, 60 lb girder r, 12 m c. T-H system. Pres. J. O'Neil, V. Pres. C. Cleminshaw, Sec. & Treas. J. J. Hagen. Capital $300,000. 4 2

Troy & Lansingburgh R. R. Co. Elec. 25 m, of which 3½ are horse and 21½ elec, 4-8½ g, 63½ lb girder r, 117 c, of which 45 are h c and 72 m c. 87 h. Edison and T-H systems. Pres. Charles Cleminshaw, V. Pres. Jos. B. Carr, Sec. & Treas. Joseph J. Hagen, Gen. Supt. C. H. Smith. Capital, $600,000; authorized, $700,000. Bonds, $300,000. Office 209 River st. 6 2

TUSKALOOSA, ALA.—Tuskaloosa St. Ry. Co 4 m, 4-8½ g, 20 & 25 lb T r, 9 box c, 16 h, 13 mu Pres. Jas. H. Fitts, Man., Sec. & Treas. S. F. Alston. Capital, $100,000. Office, Main st. 6 2

Tuskaloosa Belt Ry. Co. 2½ m, 4-8½ g, 35 lb. T r 1 c, 1 steam motor. Pres. W. C. Jemison, V. Pres. John S. Rainey, Sec. & Treas. J. L. Wallace. Leased to T. Browne. 3 2

TYLER, TEX.—Tyler St. Ry. Co. 3 m, 4-8½ g 28 & 35 lb T & flat r, 4 c. V. Pres. W. C. Gast, Sec. J. P Douglass, Gen, Man. W. C. Scott. Capital, $20,000. 9 2

U

UNION SPRINGS ALA.—Union Springs St. Car Co. 2 m, 5-1 g, 20 lb T r, 4 flat c for freight, 1 or 2 for pass., 4 mu. Pres. Wm. Stakley, Sec. & Treas. T. H. Mabson, Jr., Supt. A. D. Fielder. Capital, $10,000. e

UNIONTOWN, PA.—Uniontown St. Ry. Co. Elec 3 m, 5-2½ g, 45, 61, 62 lb girder & T r, 56 c, 5 m c. Edison system. Pres. S. E. Ewing, V. Pres. G. H. McCormick, Sec. & Treas. R. F. Hopwood, Gen. Man W. C. McCormick, Supt. R. A. Smith. Capital, $50,000. 7 2

UTICA, N.Y.—Utica, Clinton & Binghamton St. R. R. Pres. Jas. J. Scollard, Sec. & Treas. Robt. S. Williams. Capital, $849,485. Leased to and operated by Utica Belt Line St. R. R. Co. Office, 157 Genesee st. a 7 1

Deerfield & Utica. (See Deerfield.)

Oneida St. R. R. Co. 1½ m, 4-8½ g, 35 lb c b r, 3 c of which 2 are box and 1 open, 8 h. Pres. & Gen. Man. Henry Ney, V. Pres. Dan'l L. Jones, Jr., Sec. & Treas. Wm. C. Willcox. Capital $40,000. Office, 71 Genesee st. 6 2

Utica & Mohawk R. R. Co. Elec. 3¾ m, 4-8½ g, 40-45 lb T r, 14 c, of which 7 are open t. c. and 7 m. c. Edison system. Pres. Jas. F. Mann, V. Pres R. W. Sherman, Sec. Wm. E. Lewis, Treas. Geo D. Dimon, Supt. F. Everts. Capital, $75,000. Office Mann Bldg. 7 2

Utica Belt Line St. R. R. Co. Elec. 27 m, 4-8½ g 40, 42, 47 & 60 lb. T r, 56 c, of which 19 are box, 25 m c and 12 t c. T-H system. Pres. W. E. Baker, V. Pres J. W. Boyle, Sec. & Treas. C. H. Wilson, Supt. W. W. Cole, Receiver, C. E. Benton. Capital, $150,000. Bonds, $500,000. 6 2

V

VANCOUVER, B. C.—Vancouver Electric Ry & Light Co. Ld. 7½ m, 4-8½ g, 40 lb T r, 10 c, of which 9 are m. c. and 1 t. c. T-H & Westinghouse systems Pres. J. Oppenheimer, V. Pres. T. Dunn, Sec. H. T Cepuley, Treas. & Business Manager, W. E. Brown Supt. C. F. Hutchings. Capital, $300,000; authorized $500,000; Bonds $300,000. Office, 523 Hastings st. W. 10 2

VANCOUVER, WASH.—Columbia Land & Improvement Co. 3 m, 3-6 g, 30 lb T r, 2 c, 7h. Pres. J Gibbon, V. Pres. & Gen. Man. L. M. Hidden, Sec. C Brown, Treas. 1st Nat. Bank. Capital $280,000. Address, P. O. Box 44. 3 2

VERNON, IND.—North Vernon & Vernon St. R. R. Co. 3 m, 5-2½ g, 35 lb girder r, 4 c, 12 h. Pres. J. Froebel, Jr., Sec. E. Wagner, Treas. O. Bacon. Capital, $15,000. 8 2

VICTORIA, B. C.—National Electric Tramway & Lighting Co. 14 m, 4-8½ g, 40 lb girder & T r, 16 c of which 14 are m c and 2 t. c. T-H, Edison & Westinghouse systems. Pres. & Gen. Man. D. W. Higgins, V. Pres. T. L. Jones, Supt. R. Menaugh. Capital, $250,000. Office, Store st. 7 2

VICTORIA, TEX.—Victoria St. Ry. & Improvement Co., 2¼ m, 4 g, 20 lb. r, 3 box c. 11 mu. V. Pres G. A. Levi, Sec. J. E. Carpenter, Supt. C. L. Turmond Authorized stock, $25.000. 8 1

VINCENNES, IND.—Citizens' St. Ry. Co. Elec 5 m, 4-8½ g, 40, 55 lb T & girder r, 15 c, of which 6 are m. c. and 9 t. c, 2 mu. Westinghouse system. Pres & Gen. Man. A. Tindolph, Sec. & Supt. E. F. Tindolph, Treas. B. G. Hudnut. Capital $15.050. Bonds $100,000. Office, Fair View ave. 7 2

W

WACO, TEX.—Citizens' Ry. Co. Elec. 16 m, 4-8½ g, 30, 40 & 45 lb girder & T r, 36 c, of which 10 are m. c & 26 t c. Pres. & Gen. Man. H. C. Scott, Sec. J. L Brockenbrough. Supt. J. L. Griffith, Capital, $350,000 Address, P. O. box 504. 7 2

Santa Fe St. & Juarez Ave. St. Ry. Co. 3 m, 4-8½ g, 35 lb Johnson r, 10 c, 50 mu. Pres. Z. T. White Sec. & Supt. A. Larmon. 7 0

Waco Electric Ry. & Lt. Co. 10 m, 4-8½ g, 35 lb T r, 10 c, of which 8 are m c and 2 t c. T-H system Pres. W. J. Hobson, V. Pres. B. Moore, Sec. & Supt S. A. Hobson. Treas. & Gen. Man. C. W. Hobson Capital, $200,000; authorized, $250,000. Bonds, $200,000. 9 2

WAKEFIELD, MASS.—Wakefield & Stoneham St. Ry. Co. 3 m, 4-8½ g, 48 lb T r, 8 c, of which 4 are m c and 4 t c. Westinghouse system. Pres. C. F Woodward, Sec. E. M. Southworth, Treas. W. L Harris, Gen. Man. M. E. Clemons, Engr. J. A. Bancroft. Capital $50,000. 10 2

WALLA WALLA, WASH. — Walla Walla St. Ry. & Investment Co. 4 m. 3-6 g, 30 & 35 lb T r, 6 4-wheel box c. 24 h. Pres. W. P. Winans, V Pres. Miles C. Moore, Sec. J. W. Langdon, Treas., Supt. & Man. J. M. Hill. Capital $72,000; authorized $100,000. 3 2

WARRENSBURG, MO.—Electric Springs Ry. Co. 2½ m, 4 g, 16 lb. T r. 4 box c, 8 mu. Owner & Gen. Man. G. W. Colbern. 7 1

WASHINGTON, D. C.—Capital, No. O St. & So Washington R.R. 13¾ m, 4-8 g, 80 lb girder r, 72 c. 308 h. Pres. Geo. White, V. Pres. C. Flint, Sec. & Treas H K. Gray, Supt. Andrew Glass. Office, 3d & B sts S. W. 6 2

Columbia R. R. Co. 6 m, 4-8½ g, 38 & 60 lb girder r, 39 c, of which 23 are 4-wheel box & 16 4-wheel open 150 h. Pres. W. J. Stephenson, V. Pres. E. G. Davis Sec. & Treas. R. F. Baker. Supt. Theo. J. King Capital, $400,000. Office, 15th & H sts., N. E. 3 2

Eckington & Soldiers' Home Ry. Co. Elec. 10 m 4-8½ g, 80 lb. girder r, 27 c, of which 20 are m. c. and 7 t. c. T-H & E. D. Co. systems. Pres. George Truesdell, V. Pres. Chas. C. Duncanson, Sec. Joseph Paul Treas. E. K. Johnson, Supt. E. E. Winters. Capital $352,000. Bonds $129 600. Office, Room 20, Washington Loan & Trust Co. Bldg, Washington. 9 2

Georgetown & Tenalleytown Ry. Co. Elec. 9½ m 4-8½ g, 45, 60 lb. groove & T r, 19 m. c T-H & Short systems. Pres. S. Watkins, V. Pres. R. D. Weaver, Sec J. E. Beall, Treas. G. D. Ashton. Supt. F. V L. Turner. Capital $200,000. Bonds $25,000. 6 2

Glen Echo R. R. Co. Elec. 6½ m, 4-8½ g, 40 lb T r 6 m. c. Westinghouse system. Pres. Edwin Baltzley, V. Pres. F. W. Pratt, Sec Edward Baltzley Treas. J. C. Pratt. Capital, $100,000. Office, Room 7 Sun Bldg. 6 2

Metropolitan R. R. Co. 19.44 m, 4-8½ g, 60 lb grooved r, 125 c, 650 h. Pres. & Pur. Agt. George W Pearson, V. Pres. A. A. Wilson, Sec. & Treas. Wm. J Wilson. Office, 2411 P st. N. W. 6 2

Rock Creek Ry. Co. Elec. 14 m, 4-8½ g, 50 lb T r 18 c, of which 12 are m. c. and 6 t c. T-H system Pres. F. G. Newlands, V. Pres .E. J. Stellwagen, Sec H. S. Nyman, Treas. T. H. Gale, Gen. Man. A. J Warner. Capital $750,000. Office, 1324 F. Street N. W. 6 2

Tenalleytown & Rockville Ry. Co. 3½ m, 3 m. c T-H system. 7 2

Washington & Georgetown R.R. Co. Cable. 22 m 4-8½ g, 80 lb English groove girder r, 354 c, of which 94 are g c and 260 t c, 30 h. Pres. H. Hurt, V. Pres J. G. Parke, Sec. & Treas. C. M. Koones, Gen. Supt C. C. Sailer. Capital, $500,000. Bonds, $3,500,000 Office, 3,222 M St. 6 2

WASHINGTON, PA.—Washington Electric St Ry. Co. Elec. 3½ m, 5-2½ g, 45 lb girder r, 5 m. c Westinghouse system. Pres. & Supt. J. B. Wilson Sec. S. B. Ewing, Treas. J. I. Brownson, Jr. Capital $10,000; authorized $60,000. Bonds $68,000. 6 2

WATERBURY, CONN.—Waterbury Horse R. R Co. 6½ m, 4-8½ g, 40 lb T r, 27 c, of which 15 are 4-wheel box & 12 4-wheel open, 115 h. Pres. D. S Plume, Sec. A. M. Young, Treas. J. R. Smith, Supt. & Gen. Man. E. A. Bradley. Capital $50,000; authorized $150,000. Bonds $50,000. Office, 4 Bank st. 6 2

WATERFORD, N. Y.—Waterford & Cohoes R.R. Co. 2 m, 4-8½ g, 45 lb r. Pres. Thos. Breslin, Sec. & Treas. C. C. Ormsby. Capital, $25,000. (Leased for 99 years by the Troy & Lansingburgh R. R. Co.) 11 0

WATERLOO, IA.—Waterloo St. Ry. Co, 3 m, 3 g, 23, 35 lb r r, 3 c, 8 h. Pres. J. E. Sedgwick, V. Pres G. A. Whitney, Sec. & Treas. A. A. Hungerford Capital, $40,000. 9 2

WATERLOO, ONT.—Berlin & Waterloo St. Ry Co. 2¾ m, 4-8½ g, 25 & 30 lb flat & T r, 8 4-wheel open c, 16 h. Pres. & Treas. Thos. M. Burt, Sec. Alex Millar. Office, Waterloo. Capital, $40,000. Bonds $20,000. 6 2

WATERLOO, N. Y.—See Seneca Falls, N. Y.

WATERTOWN, S. DAK.—Watertown & Lake Kampeska Ry. Co. Dummy. 5½ m, 4-8½ g. 30 lb T r 2 m. c. Pres. & Gen. Man. Charles Joscelyne, Sec R. B. Spicer. Office, Kemp ave. & Oak st. a 3 1

WATERTOWN, N. Y.—Watertown St. Ry. Co Elec. 6 m, 4-8½ g, 50 lb girder & T r, 19 c, of which 11 are m c, and 8 t c. Edison system. Pres. J. C Thompson, V. Pres. C. A. Starbuck, Sec., Treas. & Gen. Man. E. S. Goodale, Supt. F. P. Brown. Capital $40,000. Bonds $75,000. Office, 54 Court St. 6 2

WATERVILLE, ME.—Waterville & Fairfield Ry. & Lt. Co. Elec. 5m, 4-8½ g, 35 lb T r, 8 c, of which 3 are m c and 5 t c. Westinghouse system Pres. & Gen. Man. A. F. Gerald, Sec. H. M. Heath Treas. H. D. Bates. Capital, $200,000. Bonds, $175,000 Office, Fairfield. 9 2

WAXAHACHIE, TEX.—Waxahachie St. Ry Co 2 m, 4-8½ g, 20 lb T r, 3 c, 16 h. Pres. T. A. Ferris, V Pres. W. F. Lewis, Sec., Treas. & Gen. Man. O Goodwin. Capital, $24,000. 9 2

Lake Park St. Ry. Co. 2 m, 4-8½ g, 20 lb T r, 4 c 18 mu. Pres. J. F. Strickland, V. Pres. W. F. Lewis Sec. W. G. Williams, Treas. J. J. Metcalf. Gen. Man E. H. Griffin. Capital, $7,500; authorized $20,000. 9 2

WEATHERFORD, TEX.—Weatherford City & Suburban R. R. Co. 5 m, 4-8½ g, 16 & 20 lb T r, 4 4-wheel box c, 13 mu. Pres. G. P. Levy, V. Pres. T R. Stone, Sec. & Treas. J. P. Owens, Supt. S. E. Will banks. Capital, $100,000. 3 1

WEBB CITY, MO.—Twin Cities St. Ry. Co. 3 m, 4-8½ g, 25 & 35 T r, 8 c, 6 h, 28 mu. Pres. A. H Roger, V. Pres. E. C. Crow, Sec., Treas. & Gen. Man J. M. Maret. Capital $50,000. Bonds $20,000. 6 2

WEST BAY CITY, MICH.—West Bay City St. Ry. Co. Elec. 9 m, 4-8½ g, 40 & 45 lb tram r 22 c of which 12 are m c and 10 t c, 3 h. Edison system Pres. S. O. Fisher, V. Pres. T. F. Shephard, Sec. & Gen. Man. F. O. Rusling, Treas. H. H. Norrington Supt. C. Dorrington. Capital $100,000. Bonds $60,000 Office cor. Henry & Fisher Aves. 6 2

WEST CHESTER, PA.—West Chester St. Ry Co. 6 m, 9 m c. T-H. & Edison systems. 7 2

WEST NEWTON, MASS.—Newton St. Ry. Co Elec. 5½ m, 4-8½ g, 45 lb T r, 21 c, of which 15 are m c and 6 t c. T-H system. Pres. H. B. Parker, V. Pres E. Stearns, Sec. J. C. Lane, Treas. C. W. Smith, Supt F. G. L. Henderson. Capital $125,000; Bonds $100,000 Office, West Newton, Mass. 9 2

WEST SUPERIOR, WIS. — Superior Rapid Transit Ry. Co, Elec. 26 m, 3-6g, 35 lb T r, 35 c, of which 25 are m c and 10 t c. T-H system. Pres. & Gen. Man. S. T. Norvell, Treas. W. H. Slack. Capital $1,000,000. 9 2

WESTPORT, CONN.—Westport & Saugatuck Horse R. R. Co. 1¾ m, 4-8 g, 40 lb r, 4 c, 6 h. Pres. A. S. Hurlbutt, Sec. and Treas. B. L. Woodworth Supt A. F. Downes. 3 2

WHEELING, W. VA.—Citizens' Ry. Co. (Includes Wheeling Ry.) Elec. 15 m, of which 3 are horse & 12 elec., 5-2 g, 35, 47 & 60 lb Tram & Johnson girder r, 37 c, of which 33 are m c and 4 h c T-H., and Wightman systems. Pres. J. Jacob, Sec Frank P. Hall, Supt. W. E. Harrington. Capital $100,000. 6 2

Wheeling & Elm Grove R. R. 10 m, 4-8½ g, 70 lb T r, 20 c, 4 Baldwin motors, 1 h. Pres. A. Reymann, Sec. & Treas. J. Roemer, Gen. Man. H. E. Weisgerber Capital, $250,000; authorized, $300,000. Office, 16th st 9 2

Wheeling Ry. Co. Elec. 15 m, 10 m c. T-H system. Pres. W. R. Kimball, Sec. F. P. Hall, Supt W. E. Harrington. Operated by Citizens' Ry. Co Capital, $66,666. 6 2

WHITMAN, MASS.—Whitman St. Ry. Co. Elec 5 m, 4-8½ g, 45, 55 lb T & girder r, 6 c, of which 4 are m. c. and 2 t. c. T-H system. Pres. G. H. Campbell Treas. A. A. Glasier, Gen. Man. H. B. Rogers. Capital $40.000. Office 203 Main st., Brockton. 9 2

WICHITA, KAN.—Wichita Electric Ry. Co. Elec. 25 m, 4-8½ g, 35 & 46 lb T & Johnson r, 30 c, of which 22 are m c and 8 t c. T-H system Pres. J. O. Davidson, Sec., Treas. & Gen Man. Thos G. Fitch, Supt. F. W. Sweet. Capital $1,000,000 Bonds $300.000 Office 100 Douglas Ave. 6 2

WILKESBARRE, PA.—Wilkesbarre & Kingston Pass. R. R. 4 m, 5-2 g, 35 lb tram r, 12 box c, 24 h Pres. J. J. Patterson, Sec. & Treas. J. Graham. Capital, $100,000. Leased to Wyoming Valley Traction Co. 3 2

Coalville Passenger R. R. Co. 2½ m, 4-8½ g, 24 lb tram & T r, 4 c, 20 h. Pres. J. J. Patterson, Sec. & Treas. J. Graham. Capital, $62,375. Leased to Wyoming Valley Traction Co. 7 2

Nanticoke St. Ry. Co. Elec, 8 m, 4-8½ g, 40 lb. T r 6 m. c. Short system. Pres. J. J. Patterson, Sec. & Treas. J. Graham. Leased to Wyoming Valley Traction Co. 7 2

Pittston St. Car Co. 1¾ m, 5-2 g, 42½ lb flat r, 4 4 wheel box c, 6 h. Pres. J. J. Patterson, Sec. & Treas. J. Graham. Capital, $10,000. Leased to Wyoming Valley Traction Co. 7 2

Pittston, Moosic & Pleasant Valley Ry. Co. Elec 7 m, 4-8½ g, 40 lb. T r, 4 m. c. Short system. Pres J. J. Patterson, Sec. & Treas. J. Graham. Leased to Wyoming Valley Traction Co. 7 2

Plymouth St. Ry. Co. Elec. 4 m, 4-8½ g, 40 lb. T r 6 m. c. Short system. Pres. J. J. Patterson, Sec & Treas. J. Graham. Leased to Wilkesbarre & Wyoming Valley Traction Co. 7 2

West Pittston & Wyoming St. Ry. Co. Elec. 20¾ m, 4-8½ g, 40 lb. T r, 4 m. c. Short system. Pres J. J. Patterson, Sec. & Treas. J. Graham. Leased to Wyoming Valley Traction Co. 7 2

Wilkesbarre & Suburban St. Ry. Co. Elec. 7½ m 5-2½ g, 52 lb girder r, 9 4-wheel box c, 17 motors Edison system. Pres. M. B. Williams, V. Pres. C. A Miner, Sec. E. H. Chase, Treas. C. Walter, Supt. & Gen. Man. ————; Capital $100,000. Leased to Wyoming Valley Traction Co. 7 2

Wilkesbarre & West Side Ry. Co. Elec. 3½ m, 4-8½ g, 35 45 & 56 lb T & girder r, 5 c, of which 3 are box & 2 open. Edison system. Pres. J. J. Patterson, Sec & Treas. J. Graham. Leased to Wyoming Valley Traction Co. 7 2

Wilkesbarre & Wyoming Valley Traction Co. 16 m. 18 m. c, Short system. Pres. B. F. Myers, Sec. & Treas. J. Graham, Supt. J. H. Gibson. 7 2

WILLIAMSPORT. PA.—Williamsport Pass. Ry. Co. Elec. 6¾ m, 4-8½ g, 60 lb c b r, 10 m c. Westinghouse system. Pres. H. R. Rhoads, Sec. J. F. Starr Treas. John Lawshe, Supt. H. C. Young. Capital $250,000. Office 760 W. 4th st. 6 2

WILMINGTON, DEL.—Front & Union St. Pass Ry. Co. (Operated by Wilmington City Ry.) 1¾ m, 5-2 g, 32 & 63 lb tram & girder r, 10 c, 80 h. Pres. P. Lea, Sec. & Treas. F. L. Kurtz, Gen. Man. H. H. Archer, Supt. C. H. Smith. Capital $50,000. Office, Front & Union sts. 6 2

Wilmington City Ry. Co. Elec. 16.75 m, of which 1 is horse and 12.75 elec, 5-2 g, 47, 52, 64, 91 lb girder & tram r, 64 c, of which 12 are h c, 40 m c and 10 t c, 16 h. Edison & Westinghouse systems. Pres P. Lea, Sec., & Gen. Man. C. H. Smith, Treas. C. G Blandy. Office, Delaware ave. & Dupont st. 11 2

WILMINGTON, N. C.—The Wilmington St. Ry. Co. Elec. 5½ m, of which 1¼ m is steam and 4 elec. 4-8½ g, 45, 60 lb **T &** girder r, 8 m c. Pres. C. A. Lieb, V. Pres. & Gen. Man. J. H. Barnard, Sec. B. F. O'Connor, Treas. J. G. White. Capital, $100,000; authorized, $300,000. Office, 29 Broadway, New York. 6 2

WINDSOR, ONT.—Windsor R. R. 4½ m, 4-8 g, 26 lb r, 6 c, 26 h. Pres. & Gen. Man. Wm. McGregor. c 2 90

Windsor, Sandwich & Amherstburg Ry Co. Elec 6¾ m, 4-8½ g, 40, 52 lb girder & T r, 16 c, of which are 4-wheel box m. c. and 4 are 4-wheel open t. Westinghouse system. Pres. J. M. Clark, Sec. C. E Warner, Gen. Man. W. C. Turner. Capital, $200,000 7 1

Windsor Electric St. Ry. Co. 1¾ m, 3-6 g, 25 lb T r, 1 motor, 4 c, 9 h, Van Depoele system; overhead conductor. Steam power. Pres. W. M. Boomer, Sec. & Treas. M. A. S. Boomer. Office, cor. Mercer & Sandwich sts. W. 1 2 90

WINFIELD, KAN.—Union St. Ry. Co. 5 m, 4 g, 16-20-35 lb T & Johnson r, 5 c, 20 mu. Pres. Wm Matthewson, Sec. W. J. Kennedy, Treas. Geo. M Robinson, Gen. Man. C. Ferguson. Capital 25,000 6 2

WINNIPEG, MAN.—The Winnipeg St. Ry. Co. Elec. 9 m, of which 5 are horse & 4 elec, 4-8½ g, 35-40 lb r, 23 c, of which 15 are h c, 5 m c and 3 t c, 80 h. Edison system. Pres. Jas. Austin, Sec. & Man. Albert W. Austin, Supt. Geo. A. Young. Capital $100,000. 3 2

WINONA, MINN.—Winona City Ry. Co. Elec. 4 m, 3-6 g, 27 lb r, 5 m c. T-H system. Pres. B. H. Langley, V. Pres. H. G. DeCoelle, Sec. B. D. Hatchez, Treas. H. K. Gilman. Office, 119 Center st. f 7 0

WINSTON, N. C.—Winston-Salem Ry. & Elec. Co. 7 m 4-8½ g, 45 lb Johnson girder r, 11 c, of which 9 are m c and 2 t c. Edison system. Pres. J. H. McClement, 16 Broad st., N. Y., V. Pres. E. L. Hawks, Sec. & Treas. G. L. Reeve, Gen. Man. H. S. Cooper, Capital, $150,000. Bonds, $200,000. (Operated and leased by Twin City Construction Co.) 6 2

WOBURN, MASS —North Woburn St. Ry. Co. 7.5 m, 35-40 lb tram & T r, 12 c, 48 h. Pres. A. F. Breed, Lynn, Mass., Sec. & Treas. D. H. Sweetser, Supt. J. E. Sewell. Capital, $100,000; authorized $200,000. 3 2

East Middlesex St. Ry. Co. See Stoneham, Mass.

WOODLAND, CAL.—Woodland St. Ry. Co. 1 m, 3 g, 30 lb T r, 3 c, 3 h. Pres. T. Ross, V. Pres. G D. Fiske, Sec. L. W. Hilliker, Treas. T. Armstrong Gen. Man. M. McCutcheon, Supt. J. D. Lawson. Capital $30,000. 6 2

WOONSOCKET, R. I.—Woonsocket St. Ry. Co. 6.65 m, 4-8½ g, 35 to 50 lb T r, 16 c, 62 h. Pres. & Gen. Man. J. P. Ray, Treas. Willard Kent, Supt. H M. Young. Capital, $24,000; authorized, $100,000 Bonds, $59,000. 10 2

WORCESTER, MASS.—Worcester Consolidated St. Ry. Co. 24 m, of which 21 are horse and 3 elec. 4-8½ g, 36, 45, 50 lb flat, T and Johnson girder r, 107 c, of which 96 are h c and 11 m c, 474 h. Pres. Chas. B. Pratt, Sec. & Gen. Man. H. S. Seely. Capital, $700,000. Bonds, 150,000. Office, 15 Market st. 6 2

Worcester & Millbury R. R. Co. Elec. 8 c. T-H system.

Worcester & Shrewsbury R. R. Co. 5 m, 2 m c. Edison system. 7 2

Worcester, Leicester & Spencer St. Ry. Co. Elec. 13 m, 4-8½ g, 48 lb T r, 26 c, of which 23 are m. c. and 8 t. c. T-H & Detroit systems. Pres. & Gen. Man S. Winslow, Treas. & Clerk, T. T. Robinson, Supt. G A. Murch. Capital $250,000. 6 2

WYMORE, NEB.—Wymore & Blue Springs Ry. Co. 3¼ m, 3-6 g, 22 lb T r, 4 4-wheel box c, 10 h Pres. J. H. Reynolds, V. Pres. Ben. Reynolds, Sec & Treas. E. P. Reynolds, Jr., Supt. T. Bauman. Gen Man. O. P. Newbranch. Capital, $36,700; authorized $50,000. 6 2

Y

YARMOUTH, N. S.—Yarmouth Electric St. Ry Co., Ltd. 2 m, 4 g, 45 lb T r, 4 c. of which 2 are m c and 2 t c. Edison system. Pres. R. Cair, V. Pres. M D. Lovitt, Sec., Treas. & Gen. Man. B. B. Law, Supt J. Burton. Capital, $40,000; authorized, $100,000. 9 2

YONKERS, N. Y.—Yonkers St. Ry. Co. Elec. 7½ m. 4-8½ g, 42-48 lb r, 14 c, of which 12 are m c and 2 t c, 88 h. Eickemeyer system. Pres. C. H. Montague. Capital, $200,000. 5 2

YORK, PA.—York St. Ry. Co. 6 m, 4-8½ g, 25, 38 & 45 lb girder & T r, 18 open c, 34 h, 11 mu. Pres & Gen. Man. W. H. Lanius, Sec. J. F. Kell, Treas. J Jessop, Supt. R. V. Thomas. Capital $83,200 authorized $100,000. Office, 27 E. Market St 1 2

YORK, NEB.—York St. Ry. Co. 4½ m, 4 g, 20 lb T r, 4 c, 18 h. Pres. W. T. Scott, Sec. M. A. Green Treas. H. L. Love. e 5 0

YOUNGSTOWN, O.—Youngstown St. R. R. Co Elec. 9 m, 4-8½ g, 48, 70 lb Johnson r, 19 c, of which 15 are m c. and 4 t. c. Edison & Sperry systems Pres. James Parmelee, Cleveland, O., V. Pres. H M. Garlick, Sec. H. M. Taylor, Youngstown. Treas Gen. Man. & Supt. F. W. Brown. Capital, $300,000 authorized, $500,000. Bonds, $300,000. 6 2

Z

ZANESVILLE, O.—Zanesville St. Ry. Co. Elec 8½ m, 5-2½ g, 64 lb., Johnson girder r, 10 m. c. Pres A. L. Conger, Supt., H. L. Hull, Gen. Man. W. D Chapman, Sec. F. A. Wilcox. Capital $300,000. 3 1

PROJECTED ROADS.

A

AURORA, ILL.—Aurora & Chicago Inter-Urban Ry. Co. 57 m. Pres. H. H. Evans, V. Pres. W. M. Van Nortwick, Sec & Treas J. J. Luck. Capital $1,000,000. 9 2

AUSTIN, TEX.—Austin City R. R. Co. 14 m, 3-6 g, 35 lb T r, 28 c, 116 mu. Pres. C. E. Judson, Sec. S. T Wilcox, Supt. Chas. T. Hicks. Office 111 Monroe St Chicago, Ill. 6 1

B

BELFAST, ME.—Belfast St. Ry. Co. C. B. Hazeltine, J. C. Brooks, N. F. Houston, Prcs., Belfast; E. K. O'Brien, Thomaston; H. L. Shepherd, Rockford. J. H. Quimby, Clerk & Treas. 8 2

BRAINTREE, MASS.—Braintree Street Ry. Co 4.15 m. Pres. F. A. Hobart, Treas. J. T. Stevens Road to be built in Spring of 1893. 7 2

BROCKTON, MASS.—Brockton & Holbrook St Ry. Co. 4 m c. T-H system. 7 2

BLOOMINGTON, ILL.—Citizens' Ry. Co. Elec 3½ m, 4-8½ g. Pres. E. C. Hewitt, Sec. I. Merchant Capital, $100,000. 7 2

BUCYRUS, O.—Bucyrus & Galion Suburban Electric Ry. Co. Pres. C. W. Fisher, V. Pres. O. L Hays, Sec. C. J. Scroggs, Treas. J. B. Gormlay, Gen Man. W. C. Lemert, Chief Eng. N. A. Sager. 12 1

BUFFALO, N. Y.—Buffalo, Kenmore & Tonawanda Electric R. R. Co. 8 m, 4-8½ g, 60 lb T & girder r, 6 m. c. T-H system. Pres. D. F. Callahan V. Pres. N. E. Mack, Sec. G. H. Frost, Treas. J. L Donovan. Capital $150,000. To be opened January 1, 1893. 8 2

C

CEDARTOWN, GA.—Cedartown St. R. R. Co 1½ m, 4-8½ g, 20 lb T r, 2 c, 10 mu. Pres. J. H. Allen Capital 10,000. Office, 29 Armstrong Bldg, Rome, Ga. 6 1

CHICAGO, ILL.—West & South Towns St Ry Co. Elec. 6 m, 4-8½ g, 80 lb girder r. Pres. C. L Bonney, Sec. H. L. Burnette. Capital, $500,000. Office 511 Tacoma Building. To be finished in 1892. 5 2

CHAMBERSBURG, PA.—Chambersburg Electric St. Ry Co. 6 m, 5-2½ g, 50 lb. girder r, 8 c, of which 5 are m c and 3 t c. Capital, $50,000. Address Albert E. Hay, Altoona, Pa. 7 2

COLUMBUS, O.—Columbus & Westerville Ry. Co. Elec. 16 m, 4-8½ g, 50-70 lb r. Pres. M. H. Nell, V. Pres. T. A. Simons, Sec. & Gen. Man. G. W. Meeker. Capital, $500,000. To be finished Dec. 1st 8 2

CONNELLSVILLE, PA.—Connellsville Electric Ry Co., 7 m, 5-2½ g, 52 lb. girder r, 4 c. Pres. J. M Reid, Sec., Treas. & Engr, J. L. Gans. Capital $100,000. 3 2

CORAOPOLIS, PA.—Pittsburgh, Neville Island & Coraopolis Ry. Co. Elec. 8 m, 5-2 g, 60 lb T & girder r, 8 m c. Pres. J. W. Arras, Sec. M. D. Rowland, Treas. J. D. Shanks. To be finished in 1893. 5 2

CUYAHOGA FALLS, O.—Cuyahoga Falls, Electric Ry Co., 18 m. 4-8½ g. Short system. A. L. Johnson, S. Short, C. E. Grover and others are interested 1 2

Cuyahoga Falls & Akron Ry. & Pow. Co. Elec. 7 m 4-8½ g, 52 lb T r, 12 c. Pres. W. J. Price, Sec. G. F Parmelee. Capital, $100,000. To be opened Jan. 1 1893. 9 3

D

DELAWARE, O.—Franchise granted to J. H. K Newcomer for Elec. road. 4 m 4 8½ g, 5 m c. 1 2

E

ELDORADO SPRINGS, MO. — Eldorado Springs & Nevada Dummy R. R. 22 m, 4-8½ g, 40 lb r, 8 c, 2 motors. To be built soon as possible. 8 2

F

FORT WAYNE, IND.—Fort Wayne & Belle Isle Ry. Co. 29 m c. T-H system. 7 2

FRAMINGHAM, MASS.—Framingham & Ashland St. Ry. Co. 5 m, 4-8½ g. Capital $60,000. 6 1

G

GLOVERSVILLE, N. Y.—Cayadutta Electric R. R. Co. 17½ m, 4-8½ g, 56 & 60 lb girder & T r, 15 c of which 11 are m c and 4 t c. Pres. E. Smith, V Pres. A. J. Zimmer, Sec. H. Dudley, Treas. J. L. Hees Gen. Man. T. C. Frenyear. Capital, $350,000. Office 1 S. Main St. To be opened about Dec. 1. 7 2

H

HAMILTON, ONT. — Hamilton, Grimsby & Beamsville Electric Ry. Co. 27 m, 4-8½ g, 40 lb T r 24 c, of which 12 are m c and 12 t c. Pres. C. J Myles, Sec. & Treas. A. Rutherford. To be opened 1892. 7 2

HOUSTON, TEX.—Houston Rapid Transit Co Elec. 17 m, 4-8½ g, 56 lb girder and T r, 20 c. V. Pres & Gen. Man. H. T. D. Wilson. Capital, $300,000. 7 2

J

JERSEY CITY, N. J.—Jersey City Rapid Transit Co. 7 2

JUNCTION CITY KAN.—Junction City & Fort Riley St. Ry. Co. Elec. 6 m. Pres. J. Eddy, Gen Man. G. W. Harris. Capital, $200,000. 7 2

L

LA PORTE, IND.—La Porte Elec. St. Ry. Co. 3 m, 4-8½ g, 35 lb T r, 5 motor c. Pres. Frank E. Snow V. Pres. L. T. Durand, Sec. & Treas. John M. Nicol Gen. Man. W. J. Hart. Capital $100,000. 7 1

LANCASTER, PA.—Lancaster & Lititz Ry. Co. Elec. 8 m, 5-2½ g, Pres. J. A. Coyle, Sec. & Treas. J. E. Ackley. 8 2

LEBANON, PA.—Lebanon & Myerstown St. Ry Elec. 10 m, 5-3 g, 50 lb girder r, 8 c. Edison system Pres. J. M. Shenk. 2 2

LONG ISLAND CITY, N. Y.—Crescent City Ry. Co. 4½ m. Office 18 Wall St., N. Y.

M

McKEESPORT, PA.—The Dravosburgh, Mendelssohn & Elizabeth Electric St. Ry. Co. 7½ m 5-2½ g, 56 lb girder r, 16 m c. Pres. H. H. Saraney Sec. J. A. Skelley. Capital, $100,000. Office, 510 Locust st. To be opened Jan. 15, 1893. 10 2

MACON, GA.—Macon & Indian Spring R. R. Co Dummy. 41 m, 4-8½ g, 50 lb T r. Capital $250,000 To be opened May, '93. Address T. J. Carling. 4 2

McVEYTOWN, PA.—Lewistown & Belleforte Electric Ry. Co. Pres. W. P. Stevenson. 7 2

MATTOON, ILL.—Mattoon St. Ry. Co. 5 m 4-8½ g, steel T r. Pres. E. M. Neal, V. Pres. E. Kern Sec. Jos. Withington, Treas. Robt. G. Owens. 1 2

MAUCH CHUNK, PA.—Carbon County Electric Ry. Co. Pres. A. B. Clemmer. Office 14 Chamber of Commerce 733 S. 2d St. Philadelphia. 11 2

MEMPHIS, TENN.—Raleigh Springs R. R. Co Elec. 11 m, 4-8½ g, 56 lb T and girder r, 10 m c. Pres D. O. Connell, V. Pres, B. L. Duke, Sec. & Treas. W R. Hall, Chief Engr. E. T. Lynch. Capital, $200,000 9 1

N

NATCHITOCHES, LA.—Natchitoches St. Ry Co. 2 miles, 4-8½ g, 4 Pass., 6 freight c, 24 mules. Pres. Phanor Brezeale, Treas. A. E. Lemee, Sec. J. A. Ducournau. 2 2

NEGAUNEE, MICH.—Negaunee & Ishpeming St. Ry. Co. 4 m. c. T-H system. 1 2

NEW ALBANY, IND.—Glen View Park Ry. Co Elec. 3½ m, 4-8½ g, 45, 56 lb. T & girder r. Pres. J Peters Jr. Sec. E. B. Stotsenburg. Office 120 Pearl St. To be opened April 1893. 10 2

NEW BERNE, N. C.—New Berne Electric Ry Co. Address W. C. Clarke, Wakefield, R. I. 2 2

NEWTOWN, N. Y.—Newtown & Flushing Ry. Co 3½ m. Office 18 Wall St., N. Y.

NORTH ADAMS, MASS.—North Adams Electric Ry. Co. 4,100 ft., 4-8½ g, 2 m c. Address S. A Kemp. 12 1

NORWALK, CONN.—Norwalk Tramway Co. Elec. 3½ m, 4-8½ g, 60 lb T r, 4 c. Pres. E. J. Neil, Sec. J. A. Osborn. Capital $30,000. 9 2

NORWALK, O.—Norwalk Electric Ry. Co. 7 m 4-8½ g, 45-65 lb r, 8 m. c. To be opened in 1892 Address E. B. Jackman, Toledo, O. 2 2

O

ORANGE, N. J.—Orange Mountain Cable Co 4000 ft, 8 g, 56 lb. m. p. r, 2 c. Pres. A. Z. Mason, V Pres. O. W. Child, Sec. & Treas. A. W. Kissam, Gen Man. F. W. Child. Capital, $350 000. Office Orange Nat. Bank Bldg. To be opened January 1893. 11 2

OSKALOOSA, IA.—Consolidated St. Ry. & Light Co. Elec. 9 m, 4 g, 45, 52 lb T & girder r, 6 m c. T-H system. Pres. A. Simes, V. Pres. C. A. Ross, Sec. C. T. French, Gen. Man. C. Winter. Capital, $250,000. Office 109 High Ave. West. To be finished Dec. 1st. 8 2

OTTAWA, ILL.—Ottawa, Starved Rock & Western Ry Co. Elec. 10 m, 4-8½ g, 50 lb T r. Directors C. F. Wilson, W. L. Philips, C. S. Cullen, J. J. O'Brien F. V. Hobert. Capital $150,000. 2 2

OXFORD, PA.—Oxford & Parkesburg Electric R. R. Co. Elec. 15 m, 4-8½ g. Capital $100,000. Address S. R. Dickey. 4 2

P

PAINESVILLE, O.—Painesville, Fairport & Richmond St. Ry. Co. Elec. 7 m, 4-8½ g, 52 lb girder r. Pres. I. K. Pierson. Capital $50,000. Commenced Sept. 1892. 8 2

PATERSON, N. J.—Paterson & Little Falls Electric Ry. Co. 3.29 m. Pres. F. C. Van Dyke, V. Pres. C. H. Russell, Treas. Jas. A. Morrisse, Sec. J. R. Beam. Capital $50,000. 9 2

Paterson, Passaic, Rutherford & Carlstadt Ry. Co Elec. 8 m. Pres. C. A. Johnson, V. Pres. J. A, Morisse Sec. R. Johnson, Treas. C. Russell. 11 2

PHILADELPHIA, PA. — North Philadelphia Pass. Ry. Co. Pres. H. A. Stiles, Sec. & Treas. G. C. Stiles. Capital, $300,000. Office, 209 S. Third st. 7 2

PITTSBURGH, PA. — Grandview Traction Co 6½ m, of which ¾ m is cable and 5¾ elec, 5-2½ g, 10 c. Pres. W. B. Lupton, V. Pres. C. H. Humbert, Sec. F. W. Gordon, Treas. W. T. Brown. Capital $250,000 Office, 155 4th Ave. To be commenced in Spring of 1893. 10 2

Morningside & Highland Park St. Ry. Co. Address A. E. Linhart, 162 4th Ave. 8 2

PONTIAC MICH.—Pontiac & Sylvan Lake St. Ry. Co. 5 m. Pres. M. B. Mills, Detroit; Sec. D. D. Jayne, 416 Hammond Bldg., Detroit; Treas. J. D. Norton, Pontiac. Capital, $150,000. 8 2

PORT CHESTER, N. Y.—Port Chester & Rye Beach St. Ry. Co. Elec. 6 m, 4-8 45 lb g r, 6 c 5 m c Pres. F. H. Skeele, V. Pres. & Gen. Man. A. H. Farrer Sec. Jas. H. Moran, Treas. V. A. Krepps. Capital $50,000. Office, 18 Cortlandt st., New York. e 5

PORT JERVIS, N. Y.—Port Jervis St. Ry. Co.

PORTLAND, ORE.—Portland & Fairview R. R. Co. Elec. 5 m, 3-6 g, 35 lb T r, 4 m c. Pres. J. D. Hart, V. Pres. L. Rosenthal, Sec. F. S. Fields, Treas. D. Dalgleish, Engr. F. Gilham. Capital $10,000; authorized $50,000. To be in operation in 1892. 7 2

Bornes Heights & Cornell Mt. Ry. Co. 6 m c. Edison system. 7 2

POTTSTOWN, PA.—Citizens' Passenger Ry. Co 12½, 4-8½ g, 70 lb. r, 6 m. c. Pres. J. A. Weber, Sec & Treas. J. C. Heilig. Office 227½ High St. 11 2

POTTSVILLE, PA. — Pottsville, Cressona, Schuylkill Haven & Orwigsburg Electric Ry. Co. 12 m, 4-8½ g, T r. Pres. J. T. Shoener, Sec. & Gen Man. L. K. Hannum. 10 2

R

ROODHOUSE, ILL.—Roodhouse & White Hall Consolidated St. Ry. Co. 3½ m, 4-8½ g, 45 lb r, 8 c Officers: C. T. Bates, J. W. Roodhouse, John Roodhouse. Capital, $100,000. To be begun and finished in Spring, 1893. 9 2

ROCKLAND, MASS.—Rockland & Abington St. Ry. Co. Elec. 18 m, 4-8½ g, 45, 56 lb T & girder r Pres. E. P. Reed, Sec. G. W. Kelley, Treas. C. N Cobb. Capital 60,000. 8 2

S

ST. LOUIS, MO.—Clayton & Forest Park Ry Co. Elec. 6 m. Pres. T. K. Skinker, V. Pres. T. L Boland, Sec. & Treas. B. F. Thomas. Capital, $50,000 To be opened May 1, 1893.

SALEM, ORE.—Capital City Ry. Co. Elec. 7 m, 4-8½ g, 30, 40 lb T r, 8 m. c. Edison system. Pres. D. Simpson, Sec. & Treas. T. H. Barnes. Capital &100,000. 8 2

SANDUSKY, O.—Sandusky, Milan & Huron Electric Ry. Co. Pres. J. W. Wickham, Jr., V. Pres H. Kelley, Sec. T. Wood, Treas. A. W. Prout. Office 122 Laurence St. 8 2

SANFORD, ME.—Monsam River R. R. Co. Elec 2½ m, 4-8½ g, 60 lb r, 2 m c. Westinghouse system Pres. E. M. Goodall, Treas. G. F. West. Capital $2000,000. To be opened in 1892. 8 2

SCOTTDALE, PA.—Scottdale, Everson & Broadford St. Ry. Co. Elec 5 m, 5-2 g, 45 lb girder r, 4 m c Pres. N. Miles, Sec. J. R. Byrne, Treas. W. N. Porter

SHAMOKIN, PA.—Shamokin & Mt. Carmel Electric Ry. Co. 12 m, 4-8½ g, 50 lb. T r 15 c. Pres E. C. Hamilton, Sec. D. J. Lewis, Treas. H. S. Robins Capital, $100,000. To be commenced March 1, 1893. 11 2

SHARON, PA.—Shenango Valley St. Ry Co. Elec 4 m, 5 2½ g, 45 lb T & girder r, 8 m c. T-H system Pres. J. C. Whitla, Sec. & Gen. Man. M. L. Knight Treas. F. G. Basker. Capital, $150,000. To be opened Jan. 1, 1894. 10 2

SHELBYVILLE, IND.—Shelbyville Electric Ry Co. 7 m, 4-8½ g, 8 m. c. Pres. G. M. Roy, Sec. E. A Major, Treas. W. S. Roy. Capital $100,000. 2 2

SPOKANE FALLS, WASH.—Spokane & University Heights St. Ry. Co. 7 m elec. 4-8½ g, 35 lb T r 3 c. Pres. & Gen. Man. Allan V. Garratt, V. Pres Robert Abernethy, Sec. L. B. Cornell. Capital, $100,000. 4 2

Spokane & Cœur d'Alene Ry. & Navigation Co. Elec. 32 m, 4-8½ g, 56 lb T r, 4 m c. Gen. Elec. system. Pres. A. A. Newberry. Sec. W. S. Norman, Treas. D. M. Drumhilbur, Ch. Eng. B. C. Riblet. Capital, $500,000. To be finished June, 1893. 8 2

SPRINGFIELD, MO.—Robberson Ave. Ry. Co 6 m c. T-H system. 7 2

T

TAMPA, FLA.—Consumers' Elec. Lt. & St. R. R Co. 8 m, 4-8½ g, 40, 45 lb, T & girder r. Westinghouse system. Pres, W. B. Henderson, V. Pres. & Treas, E. S. Douglass, Sec. A. C. Waepel. Capital $50,000. To be opened January, 1893. 11 2

TAMAQUA, PA.—Tamaqua & Lansford St. Ry Co. Elec. T r, 8 c Pres, F. P. Spiese, Sec. R. Harris, Treas. D. D. Phillips. 7 2

TORONTO, ONT.—Toronto & Mimico Electric Ry. Co. 7 m. Detroit system. 3 2

Toronto & Scarboro Elec. Ry. Lt. & Pow. Co. 15 m 4-8½ g, 60 lb T r. Pres. D. G. Stephenson, V. Pres. J Hallam, Sec. & Gen. Man. A. W. Dengman. Capital $25,000; authorized $100,000. 11 2

TROY, O.—Troy Elec. Ry. Co. 15 m, 4-8½ g Pres. T. Sullivan, V. Pres. J. C. Barry, Sec. J. W Morris, Treas. G. Gates. Capital $100,000. 2 2

V

VELASCO, TEX.—Bryan Heights Ry. Co. Dummy. 5 m, 4-8½ g, 25 lb T r. Pres. J. P. Bryan, V. Pres. G. M. Bryan, Jr., Sec. & Treas. F. S. Robbins. Capital, $25,000. To be finished about July, 1893. 4 2

W

WARREN, PA.—Warren St. Ry. Co. Pres. C. P Northrup, Sec. W. E. Price.

WASHINGTON, D. C.—District of Columbia Suburban Ry. Co. Elec. 13 m, 4-8½ g, T & girder r. Pres. G. Moyers, V. Pres. & Supt. G. P. Davis Sec. H. Barton, Treas. L. C. Loomis. To be opened about June 15, 1893. 9 2

Y

YAKIMA, WASH.—Yakima St. Ry. & Power Co. Pres. Wayne Ferguson, V. Pres. Lauchlin McLean, Sec. & Supt. F. S. Woodward, Treas. W M. Steinway. Capital stock, $100,000.

CABLE RAILWAYS.

B

BALTIMORE, MD.—Baltimore Traction Co.

BROOKLYN, N. Y.—Brooklyn Heights R. R. Co

BUTTE, MONT.—Butte Consolidated Ry. Co.

C

CHICAGO, ILL.—Chicago City Ry. Co.
North Chicago St. Ry. Co.
West Chicago St. R. R. Co.

CINCINNATI, O.—Cincinnati St. Ry. Co.
Mt. Adams & Eden Park Inclined R. R. Co.
Mt. Auburn Cable Ry. Co.
Price Hill Inclined Plane R. R. Co.

CLEVELAND, O.—Cleveland City Cable Ry. Co

D

DALLAS, TEX.—The Dallas Cable Ry. Co.

DENVER, COL.—Denver Tramway Co.
Denver Cable Ry. Co.
Denver City Cable Ry. Co.
Denver & West Side Cable Ry. Co.

G

GRAND RAPIDS MICH.— Consolidated St. Ry. Co.

H

HOBOKEN, N. J.—No. Hudson Co. Ry. Co. Elevated.

K

KANSAS CITY, MO.—Kansas City Cable Ry. Co.
Citizens' Cable Ry. Co.
Grand Ave. Ry. Co.
Metropolitan St. Ry. Co.
People's Cable Ry. Co.
Inter-State Consolidated Rapid Transit Ry. Co.
Union Ry. Co.

L

LOS ANGELES, CAL.—Second St. Cable Ry. Co.
Los Angeles Cable Ry. Co.
Temple St. Cable Ry. Co.

N

NEW YORK, N. Y.—Third Ave. R. R. Co. Line on Tenth ave. & 125th st.
Broadway & Seventh Ave. Ry. Co.

O

OAKLAND, CAL.—Oakland Cable Ry. Co.
Piedmont Consolidated Cable Co.

OMAHA, NEB.—Omaha St. Ry. Co.

ORANGE, N. J.—Orange Mountain Cable Co.

P

PHILADELPHIA, PA.—Phila. Traction Co.

PITTSBURGH, PA.—Birmingham, Knoxville & Allentown Traction Co
Central Traction Co.
Citizens' Traction Co.
Pittsburg Traction Co.

PORTLAND, ORE.—Portland Cable Ry. Co.

PROVIDENCE, R. I.—Providence Cable Tramway Co.

S

SAN DIEGO, CAL.—San Diego Cable Tramway Co.

SAN FRANCISCO, CAL.—California St. Cable R. R. Co.
Ferries & Cliff House Ry. Co.
Geary St. Park & Ocean R. R. Co.
Market St. Cable Ry. Co.
Omnibus Cable Co.
Presidio & Ferries R. R. Co.
Sutter St. R. R. Co.

SEATTLE, WASH.—Front St. Cable Ry. Co.
Madison St. Cable Ry. Co.
North Seattle Cable Ry. Co.
Seattle City Ry. Co.
South Seattle Cable Ry. Co.
Union Trunk Line.
West Seattle Cable Ry. Co.

SIOUX CITY, IA.—Sioux City Cable Ry. Co.

SPOKANE FALLS, WASH.—Spokane Cable Ry. Co.
Spokane St. Ry. Co

ST. JOHN, N. B.—St. John City Ry. Co.

ST. LOUIS, MO.—Citizens' Ry. Co.
Missouri Ry. Co.
People's Ry. Co.
St. Louis R. R. Co.

T

TACOMA, WASH.—Tacoma Ry. & Motor Co.

W

WASHINGTON, D. C.—Washington & Georgetown R. R. Co.

ELECTRIC RAILWAYS.

This list embraces those roads which are operated wholly or in part by electricity; also those in course of construction or under contract.

A

ADRIAN, MICH.—Adrian City Elec. Belt Ry. Co

AKRON, O.—Akron Electric Ry. Co.

ALBANY, N. Y.—Watervliet Turnpike & R. R. Co.
Albany Ry. Co.

ALEXANDRIA, VA.—Washington Alexandria & Mt. Vernon Electric Ry. Co.

ALLEGHENY, PA.—Federal St. & Pleasant Valley Ry.

ALLENTOWN, PA.—Allentown & Bethlehem Rapid Transit Co.

ALLIANCE, O.—Alliance St. Ry. Co.

ALTOONA, PA.—City Pass. Ry. Co. of Altoona

AMERICUS, GA.—Americus St. Ry. Co.

AMSTERDAM, N. Y.—Amsterdam St. Ry. Co.

ANACONDA, MONT.—Electric Ry., Lt. & Power Co.

ANACORTES, WASH.—Fidalgo City & Anacortes Ry. Co.

ANDERSON, IND.—Anderson Elec. St. Ry. Co.

ANN ARBOR, MICH.—The Ann Arbor St. Ry Co.

ANSONIA, CONN. — Birmingham & Ansonia Horse R. R. Co.
Derby Horse Ry. Co.

APPLETON, WIS.—Appleton Electric St. Ry.

ASBURY PARK, N. J.—Seashore Electric Ry Co

ASHEVILLE, N. C.—Asheville St. Ry. Co.
West Asheville & Sulphur Springs Ry. Co.

ASHLAND, PA.—Schuylkill Traction Co.

ASHTABULA, O.—Ashtabula Rapid Transit Co

ASTORIA, ORE.—Astoria St. Ry. Co.

ATHENS, GA.—Athens Ry. Co.

ATLANTA, GA.—Atlanta Consolidated St. Ry. Co
Atlanta Traction Co.
Fulton Co. St. Ry. Co.
Atlanta, West End & MacPherson Barracks.
Atlanta & Chattahoochee River Ry. Co.

ATLANTIC CITY, N. J.—Pennsylvania R. R. System.

ATTLEBORO, MASS.—Attleboro, N. Attleboro & Wrentham St. Ry. Co.
Attleboro, Norton & Pawtucket St. Ry. Co.

AUBURN, N. Y.—Auburn City Ry. Co.
Auburn Electric Ry. Co.

AUGUSTA, GA.—Augusta Ry. Co.
Augusta & Somerville R. R.

AUGUSTA, ME.—Augusta, Hallowell & Gardiner R. R. Co.

AURORA, ILL.—Aurora St. Ry. Co.

AUSTIN, TEX.—Austin Rapid Transit Ry. Co.

B

BALTIMORE, MD.—Baltimore & Curtis Bay St. R. Co.
Baltimore Traction Co.
Central Ry. Co.
Lake Roland Elevated Ry. Co.
North Avenue Ry. Co.

BANGOR, ME.—Bangor St. Ry.

BATTLE CREEK, MICH.—Battle Creek St Ry. Co.

BAY RIDGE, MD. -Suburban Electric Ry. Co.

BEATRICE, NEB.—Beatrice Rapid Transit & Power Co.

BEAVER FALLS, PA.—Beaver Valley Traction Co.

BELDING, MICH.—Belding St. Ry. & Imp't Co.

BENSON, NEB.—Benson & Halcyon Heights Ry Co.

BEVERLY, MASS.—Beverly & Danvers Electric St. R. R.

BIDDEFORD, ME.—Biddeford & Saco R. R. Co.

BINGHAMTON, N. Y.—Binghamton St. Ry. Co
Binghamton & Port Dickenson R. R. Co.

BIRMINGHAM, ALA.—Birmingham Ry. & Electric Co.

BIRMINGHAM, CONN.—Derby Horse Ry. Co.

BLOOMINGTON, ILL.—Bloomington City Electric Ry.

BOISE, IDAHO.—Boise Rapid Transit Co.

BOSTON, MASS.—Boston & Revere St. Ry. Co.
West End Railway.
Winnisimmet R. R. Co.

BRADDOCK, PA.—Braddock & Turtle Creek St Ry. Co.
Braddock Elec. Ry. Co.

BRISTOL, TENN.—Bristol Belt Line Ry. Co.

BROCKTON, MASS.—Brockton St. Ry. Co.
Brockton & Holbrook St. Ry. Co.
East Side St. Ry. Co.

BROOKLYN, N. Y.—Atlantic Avenue R. R. Co.
Brooklyn City R. R. Co.
Coney Island & Brooklyn R. R. Co.
Jamaica & Brooklyn Ry. Co.

BUFFALO, N. Y.—Buffalo St. Ry. Co.
Buffalo, Kenmore & Tonawanda Elec. R. R. Co.
Buffalo, North Main St. & Tonawanda R. R. Co.

BURLINGTON, IA.—Burlington Elec. Ry. Co.

BUTTE CITY, MONT.—Butte City Consolidated Ry. Co.
Metropolitan Electric Ry. Co.

C

CAIRO, ILL.—The Delta Electric Co.

CAMDEN, N. J.—Camden & Atlantic R. R. Co
Camden Horse R. R. Co.

CANTON, O.—Canton St. Ry. Co.
Lakeside St. R. R. Co.

CAPE MAY, N. J.—Cape May & Sewell's Point Elec. Ry. Co.

CARBONDALE, PA.—Carbondale & Jermyn St. Ry. Co.
Carbondale Traction Co.

CEDAR RAPIDS, IA.—Cedar Rapids & Marion Ry. Co.

CHAMBERSBURG, PA.—Chambersburg Electric St. Ry. Co.

CHAMPAIGN, ILL.—Urbana & Champaign St. Ry. Co.

CHARLOTTE, N. C.—Charlotte St. Ry. Cons. Co

CHARLOTTE, N. Y.—Grand View Beach R. R Co.

CHATTANOOGA, TENN.—Chattanooga Electric R. R. Co.
Chattanooga Coal, Iron, Land & Ry. Co.
Chattanooga & North Side St. Ry. Co.

CHESTER, PA.—Union St. Ry. Co.

CHICAGO ILL.—Cicero & Proviso Ry. Co.
Calumet Electric St. Ry. Co.
South Chicago City Ry. Co.

CHILLICOTHE, O.—Chillicothe Electric Ry & Lighting Co.

CINCINNATI, O.—Mt. Adams & Eden Park Incline Ry. Co.
Cincinnati Inclined Plane Ry. Co.
Cincinnati St. Ry. Co.
Pendleton, Mt. Lookout & E. Walnut Hill Ry. Co.
S. Covington & Cincinnati St. Ry. Co.

CLEVELAND, O.—East Cleveland Ry. Co.
Broadway & Newburgh Ry. Co.
Brooklyn St. Ry. Co.
Cleveland City Cable Ry. Co.
Collamer's Line, E. Cleveland.
Lake View & East Cleveland St. R. R. Co.
South Side St. Ry. Co.
Woodlawn Ave. & West Side St. R. R. Co.

CLINTON, IA.—State Electric Co.

COLORADO SPRINGS, COLO. — Colorado Springs Rapid Transit Ry. Co.

COLUMBIA, PA.—Columbia & Ironville St. Pass Ry. Co.

COLUMBUS, GA.—North Highlands R. R. Co.

COLUMBUS, O.—Columbus Consolidated St. Ry. Co.
Columbus & Westerville Ry. Co.
Columbus Elec. Ry.
Glenwood & Greenlawn St. Ry Co.
Worthington, Clintonville & Columbus St. Ry. Co.

CONCORD, N. H.—Concord St. Ry. Co.

CONNELLSVILLE, PA.—Connellsville Electric Co.
Connellsville, N. Haven & Leisenring St. Ry. Co.

COVINGTON, KY.—South Covington & Cincinnati St. Ry. Co.

CUMBERLAND, MD — Cumberland Electric Ry. Co.

D

DALLAS, TEX.—Dallas Consolidated Traction Ry. Co.
Dallas Rapid Transit Ry.

North Dallas Belt Ry. Co.

DANVILLE, ILL.—Danville Gas, Elec. Lt. & St. Ry. Co.

DANVILLE, VA.—Danville St. Car Co.

DAVENPORT, IA.—Davenport Central Ry. Co.
Davenport Elec. Ry. Light & Power Co.
The Fort Scott Rapid Transit Ry. Co.

DAYTON, O.—White Line St. Ry. Co.
Dayton & Soldiers' Home Ry. Co.

DECATUR, ILL.—City Electric Ry. Co.

DEFIANCE, O.—The Defiance Light & Power Co

DELAWARE, O.—Delaware Electric St. Ry. Co

DENNISON, O.—The United Electric Co.

DENVER, COL.—Colfax Ave. Electric Ry.
Denver Tramway Co.
West End St. Ry. Co.

DES MOINES, IA.—Des Moines St. Ry. Co.

DETROIT, MICH.—Detroit Citizens St. Ry. Co.
Detroit, Rouge River & Dearborn R. R. Co.
Highland Park Ry. Co.

DOVER, N. H.—Union St. Ry. Co.

DU BOIS, PA.—Dubois Traction Pass. Ry. Co.

DUBUQUE, IA.—Dubuque St. R. R. Co,
Key City Electric Ry Co.
Electric Ry., Light & Power Co., of Dubuque.

DULUTH, MINN.—Duluth St. Ry. Co.
Lakeside Ry. Co.
Motor Line Improvement Co.

DURANGO, CAL.—Durango Ry. & Realty Co.

E

EAST LIVERPOOL, O.—East Liverpool & Wellsville St. R. R. Co.

EASTON, PA.—Easton Transit Co.
Pennsylvania Motor Co.

EAU CLAIRE, WIS.—St. Ry. Lt. & Power Co.

ELGIN, ILL.—Elgin City Ry. Co.

ELKHART, IND.—Citizens' Ry Co.

ELMIRA, N. Y.—Elmira & Horseheads R. R. Co
West Side R. R. Co.

ERIE, PA.—City Passenger Co.
Erie Electric Motor Co.

EVANSVILLE, IND.—Evansville St. R. R. Co.

F

FAIRHAVEN, WASH.—Fairhaven Electric Ry. Co.

FINDLAY, O.—Findlay St. Ry. Co.

FISHKILL-ON-HUDSON, N. Y.—Citizens' St. Ry. Co.

FITCHBURG, MASS.—Fitchburg & Leominster St. Ry. Co.

FLUSHING, N.Y.—Flushing & College Point St. Ry. Co.

FORT SCOTT, KAN.—Fort Scott Rapid Transit Co.

FORT WAYNE, IND.—Fort Wayne Electric Ry Co.
Fort Wayne & Belle Isle Ry. Co.

FORT WORTH, TEX.—Fort Worth & Arlington Heights Ry.
City Ry. Co.
North Side Ry. Co.
Riverside St. Ry. Co.

FREDONIA, N. Y.—Dunkirk & Fredonia R. R Co.

G

GALLIPOLIS, O.—Gallipolis St. Ry. Co.

GALVESTON, TEX.—Galveston City Ry. Co.
Gulf City St. Ry. & Real Estate Co.
South Galveston & Gulf Shore R. R. Co.

GETTYSBURG, PA.—Gettysburg Battlefield R. R. Co.

GIRARDVILLE, PA.—Mahanoy, Shenandoah Girardville & Ashland St. Ry. Co.

GLENS FALLS, N. Y.—Glens Falls, Sandy Hill & Fort Edward St. R. R. Co.

GLOUCESTER, MASS.—Gloucester St. Ry. Co

GLOVERSVILLE, N. Y.—Cayadutta Electric R. R. Co.

GRAND RAPIDS, MICH.—Consolidated St. Ry. Co.

GREAT FALLS, MONT.—Great Falls St. Ry. Co

GREENSBURG, PA.—Greensburg & Hempfield St. Ry. Co.

H

HAMILTON, O.—Hamilton & Lindenwald Elec Transit Co.

HAMILTON, ONT.—Hamilton St. Ry. Co.

HAMPTON, VA.—Hampton & Old Point R. R. Co.

HANNIBAL, MO.—Hannibal Ry. Co.

HARRISBURG, PA.—East Harrisburg Pass. Ry. Co.
Citizens Pass Ry. Co.
Harrisburg City Pass. Ry. Co.

HARTFORD, CONN.—Hartford & Wethersfield Ry. Co.

HARVEY, ILL.—Harvey Transit Co.

HAVERHILL, MASS.—Haverhill & Amesbury St. Ry. Co.

HELENA, MONT.—Helena Electric Ry. Co.
Helena Rapid Transit Co.
Helena Union Ry. Co.

HOBOKEN, N. J.—N. Hudson County Ry. Co.

HOLYOKE, MASS.—Holyoke St. Ry. Co.

HOT SPRINGS, S. DAK.—Hot Springs & Chautauqua R. R. Co.

HOUSTON, TEX.—Houston City Ry. Co.
Houston Rapid Transit Co.

HUDSON, N. Y.—Hudson Electric Ry. Co.

HULL, MASS.—Hull St. Ry. Co.

HUNTINGTON, W. VA.—Huntington Electric Light & St. Ry. Co.

I

INDIANAPOLIS, IND.—Citizens' St. Ry. Co.

IRONWOOD, MICH.—Twin City Ry. Co.

ITHACA, N. Y.—Ithaca St. Ry. Co.

J

JACKSON, MICH.—Jackson St. Ry. Co.

JACKSONVILLE, ILL.—Jacksonville St. Ry Co.

JAMESTOWN, N. Y.—Jamestown Street Railway. Co.

JERSEY CITY, N. J.—Jersey City & Bergen R. R. Co.

JOHNSON CITY, TENN.—Johnson City & Carnegie St. Ry. Co.

JOHNSTOWN, N. Y.—Johnstown, Gloversville & Kingsboro Horse Ry. Co.

JOHNSTOWN, PA.—Johnstown Pass. Ry. Co.

JOLIET, ILL.—Joliet St. Ry. Co.

JOPLIN, MO. Joplin Electric Ry. & Motor Co.

K

KANKAKEE, ILL.—Kankakee Elec. Ry. Co.
North Kankakee Elec. Lt. & Ry. Co.

KANSAS CITY, KAN.—Kansas City Elevated Ry. Co.

KANSAS CITY, MO. — Consolidated City & Chelsea Park Ry. Co.
Interstate Rapid Transit Co.
Metropolitan St. Ry. Co.
North East St. Ry. Co.
Vine St. Motor Ry. Co.
West Side R. R. Co.

KEARNEY, NEB.—Kearney Electric Ry.

KEOKUK, IA.—Gate City Electric Ry. Co.

KNOXVILLE, TENN.—Knoxville St. Ry. Co.

KOKOMO, IND.—Kokomo Electric Ry. Co.

L

LAFAYETTE, IND.—Lafayette St. Ry. Co.

LANCASTER, PA.—Lancaster & Millersville St R. R. Co.
Lancaster City & West End St. Ry. Co.

LANSING, MICH.—Lansing City Ry. Co.

LAREDO, TEX.—Laredo Electric St. Ry. Co.

LA SALLE, ILL.—City Electric Ry. Co.

LAWRENCE, MASS.—Merrimack Valley St. Ry Co.

LEBANON, MO.—Lebanon Light & Water Co.

LEBANON, PA.—Lebanon & Annville St. Ry. Co.
Lebanon & Myerstown St. Ry. Co.

LEXINGTON, KY.—Lexington Pass. & Belt Line Ry. Co.

LIMA, O.—The Lima Electric Ry. Co.

LINCOLN, NEB.—Home St. Ry. Co.
Lincoln City Electric Ry. Co.

LITTLE ROCK, ARK.—City Electric Ry. Co.

LOGANSPORT, IND.—Logansport, Ry Co.

LONG ISLAND CITY, N. Y.—Long Island City & Newtown R. R. Co.
Steinway Ry. Co. of Long Island City.

LOS ANGELES, CAL.—Los Angeles Consolidated Elec. Ry. Co.

LOUISVILLE, KY.—Louisville Ry. Co.

LOWELL, MASS.—Lowell & Suburban St. Ry. Co

LYNCHBURG, VA.—Lynchburg St. Ry. Co.
Lynchburg Electric Ry. Co.

LYNN, MASS.—Lynn & Boston St. Ry. Co.
Lynn Belt Line Ry. Co.

M

MACON, GA.—Macon City & Suburban Ry. Co.
Central City St. Ry. Co.
Metropolitan St. Ry. Co.

MADISON, WIS.—Madison City Ry. Co.

MANSFIELD, O.—Citizens' Electric Ry. & St. & Power Co.

MARION, IND.—Marion St. Ry. Co.

MARINETTE, WIS.—Marinette St. Ry. Co.

MARLBORO, MASS.—Marlboro St. R R. Co.

MARQUETTE, MICH.—Marquette & Presque Isle Ry. Co.

MARTINSBURG, W. VA.—Martinsburg St. Ry. Co.

MAYSVILLE, KY.—Maysville St. R. & Transfer Co.

McKEESPORT, PA.—McKeesport & Reynoldton Pass. Ry. Co.

MEMPHIS, TENN.—City & Suburban St. Ry. Co
Citizens' St. R. R. Co.
Memphis & Raleigh Springs Ry Co.

MENOMINEE, MICH.—Menominee Elec. Ry. & Power Co.

MERIDEN, CONN.—Meriden Horse R. R. Co.

MERRILL, WIS.—Merrill Ry. & Lighting Co.

MICHIGAN CITY, IND.—Citizens' St. Ry. Co.

MILFORD, MASS.—Milford & Hopedale St. Ry Co.

MILWAUKEE, WIS.—Milwaukee Elec. Ry. Co
Milwaukee St. Ry. Co.
Milwaukee & Wauwatosa Electric Co.
West Side Ry. Co.

MINNEAPOLIS, MINN.—Minneapolis St. R. R. Co.

MOLINE, ILL.—Moline Central St. Ry. Co.
Davenport & Rock Island Ry Co.

MONTGOMERY, ALA —Montgomery & Cloverdale Ry. Co.

MONTREAL, CAN.—Montreal St. Ry. Co.
Royal Electric Co.

MUSKEGON, MICH.—Muskegon Railway Co.

N

NANTUCKET, MASS.—Nantucket Beach St. Ry. Co.

NASHVILLE, TENN.—Citizens' Rapid Transit Co.
United Electric Ry. Co.
Overland Ry. Co.

NATICK, MASS.—Natick Electric St. Ry Co.

NEGAUNEE, MICH.—Negaunee & Ishpeming St. Ry Co.

NEW ALBANY, IND.—New Albany R. R. Co.
Highland R. R. Co.

NEW BEDFORD, MASS.—Union St. Ry. Co.

NEW CASTLE, PA.—New Castle Elec. St. Ry. Co

NEW HAVEN, CONN.—New Haven & West Haven Horse R. R. Co.
Morris Cove Electric Ry. Co.

NEW ORLEANS, LA—New Orleans & Carrollton R. R. Co.

NEW WESTMINSTER, B. C.—New Westminster & Vancouver Tramway Co.

NEW WHATCOM, WASH.—Bellingham Bay Electric Ry. Co.
Lake Whatcom Electric Ry. Co.

NEW YORK, N. Y.—Harlem Bridge, Morrisania & Fordham Ry. Co.

NEWARK, N, J.—Newark Pass. Ry. Co
Newark & S. Orange St. Ry. Co.

NEWARK, O.—Newark & Granville Electric St. Ry. Co.

NEWBURYPORT, MASS. — Black Rocks & Salisbury Beach Ry. Co.
Newburyport & Amesbury Horse Ry. Co.

NEWPORT, R. I.—Newport St. Ry. Co.

NEWTON, MASS.—Newton St. Ry. Co.

NEWTONVILLE, MASS.—Newton & Boston St. Ry. Co.

NIAGARA FALLS, N. Y.—Niagara Falls & Suspension Bridge Ry. Co.

NORFOLK, NEB.—Norfolk St. Ry. Cons. Co.

NORTH ADAMS, MASS.—Hoosac Valley St Ry. Co.

NORWALK, CONN.—Norwalk Tramway Co.

NORWALK, O.—Norwalk Electric Ry. Co.

NORWICH, CONN.—Norwich St. Ry. Co.

O

OAKLAND, CAL. — Consolidated Piedmont Cable Co.
Oakland R. R. Co.
Oakland Consolidated St. Ry. Co.
Oakland, San Leandro & Haywards Ry. Co.

OGDEN, UTAH.—Ogden City St. Ry. Co,

OLYMPIA, WASH.—Olympia Lt. & Pow. Co.
West Side Ry. Co.

OMAHA, NEB.—Omaha & Council Bluffs Ry. & Bridge Co.
Metropolitan St. Ry. Co.
Omaha St. Ry. Co.
Patrick Land Co.

OSKALOOSA, IA—Consolidated St. Ry. & Lt. Co.

OSWEGO, N. Y.—Oswego St. Ry. Co.

OTTAWA, ILL.—Ottawa Electric St. Ry. Co.

OTTUMWA, IA.—Ottumwa Electric Ry. Co.

OXFORD, ALA.—Oxford Lake Line Ry. Co.

OXFORD, PA.—Oxford & Parkesburg Electric R. R. Co.

P

PADUCAH, KY.—Paducah St. Ry. Co.

PARIS, TEX.—Paris Elec. Lt. & Ry. Co.

PATERSON, N. J.—Paterson Ry. Co.
Paterson Central Electric Ry. Co.
Paterson & Little Falls Electric Ry. Co.

PAWTUCKET, R. I.—Pawtucket St. Ry. Co.
Interstate St. Ry. Co.

PEORIA, ILL.—Central Ry. Co.
Fort Clark Horse Ry. Co.

PETERSBURG, VA.—Petersburg St. Ry. Co.

PIQUA, O.—Piqua Electric Street Ry. Co.

PITTSBURGH, PA.—Duquesne Traction Co.
Federal St. & Pleasant Valley R. R. Co.
Pittsburgh, Allegheny & Manchester Tractio n Co.
Pittsburgh Traction Co.
Pittsburgh & Birmingham Traction Co.
Schenley Park & Highland Ry. Co.
Second Ave. Pass. Ry. Co.
Suburban Rapid Transit Ry. Co.

PITTSFIELD, MASS.—Pittsfield Electric St Ry Co.

PLAINFIELD, N. J.—Plainfield St. Ry. Co.

PLYMOUTH, MASS.—Plymouth & Kingston Ry. Co.

PORT ARTHUR, ONT.—Town of Port Arthur Electric Ry.

PORT HURON, MICH.—City Electric Ry. Co.

PORT TOWNSEND, WASH.—Port Townsend St. Ry. Light & Power Co.
Port Townsend Belt Ry. Co.

PORTCHESTER, N. Y.—Portchester & Rye St. Ry. Co.

PORTLAND, ME.—Portland R. R. Co.

PORTLAND, ORE.—City & Suburban Ry. Co
East Side Railway Co.
Portland Consolidated St. Ry. Co.
Portland & Fairview R. R. Co.

POTTSVILLE, PA.—People's Ry. Co.
Schuylkill Electric Ry. Co.

PROVIDENCE, R. I.—Union St. Ry. Co.

PUEBLO, COLO.—Pueblo City Ry. Co.

PUNXSUTAWNEY, PA.—Punxsutawney St. Pass. Ry. Co.

PUT-IN-BAY, O.—Put-in-Bay Water Works, Light & Ry. Co.

Q

QUINCY, ILL.—Quincy Horse R. R. & Carrying Co.

QUINCY, MASS.—Quincy & Boston St. Ry. Co.
Manet St. Ry. Co.

R

RALEIGH, N. C.—Raleigh St. Ry. Co.

READING, PA.—East Reading R. R. Co.
Neversink Mountain Ry. Co.
Reading & Southwestern Ry. Co.

RICHMOND, IND.—Richmond City Elec. St Ry. Co.

RICHMOND, VA.—North Side Land & Highland Park R. R. Co.
Richmond Ry. & Electric Co.
Richmond & Manchester Ry. Co.

ROANOKE, VA.—Roanoke St. Ry. Co.

ROCHESTER, N. Y.—Grand View Beach Ry. Co
Rochester Electric Ry. Co
Rochester Ry. Co.

ROCHESTER, PA.—People's Electric St. Ry. Co.

ROCKFORD, ILL.—Rockford City Ry. Co.
West End St. Ry. Co.

ROCKLAND, ME.—Rockland Thomaston & Camden St. Ry Co.

S

SACRAMENTO, CAL.—Central St. Ry. Co.

SAGINAW, MICH.—Saginaw Union St. Ry. Co.

SALEM, MASS.—Essex Elec. Ry. Co.
Naumkeag St. Ry. Co.

SALEM, O.—Salem Electric St. Ry. Co.

SALEM, ORE.—Capital City Ry. Co.

SALINA, KAN.—Salina Electric Ry. Co.

SALT LAKE CITY, UTAH.—Salt Lake City R. R. Co.
Salt Lake Rapid Transit Co.

SAN ANTONIO, TEX.—Alamo Elec. St. Ry. Co
San Antonio St. Ry. Co.
Rapid Transit St. Ry. Co.
West End St. Car Co.

SAN DIEGO, CAL.—San Diego St. Ry. Co.

SAN FRANCISCO, CAL.—San Francisco & San Mateo St. Ry.
Metropolitan St. Ry. Co.
Pacific Improvement Co.

SAN JOSE, CAL.—San Jose & Santa Clara R. R Co.
First St. R. R. Co.

SANDUSKY, O.—Sandusky St. R. R. Co.
People's Electric Ry. Co.

SANTA CRUZ, CAL.—Santa Cruz, Garfield Park & Capitola Electric Ry. Co.

SARATOGA, N. Y.—Union Electric Ry. Co. of Saratoga.

SAULT STE. MARIE, MICH.—Sault Ste Marie St. Ry. Co.

SAVANNAH, GA.—Savannah St. Ry. Co.
Savannah, Thunderbolt & Isle of Hope Ry. Co.

SCHENECTADY, N.Y.—Schenectady St. Ry. Co

SCOTTDALE, PA.—Scottdale, Everson & Broadford St. Ry. Co.

SCRANTON, PA.—The People's St. Ry Co.
Scranton Passenger Ry. Co.
Scranton Suburban Ry. Co.

SEATTLE, WASH.—Grant Street Elec. Ry. Co.
Green Lake Electric Ry. Co
Rainier Avenue Electric Ry. Co.
Seattle Consolidated St. Ry. Co.
Seattle Electric Ry. & Power Co.
Union Trunk Line.
West St. & North End Ry. Co

SEDALIA, MO.—The Electric Ry., Light & Power Co. of Sedalia.
Sedalia St. Ry. Co.

SENECA FALLS, N.Y.—The Seneca Elec. Ry. Co

SHAMOKIN, PA.—Shamokin Electric St. Ry. Co

SHELBYVILLE, IND.—Shelbyville Electric St Ry. Co.

SHERMAN, TEX.—College Park Rapid Transit Co.

SHREVEPORT, LA.—Ry. & Land Improvement Co.

SIOUX CITY, IA.—Riverside Park Ry. Co.
Sioux City St. Ry. Co.
Sioux City & Leeds Electric Ry. Co.

SIOUX FALLS, S. DAK.—S Dak. Rapid Transit Ry. Co.

SOUTH BEND, IND.—South Bend & Mishawaka Ry. Co.

SOUTHINGTON, CONN.—Southington & Plantsville Ry. Co.

SPOKANE, WASH.—City Park Transit Co.
Ross Park St. Ry. Co.
Spokane & Montrose Motor Co.
Spokane St. Ry. Co.

SPRINGFIELD, ILL.—People's Electric Ry. Co
Springfield City Ry. Co.

SPRINGFIELD, MASS.—Springfield St. Ry Co

SPRINGFIELD, MO.—Metropolitan Electric Ry. Co.
Robberson Ave. Ry. Co.

SPRINGFIELD, O.—Springfield Elec. Ry. Co.

STATEN ISLAND.—South Beach Ry. Co.

ST. CATHARINES, CAN.—St. Catharine's Merritton & Thorold St. Ry. Co.

ST. CLOUD, MINN.—St. Cloud City St. Car. Co.
St. Cloud & Sauk Rapids Ry. Co.

ST. JOHN, N. B.—St. John St. Ry. Co.

ST. JOSEPH, MICH.—St. Joseph & Benton Harbor Electric Ry. & L't Co.

ST. JOSEPH, MO.—Union Ry. Co.
People's St Ry. Electric Light & Power Co.
Wyatt Park Ry. Co.

ST. LOUIS, MO.—Benton-Bellefontaine Ry. Co.
Clayton & Forest Park Ry. Co.
Forest Park & Laclede Ave. & Fourth St. Ry. Co.
Lindell R. R. Co.
Midland St. Ry. Co.
Missouri Ry. Co.
Mound City Ry. Co.
Southern Ry. Co.
St. Louis & East St. Louis Electric R. R. Co
St. Louis & Suburban Ry. Co.
Union Depot Ry. Co.

ST. PAUL, MINN.—St. Paul City Ry. Co.
N. St. Paul Ry. Co.
St. Paul & White Bear Ry. Co.

STERLING, ILL.—Union Electric Line Co.

STEUBENVILLE, O.—Steubenville Ry. & Elec. Co.

STILLWATER, MINN.—Stillwater St. R. R. Co

STOCKTON, CAL.—Stockton Electric Ry. Co.

STREATOR, ILL.—Streator Ry. Co.

SUNBURY, PA.—Sunbury & Northumberland St. Ry. Co.

SUPERIOR, WIS.—Douglas Co. St. Ry. Co.

SYRACUSE, N. Y.—Syracuse Consolidated St Ry. Co.

T

TACOMA, WASH.—Point Defiance, Tacoma & Edison Ry. Co.
Tacoma Ry. & Motor Co.
Tacoma & Steilacoom Ry. Co.

TAMPA, FLA.—Consumers' Elec. Lt. & St. R R. Co.
Tampa St. Ry. & Power Co.

TERRE HAUTE, IND.—Terre Haute St. Ry. Co

TEXARKANA, ARK.—Texarkana St. Ry.

TOLEDO, O.—Toledo Consolidated St. Ry. Co.
Toledo Electric St. Ry. Co.

TONAWANDA, N. Y.—Tonawanda St. Ry. Co.

TOPEKA, KAN.—Topeka Ry. Co.

TORONTO, ONT.—Metropolitan St. Ry. Co.
Toronto & Mimico Electric Ry. Co.
Toronto & Scarboro Electric Ry. Lt. & Pow. Co.

TRENTON, N. J.—Trenton Pass. Ry. Co,

TROY, N. Y.—Troy & Lansingburgh R. R. Co.
Troy & Albia Horse Ry. Co.
Troy City Ry. Co.

U

UNIONTOWN, PA.—Uniontown St. Ry. Co.

UTICA, N. Y.—Utica Belt Line Ry. Co.
Utica & Mohawk R. R. Co.

V

VANCOUVER, B. C.—Vancouver Electric Ry. & Light Co.

VICTORIA, B. C.—National Electric Lighting & Tramway Co.

VINCENNES, IND.—Citizens' St. Ry. Co.

W

WACO, TEX.—Citizens' Ry. Co.
Waco Elec. Ry. & Lt. Co.

WAKEFIELD, MASS.—Wakefield & Stoneham St. Ry. Co.

WASHINGTON, D. C.—District of Columbia Suburban Ry. Co.
Eckington & Soldiers' Home Electric Ry.
Georgetown & Tenalleytown St. Ry. Co.
Glen Echo R. R. Co.
Metropolitan R. R. Co.
Rock Creek Ry. Co.
Tenalleytown & Rockville Ry. Co.

WASHINGTON, PA.—Washington Electric St Ry. Co.

WATERTOWN, N. Y.—Watertown St. Ry. Co.

WATERVILLE, ME.—Waterville & Fairfield Ry. & Lt. Co.

WEST BAY CITY, MICH.—West Bay City St. Ry.

WEST CHESTER, PA.—West Chester St. Ry. Co.

WEST NEW BRIGHTON, S. I., N. Y.—Port Richmond & Prohibition Park R. R. Co.

WEST SUPERIOR, WIS.—Superior Rapid Transit Ry. Co.

WHEELING, W. VA.—Citizens' Ry. Co.
Wheeling Ry. Co.

WHITMAN, MASS.—Whitman St. Ry. Co.

WICHITA, KAN.—Wichita Electric Ry Co.

WILKESBARRE, PA.—Nanticoke St. Ry. Co.
Pittston, Moosic & Pleasant Valley Ry. Co.
Plymouth St. Ry. Co.
West Pittston & Wyoming St. Ry. Co.
Wilkesbarre & Suburban Ry. Co.
Wilkesbarre & West Side R. R.
Wilkesbarre & Wyoming Valley Traction Co.

WILLIAMSPORT, PA.—Williamsport Pass. Ry Co.

WILMINGTON, DEL.—Wilmington City Ry. Co.

WILMINGTON, N. C.—Wilmington St. Ry. Co.

WINDSOR, CAN.—Windsor Electric St. Ry Co
Windsor, Sandwich & Amherstburg Ry. Co.

WINONA, MINN.—Winona City Ry. C.

WINNIPEG, MAN.—Winnipeg St. Ry. Co.

WINSTON, N. C.—Winston-Salem Ry. & Electric Co.

WINONA, MINN.—Winona City St. Ry. Co.

WORCESTER, MASS.—Worcester, Leicester & Spencer St. Ry. Co.
Worcester Consolidated St. Ry. Co.
Worcester & Millbury R. R. Co.
Worcester & Shrewsbury R. R. Co.

Y

YARMOUTH, N. S.—Yarmouth Electric St. Ry. Co.

YOUNGSTOWN, O.—Youngstown Elec. St. Ry

Z

ZANESVILLE, O.—Zanesville Elec. St. R. R. Co.

WILLARD L. CANDEE, H. DURANT CHEEVER, } Managers.

GEO. T. MANSON, Gen'l Supt.



THE FACT THAT

OUR COMPETITORS CLAIM THAT THEIR PRODUCT IS JUST AS GOOD AS OKONITE,

PROVES THAT

OKONITE IS THE STANDARD

OF PERFECT INSULATION.

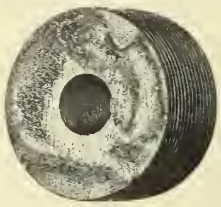
OUR FEED WIRES AND CABLES

ARE THE BEST,

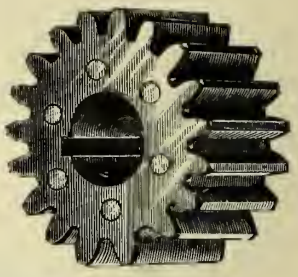
AND ARE USED BY THE LEADING ELECTRIC STREET RAILWAY COMPANIES.

THE OKONITE COMPANY, LIMITED,

13 PARK ROW, NEW YORK.



DERMAGLUTINE



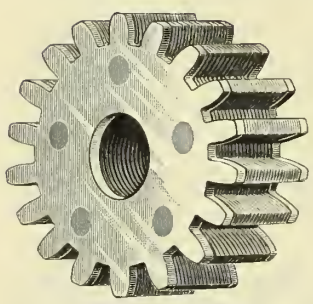
Noiseless and Equal to Steel.

IMPROVED PROCESS RAWHIDE FOR ELECTRIC STREET CAR SERVICE AND MECHANICAL PURPOSES.

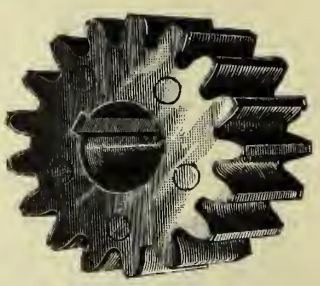
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A. GROETZINGER & SONS,

271 River Ave., Allegheny City, Pa.



WEARING QUALITIES UNSURPASSED BY ANY OTHER SIMILAR ARTICLE ON THE MARKET. ACTUAL SERVICE HAS DEMONSTRATED IT SUPERIOR TO STEEL. SEND FOR CATALOGUE AND PRICE LIST. ALL ORDERS WILL RECEIVE PROMPT ATTENTION. EXCELLENT FACILITIES FOR THE MANUFACTURE OF THIS ARTICLE ON A LARGE SCALE. GIVE IT A TRIAL.





MANUFACTURERS OF THE

BEST BELTING IN THE WORLD

FOR RUNNING ELECTRIC RAILWAY PLANTS.

THE MANHATTAN ELECTRIC LIGHT CO.,
(LIMITED.)

NEW YORK, October 27, 1890.

CHAS. MUNSON BELTING CO., City:

Gentlemen—Answering your inquiry regarding your Eagle Belts, we desire to say that we are now using two 48 inch belts, 120 ft. long each, two 36 inch belts, 53 ft. long each, and about 20 12 inch belts of a total length of over 1,000 ft.

These belts are giving us no trouble whatever, and run with scarcely any stretch. They are giving perfect satisfaction, and we unbesitatingly recommend them.

Yours very truly,
THE MANHATTAN ELECTRIC LIGHT CO., Limited.
H. M. EDWARDS, Auditor.

THE BRUSH ELECTRIC CO. OF BALTIMORE CITY.

BALTIMORE, August 30, 1890.

CHAS. MUNSON BELTING CO., Mr. N. Y. BYAM, Gen'l Mgr.,
204 Smithfield St., Pittsburgh, Pa.:

Dear Sir—I beg to answer your favor of Aug. 29, which is duly to hand and contents noted. I have had a great deal of experience with the different kinds of belting and have run belts from 100 ft. per minute to 6,000 to 7,000 ft. per minute, and beg to inform you that your belts have always answered the purpose to my entire satisfaction; they have given me little or no trouble and, compared with other belts, I think them far superior for electric light work, on account of the stretch and the lasting qualities.

Trusting that this information is what you desire, I remain,
Very truly yours, THE BRUSH ELECTRIC CO.
EDWIN F. BAKER, Gen'l Supt.

CHICAGO: 22, 24, 26, 28, 30, 32, 34 & 36 S. Canal St.

PITTSBURGH, SAN FRANCISCO, NEW ORLEANS.

RAILWAY EQUIPMENT CO.

Pullman Building, Michigan Ave., Chicago, Ill.

THE ONLY COMPANY IN THE UNITED STATES DEALING IN

ELECTRIC RAILWAY SUPPLIES

EXCLUSIVELY.

OUR VARIOUS LINE DEVICES ARE CONSIDERED "STANDARD" BY ROADS USING THE EDISON, WESTINGHOUSE, THOMSON-HOUSTON, SHORT AND OTHER SYSTEMS. AGENTS FOR LATTICED IRON POLES, BURTON ELECTRIC HEATERS, ATKINSON SWITCHES, AND EVERYTHING NEEDED ON ELECTRIC ROADS FOR STATION, CAR AND LINE USE.

K. K. WIRE. ✳ ✳ COPPER WIRE.

SELLING AGENTS

BURTON ELECTRIC HEATER COMPANY, RICHMOND, VA.

GEARS, PINIONS, BEARINGS, TROLLEYS.

New Prices on Rawhide Pinions. Superior to any Others in the Market.

THE BENEFIT OF OUR LONG EXPERIENCE AND THOROUGH KNOWLEDGE OF THE ELECTRIC RAILWAY BUSINESS WILL BE CHEERFULLY GIVEN TO PARTIES ABOUT TO EQUIP SUCH ROADS. CORRESPONDENCE SOLICITED. CATALOGUES FURNISHED.

RAILWAY EQUIPMENT CO.

W. R. MASON, General Manager. PULLMAN BUILDING, MICHIGAN AVE., CHICAGO, ILL.

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MANUFACTURED BY

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HARTFORD, CONN.

DIRECTORY

OF

MANUFACTURERS AND DEALERS IN STREET RAILWAY SUPPLIES.

NOTE.—For reference to the advertisements, see alphabetical index on page XXXV.

ADVERTISING RACKS.
Randall, I. H., 1131 Tremont St., Boston, Mass.
U.S. Steam & Street Ry. Advertising Co., Boston, New York, etc.

AUTOMATIC SWITCHES.
Dorner & Dutton, Cleveland, O.
Fulton Foundry Cleveland, O.
Johnson Co., Johnstown, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Pennsylvania Steel Works, Philadelphia, Pa.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.
White, Edward C., New York.

AXLES.
Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Peckham Motor Truck & Wheel Co., Kingston, N.Y.
Stephenson, Jno., Co. Ld., New York.
White, Edward C., New York.
Whitney, A., & Sons, Philadelphia, Pa.

BEARINGS.
Bemis Car Box Co., Springfield, Mass.
Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Nuttall, R. D., Co., Allegheny, Pa.
Stephenson, John, Co., Ld., New York.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.
White, Edward C., New York.

BEARINGS, TUBULAR
Meneely Bearing Co., West Troy. N. Y.

BELLS, CAR.
Lefmann, Julius, St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New Departure Bell Co., Bristol, Conn.
Pittsburgh Steel Hollow Ware Co. (Ltd.), Pittsburgh, Pa.
Wall, P., Mfg. Supply Co., Allegheny, Pa.

BELTING.
Bickford & Francis Belting Co., Buffalo, N. Y.
Jewell Belting Co., Hartford, Conn.
Munson, Charles, Belting Co., Chicago, Ill.
Page Belting Co., New York, Chicago, etc.
Rhoads, J. E. & Sons, Philadelphia. Pa.
Shultz Belting Co., St. Louis, Mo.

BELTING, LEATHER LINK.
Shultz Belting Co., St. Louis, Mo.

BENDING MACHINES.
Johnson Co., Johnstown, Pa.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.

BLINDS.
Frost Veneer Seating Co., 206 Canal St., N. Y.
Trimble, Jas. A., 220-222 E. 20th St., New York.

BOILER & PIPE COVERINGS.
Johns, H. W., Manufacturing Co., New York.
Johns-Pratt Co., Hartford, Conn.

BOILER COMPOUNDS.
Lord, G. W., Philadelphia, Pa.

BOILER TUBE CLEANERS.
Clay, Oliver P., The, Co., Cleveland, O.

BOILERS.
Babcock & Wilcox, 30 Cortlandt st., New York.
Corliss Steam Engine Co., Providence, R. I.
Dickson Manufacturing Co., Scranton, Pa.
Field Engineering Co., New York.
Fleming, W. R. & Co., 174 Fulton st., New York.
Heine Safety Boiler Co., St. Louis, Mo.
Parker, J. W. & Co., Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Phœnix Iron Works, Meadville, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stearns Manufacturing Co., Erie, Pa,
Stirling Co., The, Chicago, Ill.

BOLTS, FISH PLATES, ETC.
Barbour, Stockwell & Co., Cambridgeport, Mass.
Belleville Steel Co., St. Louis, Mo.
Cambria Iron Co., Philadelphia, Pa.
Craig, Wm. P., 150 Broadway, New York.
Dick, Kerr & Co., London, Eng.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland, O.
Humphreys & Sayce, 10 Wall St., New York.
Illinois Steel Co., The Rookery, Chicago.
Johnson Co., Johnstown, Pa.
Lewis & Fowler Mfg. Co, Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Steel Co., Philadelphia, Pa.
Raiston & Henry, Philadelphia, Pa.
Wharton, Wm., Jr. & Co., Philadelphia, Pa.

BOOKS.
Street Railway Publishing Co., New York.

BOXES, JOURNAL.
Bemis Car Box Co., Springfield, Mass.
Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland. O.
Lefmann, Julius, St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Randall, I. H., 1131 Tremont St., Boston, Mass.
Stephenson, Jno., Co. Ld., New York.
White, Edward C., New York.
Whitney, A., & Sons, Philadelphia, Pa.

BOXES, SAND.
Brill, J. G. Co., Philadelphia. Pa.
Lewis & Fowler Mfg. Co., B'kln.
Reliable Manufacturing Co., The, Boston, Mass.

BRAKE HANDLES.
Brill, J. G. Co., Philadelphia, Pa.
Lefmann, Julius. St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Reliable Manufacturing Co., The, Boston, Mass.
Stephenson, Jno. Co., Ld., New York.
White, Edward C., New York.

BRAKES.
Barnes Brake Co., Cleveland, O.
Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton, Cleveland, O.
Genett Air Brake Co., Chicago, Ill.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Reliable Manufacturing Co., The, Boston, Mass.
Stephenson, Jno. Co. Ld., New York.

BRAKE RODS.
Brill, J. G. Co., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Stephenson. Jno., Co. Ld., New York.

BRAKE SHOES.
Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Stephenson, Jno., Co., Ld., New York.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.
White, Edward C., New York.

BRAKES, RATCHET.
Reliable Manufacturing Co., The, Boston, Mass.

BRAKES, TRACK.
Brill, J. G. Co., Philadelphia Pa.
Stephenson, Jno., Co. Ld., New York.

BRIDGES, IRON.
Berlin Iron Bridge Co., East Berlin, Conn.

BUILDINGS, IRON.
Berlin Iron Bridge Co., East Berlin, Conn.

BUSHINGS, GRAPHITE.
Graphite Lubricating Co., The, Jersey City, N. J.
Walker Manufacturing Co., The, Cleveland, O.

CABLE DRIVING MACHINERY.
Dickson Manufacturing Co., Scranton, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Saxton, E., Washington, D. C.
Walker Manufacturing Co., The. Cleveland, O.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.

CABLE GRIP RELEASE.
Automatic Cable Grip Release Co., St. Louis, Mo.

CABLE GRIPS.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

CABLE RAILWAY PLANTS.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

CABLE ROADS AND MATERIALS.
Barry & McTighe, New York.
Conway, M. W., 487 Monroe st , Brooklyn, N. Y.
Dick, Kerr & Co., London, Eng.
Fowler, Geo. L., 171 Broadway, New York.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Saxton, E., Washington, D. C.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

CABLE YOKES,
Johnson Co., Johnstown, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia. Pa..

CABLES, ELECTRIC
Detroit Electrical Works, Detroit, Mich.
Eastern Electric Cable Co., Boston, Mass.
Little, F. P. & Co., Buffalo, N. Y.
New York Insulated Wire Co., New York.
Okonite Co. (Ltd.), The, New York.
Railway Equipment Co., Chicago, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Simplex Electrical Co., Boston, Mass.

CABLES, ELECTRIC LIGHT & POWER
Detroit Electrical Works, Detroit, Mich.
Field Engineering Co., New York.
Little, F. P. & Co., Buffalo N. Y.
Okonite Co. (Ltd.), The, New York.
Simplex Electrical Co., Boston, Mass.

CABLE OIL.
Imperial Pine Product Co., New York.

CABLES, ROPES.
Cradock, George, & Co., Wakefield, England.
Hazard Manufacturing Co., Wilkesbarre, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Trenton Iron Co., Trenton, N. J.
Smith, Thos. & Wm., Newcastle-on-Tyne, England.
Walker Manufacturing Co., Cleveland, O.

CABLES, TELEPHONE & TELEGRAPH
Detroit Electrical Works, Detroit, Mich.
Little, F. P. & Co., Buffalo, N. Y.
Okonite Co. (Ltd.), The, New York.
Roebling's, John A., Sons Co., Trenton, N. J.
Simplex Electrical Co., Boston, Mass.

CAR CEILINGS.
Bowers Manufacturing Co., The, Newark, N J.
Brill, J. G. Co., Philadelphia, Pa.
Frost Veneer Seating Co., 206 Canal St., N. Y.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Stephenson, Jno., Co. Ld., New York.

CAR CHANNELS.
Belleville Steel Co., St. Louis, Mo.
Cambria Iron Co., 218 S. Fourth St., Philadelphia, Pa.
Johnson Co., Johnstown, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

CAR LIGHTING (GAS).
Safety Car Heating & Lighting Co., 160 B'way, N. Y

CAR LININGS.
Kuhlman Co., Cleveland, O.

CAR PANELS.
Brill, J. G. Co., Philadelphia. Pa.
Kuhlman, G. C., Co., Cleveland, O.
Lewis & Fowler Mfg. Co , Brooklyn, N. Y.
Sjoberg, J. P., & Co., New York,
Stephenson, Jno., Co., New York.
Trimble, Jas. A., 28th Street, New York.

CAR ROOFS.
Frost Veneer Seating Co., 206 Canal St., New York
Kuhlman, G. C., Co., Cleveland, O.
Sjoberg, J. P., & Co., New York.
Trimble, Jas. A. 220 222 E. 28th St., New York.

CAR SEATS.
Bowers Manufacturing Co., The, Newark, N. J.
Brill, J. G. Co., Philadelphia, Pa.
Frost Veneer Seating Co., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Sjoberg, J. P., & Co., New York.
Stephenson, Jno., Co. Ld., New York.
Trimble, Jas. A., 28th street, New York.

EDWARD SMITH & CO., COLORS AND VARNISHES, TIMES BUILDING, NEW YORK.

CAR SIDES AND ENDS.
Frost Veneer Seating Co., 206-8 Canal st. N. Y.
Kuhlman, G. C., Co., Cleveland, O.
Sjoberg, J. P., & Co., New York.
Trimble, Jas. A., 28th Street, New York.

CAR STOVES.
Standard Railway Supply Co., Chicago, Ill.

CAR TRIMMINGS.
Brill, J. G., Co., Philadelphia, Pa.
Lefmann, Julius, St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Stephenson, Jno., Co., Ld., New York.

CARRIAGES.
Briggs Carriage Co.. Amesbury, Mass.

CARS, NEW.
American Car Co., The, St. Louis, Mo.
Briggs Carriage Co., Amesbury, Mass.
Brill, J. G., Co., Philadelphia, Pa.
Brownell Car Co., St. Louis, Mo.
Ellis Car Co. Amesbury, Mass.
Gilbert Car Co., Troy, N. Y.
Humphreys & Sayce, 10 Wall St., New York.
Jones, J. M., Sons, West Troy, N. Y.
Kuhlman, G. C., Co., Cleveland, O.
Laclede Car Co., St. Louis, Mo.
Lamokin Car Works, Philadelphia and Chester, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y
New York Equipment Co., New York.
Newburyport Car Mfg. Co., Newburyport, Mass.
Pullman's Palace Car Co., Chicago, Ill.
Ralston & Henry, Philadelphia, Pa.
Randall, I. H., 1131 Tremont st., Boston, Mass.
Sheffield Velocipede Car Co., Three Rivers, Mich.
Stephenson, John, Co., Ld., New York.
St. Louis Car Co., St. Louis, Mo.
Trimble, James A., New York.

CARS, SECOND HAND.
Hirsch, L. K., Chicago, Ill.
Humphreys & Sayce, 10 Wall st., New York.
New York Equipment Co., New York.
Partridge, Arthur S., St. Louis, Mo.
Ralston & Henry, Philadelphia, Pa.
West End Street Railway Co., Boston, Mass.

CASTINGS.
Chester Steel Castings Co., Philadelphia, Pa.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Pennsylvania Steel Co., Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa
White, Edward C., New York.
Whitney, A., & Sons, Philadelphia, Pa.

CASTINGS, COPPER
Detroit Electrical Works, Detroit, Mich.

CHAIRS.
Burnham & Duggan Railway Appliance Co., Boston, Mass.
Duplex Street Railway Track Co., New York.
Johnson Co., Johnstown, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Mark & Sterling, Cleveland, O.
New York Equipment Co., New York.
Pennsylvania Steel Works, Philadelphia, Pa.
Wharton, Wm., Jr. & Co., Philadelphia, Pa.

CHANNEL PLATES.
Craig, Wm. P., East Orange, N. J.

COMMUTATOR BARS.
Billings & Spencer Co., Hartford, Conn.

CONDUCTORS' CAPS.
Wales Manufacturing Co., Syracuse, N. Y

COPPER WIRE
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Ralston & Henry, Philadelphia, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

CROSSINGS, FROGS AND SWITCHES.
Barbour, Stockwell & Co., Cambridgeport, Mass.
Dick, Kerr & Co., London, Eng.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland, O.
Humphreys & Sayce, 10 Wall st., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Mark & Sterling, Cleveland, O.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Pennsylvania Steel Co., Philadelphia, Pa.
Price Railway Appliance Co., Philadelphia, Pa.
Randall, I. H., 1131 Tremont st., Boston, Mass.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White, Edward C., New York.

CURVED RAILS.
Barbour, Stockwell & Co., Cambridgeport, Mass.
Belleville Steel Co., St. Louis, Mo.
Craig, Wm. P., East Orange, N. J.
Fulton Foundry, Cleveland, O.
Johnson Co., Johnstown, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Steel Co., Philadelphia, Pa.
Richmond Locomotive and Machine Works, Richmond, Va.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.

DERMAGLUTINE.
Groetzinger, A. & Sons, Allegheny, Pa.

DIFFERENTIAL CABLE DRUMS.
Walker Manufacturing Co., The, Cleveland, O.

DUMMY ENGINES.
Porter, H. K., & Co., Pittsburgh, Pa.

DYNAMOS.
Detroit Electrical Works, Detroit, Mich.
Edison General Electric Co., New York.
Eddy Electric Mfg Co., Windsor, Conn.
Field Engineering Co., New York.
General Electric Co., Boston and New York.
Germania Electric Co , Boston, Mass.
Mather Electric Co., Boston, Mass.
Short Electric Ry. Co., Cleveland, O.
Siemens & Halske Electric Co. of America, Chicago
Thomson-Houston Electric Co., Boston, Mass.
Westinghouse, Church, Kerr & Co., New York.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Wightman Electric Manufacturing Co., Scranton, Pa.
Woodbridge & Turner Engineering Co., New York.

ELECTRIC RAILWAYS.
Barry & McTighe, New York.
Complete Electric Construction Co., New York.
Delafield Construction Co., New York
Detroit Electrical Works, Detroit, Mich.
Dick, Kerr & Co., London, Eng.
Edison General Electric Co., New York.
Field Engineering Co., New York.
General Electric Co., Boston and New York.
Little, F. P. & Co., Buffalo, N. Y.
Murray, Thomas, New York.
Neftel & Marsh Co , New York.
Ralston & Henry, Philadelphia, Pa.
Short Electric Railway Co., Cleveland, O.
Sperry Electric Railway Co.,
Thomson-Houston Electric Co., Boston, Mass.
Pepper & Register, Philadelphia, Pa.
Reed & McKibbin, 2 Wall St., New York.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White, J. G. & Co., 29 Broadway, New York.
Woodbridge & Turner Engineering Co., New York.

ELECTRIC SWITCHES,
Hart & Hegeman Manufacturing Co.. Hartford, Conn.

ELECTRICAL INSTRUMENTS.
Weston Electrical Instrument Co., Newark, N.J.

ELECTRICAL SUPPLIES
Anderson, A. & J. M., Boston, Mass.
Billings & Spencer Co., Hartford, Conn.
Detroit Electrical Works, Detroit, Mich.
Dick, Kerr & Co., London, Eng.
Eddy Electric Manufacturing Co., Windsor, Conn.
General Electric Co., Boston and New York.
Germania Electric Co.. Boston, Mass.
Goodrich, B. F. Co., The, Akron, O.
Gordon, W. H. & Co., New York.
Groetzinger, A. & Sons, Allegheny, Pa.
Hart & Hegeman Manufacturing Co., Hartford, Conn.
Johns, H. W., Manufacturing Co., New York.
Johns-Pratt Co., Hartford, Conn.
Johnson Electric Co., Cleveland, O.
Lefmann, Julius, St. Louis, Mo.
Little, F. P., & Co., Buffalo, N. Y.
Mather Electric Co., Boston, Mass.
New York Equipment Co., New York.
New York Insulated Wire Co., New York.
Nuttall, R. D. & Co., Allegheny, Pa.
Okonite Co. (Ltd.), The, New York.
Partridge, Arthur S., St. Louis, Mo.
Perkins Electric Lamp Co., Boston, Mass.
Railway Equipment Co., Chicago, Ill.
Ralston & Henry, Philadelphia, Pa.
Simplex Electrical Co., Boston, Mass.
Smith & Wallace, Boston, Mass.
Sperry Electric Railway Co., New York.
Standard Paint Co., New York.
Standard Railway Supply Co., Chicago, Ill.
Thomson-Houston Electric Co., Boston, Mass.
Wales Manufacturing Co., Syracuse, N. Y.
Walworth Manufacturing Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Weston Electrical Instrument Co., Newark, N.J.
White, John, Allegheny, Pa.

ENGINEERS, CONSULTING.
Barry & McTighe, New York.
Complete Electric Construction Co., New York.
Delafield Construction Co., New York.
Dick, Kerr & Co., London, Eng.
Field Engineering Co., New York.
Fowler, Geo. L., 53 B'way, New York.
Higgins, Edward E., New York.
Mailloux, C. O., 32 Liberty st., New York.
Murray, Thomas, New York.
Neftel & Marsh Co., New York.
Parker, J. W. & Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Reed & McKibbin, 2 Wall St., New York.
Sturges, W. M., Utica, N. Y.
Walworth Manufacturing Co., Boston, Mass.
Wetherill, Robert, & Co., Chester, Pa.
White, J. G. & Co., 50 Broadway, New York.
Woodbridge & Turner Engineering Co., New York.

ENGINEERS, ELECTRICAL.
Barry & McTighe, New York.
Complete Electric Construction Co., New York.
Delafield Construction Co., New York.
Dick, Kerr & Co., London, Eng.
Field Engineering Co., New York.
General Electric Co., Boston and New York.
Higgins, Edward E., New York.
Little, F. P. & Co., Buffalo, N. Y.
Mailloux, C. O., Liberty St., New York.
Murray, Thomas, New York.
Neftel & Marsh Co., New York.
Parker, J. W. & Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Reed & McKibbin, 2 Wall St., New York.
Siemens & Halske Electric Co. of America, Chicago
Sturges, W. M., Utica, N. Y.
Woodbridge & Turner Engineering Co., New York.

ENGINEERS, MECHANICAL.
Barry & McTighe, New York.
Dick, Kerr & Co., London, Eng.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Field Engineering Co., New York.
Fowler, Geo. L., 53 Broadway, New York.
Hill Clutch Works, Cleveland, O.
Parker, J. W. & Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Phœnix Iron Works, Meadville, Pa.
Walker Manufacturing Co., The, Cleveland, O.
Woodbridge & Turner Engineering Co., New York.

ENGINES.
Allis, The Edward P. Co., Milwaukee, Wis.
American Engine Co., Bound Brook, N. J.
Ames Iron Works, Oswego, N. Y.
Ball & Wood Co., The, New York.
Ball Engine Co., Erie Pa.
Bates Machine Co., Joliet, Ill.
Buckeye Engine Co., Salem, O.
Cooper, C. & G. & Co., Mt. Vernon, O.
Corliss Steam Engine Co., Providence, R.
Dickson Manufacturing Co., Scranton, Pa.
Field Engineering Co., New York.
Fleming, W. R. & Co., New York.
Hirsch, L. K., Chicago, Ill.
Hooven, Owens & Rentschler, Hamilton, O.
Lake Erie Engineering Works, Buffalo, N. Y.
McIntosh, Seymour & Co., Auburn, N. Y.
Otto Gas Engine Works, Philadelphia, Pa.
Parker, J. W. & Co., Philadelphia, Pa.
Payne, B. W. & Sons, Elmira, N. Y.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Philadelphia Engineering Works (Ltd.), Philadelphia, Pa.
Phœnix Iron Works, Meadville, Pa.
Southwark Foundry & Machine Co., Philadelphia Pa.
Sioux City Engine Works, Sioux City, Ia.
Stearns Manufacturing Co., Erie, Pa.
Walker Manufacturing Co., The, Cleveland, O.
Westinghouse, Church, Kerr & Co., New York, etc

ENGINES, HOISTING.
Dickson Manufacturing Co., Scranton, Pa.
Walker Manufacturing Co., The, Cleveland, O.

ENGINES, SECOND HAND.
Hirsch, L. K., Chicago, Ill.

EYE BOLTS.
Billings & Spencer Co., Hartford, Conn.

FARE BOXES.
Brill, J. G. Co., Philadelphia, Pa.
Brownell Car Co., St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Lima Register Co., Lima, O.
Stephenson, John, Co., Ld., New York.
Wales Manufacturing Co., Syracuse, N. Y.

FARE COLLECTORS.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.

FARE REGISTERS.
Brill, J. G. Co., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Meaker Mfg. Co., 134 Washington st., Chicago, Ill.
Railway Register Mfg. Co., 1193 B'way., N. Y.
St. Louis Car Co., 3023 N. Broadway, St. Louis, Mo
St. Louis Register Co., St. Louis, Mo.
Standard Index & Register Co., New York.
Wales Manufacturing Co., Syracuse, N. Y.

FEED WATER HEATERS.
Colles, E. G. T. & Co., 22 S. Jefferson st., Chicago.
Davis, I. B. & Son, Hartford, Conn.
Goubert Manufacturing Co., The, New York.
Hoppes Manufacturing Co., Springfield, O.
National Pipe Bending Co., New Haven, Conn.
Nelson, Elihu, New York.
Phœnix Iron Works, Meadville, Pa.
Wainwright Manufacturing Co. of Massachusetts, Boston, Mass.

FEED WATER PURIFIERS (Live Steam).
Colles, E. C. T. & Co., Chicago.
Davis, I. B., & Son, Hartford, Conn.
Goubert Manufacturing Co., New York.
Hoppes Manufacturing Co , Springfield, O.
National Pipe Bending Co., New Haven, Conn.
Nelson, Elihu, New York.

FORGINGS.
Dorner & Dutton, Cleveland, O.

FRICTION CLUTCHES AND COUPLINGS.
Bates, H. N., & Co., Boston, Mass.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Hill Clutch Works, Cleveland, O.
Lake, J. H. & D. Co., Hornellsville, N. Y.
Walker Manufacturing Co., Cleveland, O.

FURNACES.
Fleming, W. R., & Co., 174 Fulton st., New York.

GEARING.
Climax, Manufacturing Co., Buffalo, N. Y.
Detroit Electrical Works, Detroit, Mich.
Dickson Manufacturing Co., Scranton, Pa.
Dorner & Dutton, Cleveland, O.
Edison General Electric Co., Broad st., N. Y.
Fulton Foundry, Cleveland, Ohio.
Groetzinger, A. & Sons, Allegheny, Pa.
Lefmann, Julius, St. Louis, Mo.
Little, F. P., & Co., Buffalo, N. Y.
New Process Raw Hide Co., The, Syracuse, N. Y.
Nuttall, R. D. Co., Allegheny, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Railway Equipment Co., Chicago, Ill.
Randall, I. H., 1131 Tremont st., Boston, Mass.
Short Electric Railway Co., Cleveland, O.
Smith & Wallace, Boston, Mass.
Thomson-Houston Electric Co., Boston, Mass.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
Woodbridge & Turner Engineering Co., New York.

GONGS, CABLE AND CAR.
Johnson Electric Co., Clevoland, O.
Lefmann, Julius, St. Louis, Mo.
Lewis & Fowlor Mfg. Co., Brooklyn, N. Y.
New Departure Bell Co., Bristol, Conn.
Pittsburgh Steel Hollow Ware Co. (Ltd.), Pittsburgh, Pa.
Wall, P., Manufacturing Supply Co., Allegheny Pa.

GRIP DIES.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

GRIPS.
Pennsylvania Iron Works Co.. Philadelphia, Pa.

GUTTERS.
Barbour, Stockwell & Co., Cambridgeport, Mass.
Dorner & Dutton, Cleveland, O.
Wharton, Wm,. Jr., & Co., Philadelphia, Pa.

HEADLIGHTS.
Gordon, W. H. & Co., New York.
Lefmann, Julius, St. Louis. Mo.
Partridge, Arthur S., St. Louis, Mo.
Steam Gauge & Lantern Co., Syracuse, N. Y.
Wales Manufacturing Co., Syracuse, N. Y.

HEATERS, CAR.
Brill, J. G. Co., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Morton Safety Heating Co., The, Baltimore, Md.
Railway Equipment Co., Chicago, Ill.
Safety Car Heating & Lighting Co., New York.
Standard Railway Supply Co., Chicago, Ill.
Thomas Stove Co., New York.

HEATERS, ELECTRIC.
Dewey Electric Heating Co., Syracuse, N. Y.
Railway Equipment Co., Chicago, Ill.
Smith & Wallace, Boston, Mass.
Taylor, Goodhue & Ames, Chicago, Ill.
Toledo Electric Heating Co., Toledo, O.

HOLLOW WARE, STEEL.
Pittsburgh Steel Hollow Ware Co. (Ltd.), Pittsburgh, Pa.

HYDRAULIC JACKS.
Walker Manufacturing Co , The, Cleveland, O.
Watson & Stillman, 204-210 E. 43d st., N. Y.

INSULATORS.
Detroit Electrical Works, Detroit, Mich.
Johns, H. W , Manufacturing Co., New York. }
Johns-Pratt Co., Hartford, Conn. }
Johnson Electric Co., Cleveland, O.
Lefmann, Julius, St. Louis. Mo.
Little, F. P., & Co., Buffalo, N. Y.
Mather Electric Co., Boston, Mass.
Munsell, Eugene & Co.. New York.
Railway Equipment Co., Chicago, Ill.
Standard Paint Co., New York.
Wales Manufacturing Co.. Syracuse, N. Y.
Walworth Mfg. Co., Boston, Mass.
White, John, Allegheny, Pa.

INSULATORS, MICA.
Johns, H. W., Manufacturing Co., New York. }
Johns-Pratt Co., Hartford, Conn. }

INSURANCE, ACCIDENT, LIFE, ETC.
American Casualty Insurance & Security Co., New York.
Guarantee & Accident Lloyds, New York.

IRON STRUCTURAL WORK.
Berlin Iron Bridge Co., East Berlin, Conn.
Johnson Co., Johnstown, Pa.
Milliken Bros., New York and Chicago.

KNEES AND OTHER TRACK CASTINGS.
Barbour, Stockwell & Co., Cambridgeport, Mass.
Craig, Wm. P., 95 Liberty st., New York.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland, O.
Humphreys & Sayce, 10 Wall st., N. Y.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Mark & Sterling, Cleveland. O.
Pennsylvania Steel Works, Philadelphia, Pa.
Tramway Rail Co., Pittsburgh, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

LAMPS.
Brill, J. G. Co., Philadelphia, Pa.
Gordon, W. H. & Co., New York.
Lefmann, Julius, St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn N. Y.
Steam Gauge & Lantern Co., Syracuse, N. Y.
Stephenson, John, Co., Ltd., New York.
Wall, P., Manufacturing Supply Co., Allegheny, Pa.

LAW.
Eppley, Francis M., 140 Nassau st., New York.

LAMPS, ELECTRIC.
Edison General Electric Co., 16 & 18 Broad St., New York.
Germania Electric Co., Boston, Mass.
Gordon, W. H. & Co., New York.
Lefmann, Julius, St. Louis, Mo.
Little, F. P., & Co., Buffalo, N. Y.
Partridge, Arthur S., St. Louis, Mo.
Perkins Electric Lamp Co., Boston' Mass.

LATHES, MOTOR GEAR.
Lodge & Shipley Machine Tool Co., Cincinnati, O.

LOCOMOTIVES.
Dickson Manufacturing Co., Scranton, Pa.
Humphreys & Sayce, 10 Wall St., New York.
Porter, H. K., & Co., Pittsburgh, Pa.

LUBRICANTS.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Graphite Lubricating Co., Jersey City, N. J.

MACHINE TOOLS
Barnes, W. F. & John, Co., Rockford, Ill.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
Ralston & Henry, Philadelphia, Pa.

MAGNESIA SECTIONAL COVERINGS.
Keasbey, Robert A., New York.

MATTING, WOOD.
Beadle, Edward, 1193 Broadway, New York.
Brill, J. G. Co., Philadelphia, Pa.
Lefmann, Julius, St. Louis, Mo.
Toffler, A., 211 E. 22d St., New York.

METAL SAWING MACHINES
Q. & C. Co., The, Chicago, Ill.

MICA.
Munsell, Eugene & Co., New York.
Schoonmaker, A. O., New York.

MOTORS, ELECTRIC.
Detroit Electrical Works. Detroit, Mich.
Edison General Electric Co., Broad St., New York.
Eddy Electric Manufacturing Co., Windsor, Conn.
General Electric Co., Boston and New York.
Germania Electric Co., Boston, Mass.
Humphreys & Sayce, 10 Wall St., New York.
Little, F. P., & Co., Buffalo, N. Y.
Mather Electric Co., Boston, Mass.
Short Electric Ry. Co., Cleveland, O.
Siemens & Halske Electric Co. of America, Chicago
Sperry Electric Railway Co., New York.
Thomson-Houston Electric Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Woodbridge & Turner Engineering Co., New York.

MOTORS GAS, STEAM, ETC.
Baldwin Locomotive Works, Philadelphia, Pa.
Porter, H. K. & Co., Pittsburgh, Pa.

NUMBER BADGES.
Wales Manufacturing Co., Syracuse, N. Y.

OFFICE FURNITURE, ETC.
Andrews, A. H. & Co., Chicago, Ill.

OIL AND GREASE CUPS.
Lunkenheimer Brass Mfg. Co., Cincinnati, O.

PAINT, GRAPHITE.
Dixon, Joseph, Crucible Co., Jersey City N. J.

PAINT, PRESERVATIVE, FOR IRON.
Standard Paint Co., New York.

PAINTS
Devoe, F. W., & Co., New York.
Johns, H. W., Manufacturing Co., New York. }
Johns-Pratt Co., Hartford, Conn. }

PATENT SOLICITORS, ETC.
Fitzgerald, S. C., Washington, D. C.

PEDESTALS.
Brill, J. G. Co., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.,
Stephenson, John, Co., Ld., New York
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White, Edward C., New York.

PHOSPHOR BRONZE.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

POLES, METAL.
Lefmann, Julius, St. Louis, Mo.
Milliken Bros., New York and Chicago.
New York Equipment Co., New York.
Nuttall, R. D., Co., Allegheny, Pa.
Partridge, Arthur S., St. Louis, Mo.
Railway Equipment Co., Chicago, Ill.
Ralston & Henry, Philadelphia, Pa.
Valentine-Clark Co., The, Chicago, Ill.
Walworth Manufacturing Co., Boston, Mass.

POLES, WOODEN.
Kichline, Geo. F., Easton, Pa.
New York Equipment Co., New York.
Nuttall, R. D., Co., Allegheny, Pa.
Railway Equipment Co., Chicago, Ill.
Ralston & Henry, Philadelphia, Pa.
Valentine-Clark Co., The, Chicago, Ill.

POWER TRANSMISSION ROPES.
Brigham, Arthur A., Boston, Mass.

PRESSES, LEVER, HYDRAULIC, ETC.
Walker Manufacturing Co., The, Cleveland, O.
Watson & Stillman, New York.

PRESSES, WHEEL.
Dorner & Dutton, Cleveland, O.
Fulton Foundry, Cleveland, O.
Hathaway, Alfred G., Cleveland, O.
Watson & Stillman, New York.

PULLEY BOXES.
Walker Manufacturing Co., The, Cleveland, O.

PULLEYS.
Bates, H. N., & Co., Boston, Mass.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Hill Clutch Works, Cleveland, O.
Walker Manufacturing Co., The, Cleveland, O.

PULLEYS, CABLE.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr. & Co., Philadelphia, Pa.

PUMPS.
Dickson Manufacturing Co., Scranton, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

RAIL JOINTS.
American Rail Joint Co., Marion, Ind.
Cambria Iron Co., Philadelphia, Pa.
Johnson Co., Johnstown, Pa.
Mark & Sterling, Cleveland, O.
New York Equipment Co., New York.
Pennsylvania Steel Co., Philadelphia, Pa.
Tramway Rail Co., Pittsburgh, Pa.
Wharton, Wm Jr. & Co., Philadelphia, Pa.

RAIL JOINT BRIDGES.
Mark & Sterling, Cleveland, O.

RAILS, GIRDER.
Consolidated Railway Supply Co., Boston, Mass.
Dick, Kerr & Co., London, Eng.
Duplex Street Railway Track Co., New York.
Hirsch, L. K., Chicago, Ill.
Illinois Steel Co., The Rookery, Chicago.
Johnson Co., Johnstown, Pa.
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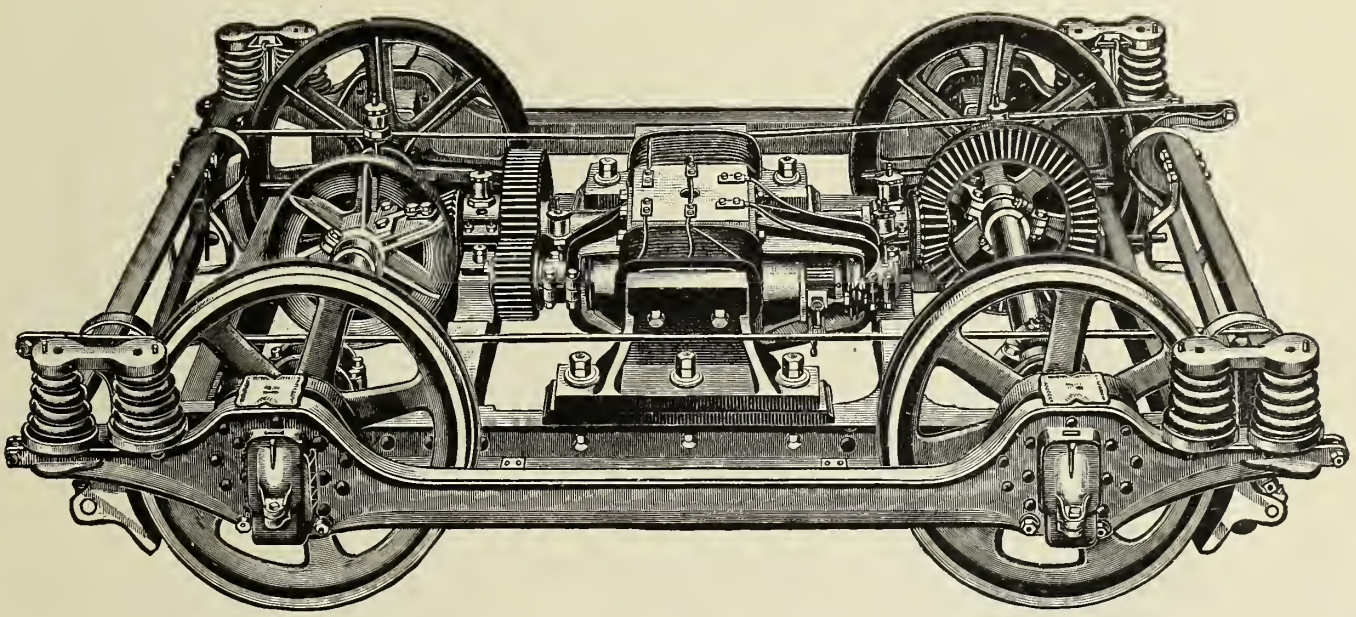
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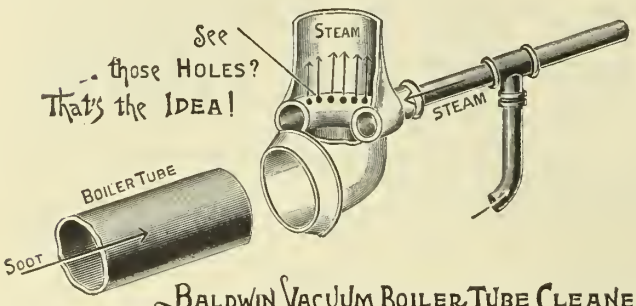
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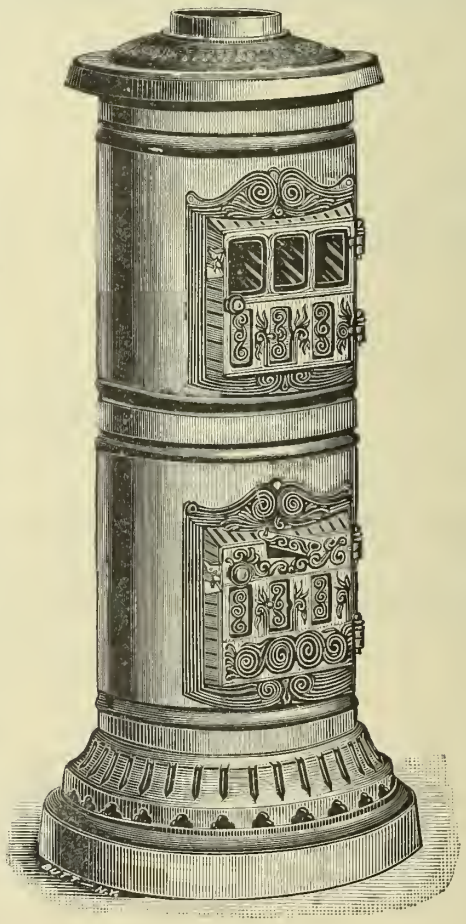
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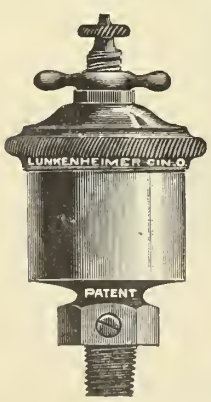


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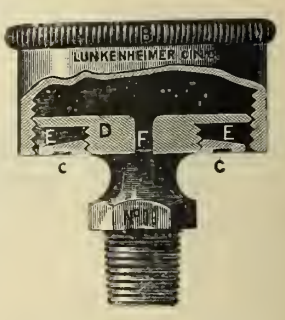


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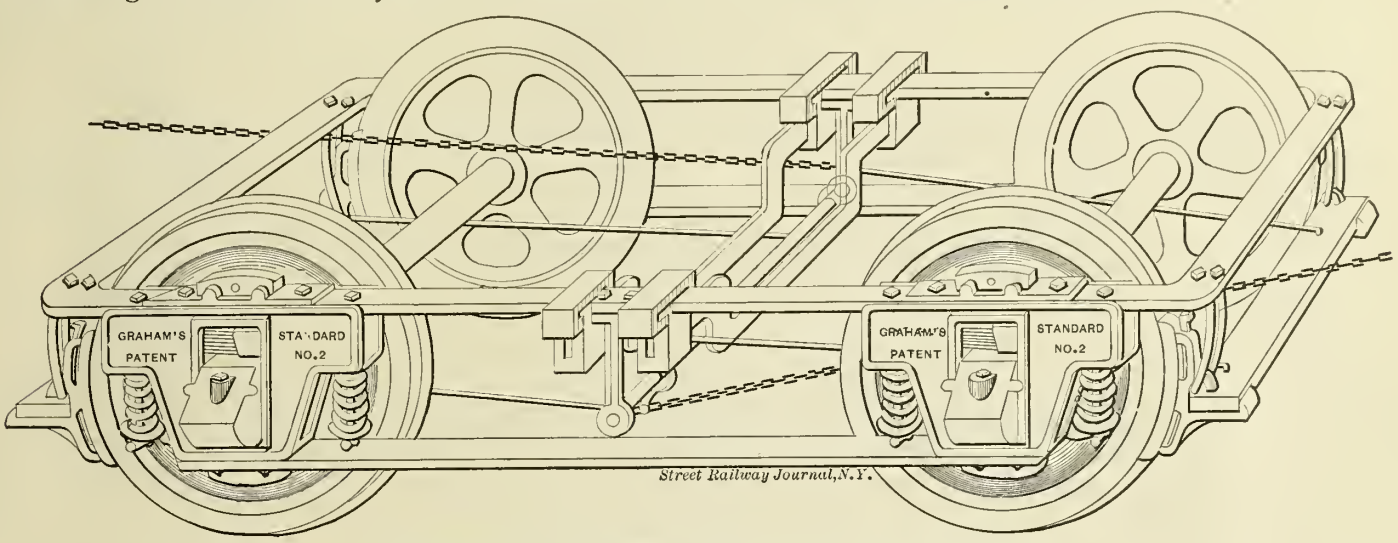


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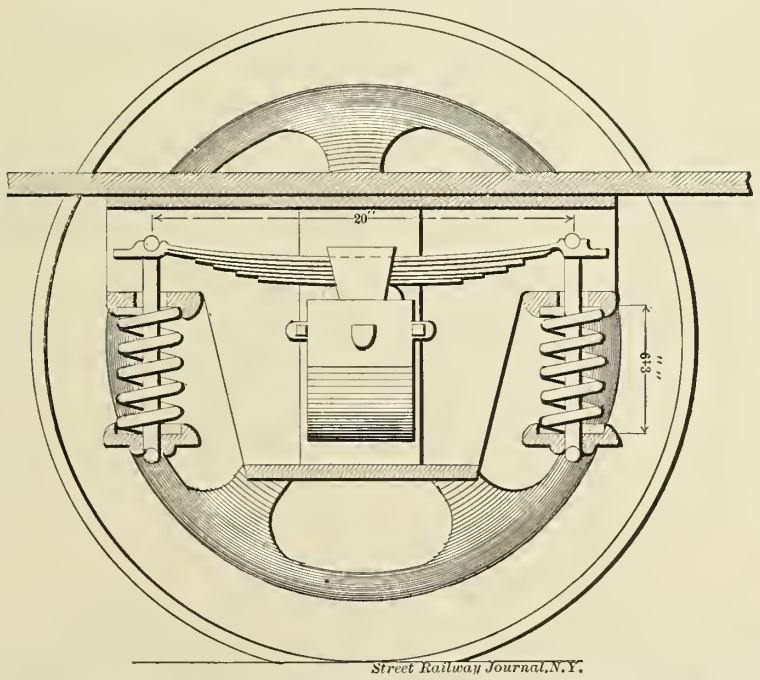
"I think that we have most of us been in error as to the construction of our trucks. I think that has nearly as much to do with the breaking down of our joints as anything else. I think we are all of us operating nearly the same kind of trucks. They are rigid on the axle boxes. Half of the weight of the motor and the whole weight of the truck goes down on the rail like a sledge hammer when an obstruction is met. We have got to find something that will take off that compression, that impact. It is like taking a weight of four or five tons and hammering it down on the rail. Every time you hit it, it goes lower. The sooner we come to understand this, the less trouble we will have. We are putting an elliptical spring on top of the axle box, and suspending the whole weight by this spring, so that the wheel box will work up and down as you come to a depression or elevation on the track. It allows the wheel to go up and down. I believe that the trucks have something to do with the rail joint."



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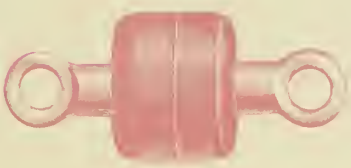
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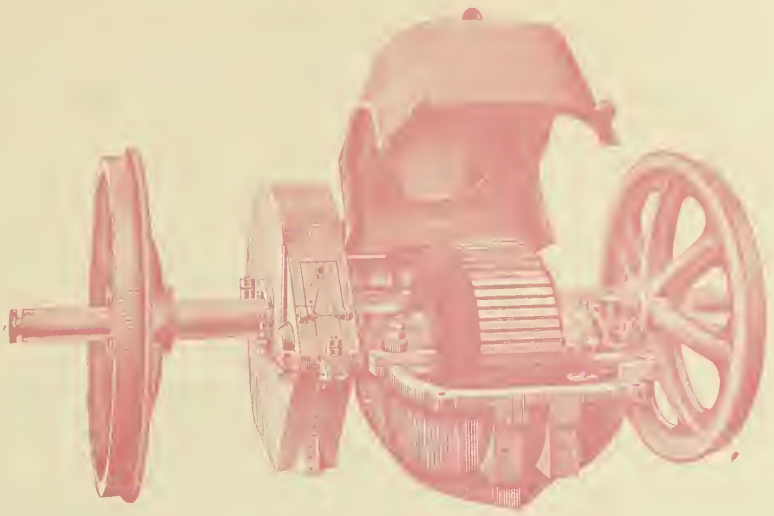
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